دانشگاه گیلان

2019 STUDDENT RESEARCH WEEK

FACULTY OF SCIENCE
UNIVERSITY OF GUILAN

December 14-17

CONTENT:

Chemistry Abstracts

CHEMISTRY ABSTRACTS
Authors:

Bahareh Abbas Khakiani	*Zahra Khazaei*	*Zahra Shaabanzadeh*	*Tayyebeh Nosrati Fallahkar*
Maryam Hajnajafi	*Masoumeh Mazloumi*	*Farhad Shirini*	*Meysam Alipour Khoshdel*
Neda Mardazad	*Hadiseh Yazdani Nyaki*	*Athena Maboodi*	*Azadeh Sadat Shoaee-Moafi*
Elmira Hajati	*Behnaz Mohammadi Khanghah*	*Parvin Moshiri*	*Nima Alizadeh*
Hadis Faridi-Haftkhani	*Havva Rezaee*	*Khadije RahmanZadeh*	*Ramtin Yarinia*
Ramin alizadeh tajan	*Rezvane Rahmanpour siahgalde*	*Roghayeh Darvish*	*Zahra Shabanzade*
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Alireza Safari	*Fatemeh Rouhi*	*Faeze Dehghannejhad*	*Farhad. Golrokh*

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Maryam Souri Damirchisofla	*Mozhgan Biuki*	*Motahare nafei*	*Masoumeh Moradi*
Mahtab Pourmohammadi	*Mahsa Mohammadrezaie*	*Mona Mohammadzadeh*	*Nadia Gerivani*
Nesa Haghgoo	*Nesa Roshani Talesh*	*Nasibeh kohansal*	*Nafiseh Mohtamedifar*
Niloufar Akbari	*Niloofar Sadeghpour*	*Homayoon Eslomi Zadeh*	

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Thermophysical properties of [EMIm]Br and [PrMIm]Br, imidazolium based ionic liquids in water + ethylene carbonate mixtures at T = (298.2, 308.2 and 318.2) K

Bahram Ghalami-Choobar, Tayyebeh Nosrati Fallahkar*
Department of chemistry, Faculty of science, university of Guilan, Rasht, Iran
Corresponding author E-mail: B-Ghalami@guilan.ac.ir

Abstract

Ionic liquids (ILs) are molten salts with a melting point below 100°C [1]. A combination of ionic liquids and a small amount of carbonate solvents such as Ethylene Carbonate (EC), Dimethyl Carbonate (DMC) and Diethyl Carbonate (DEC) are becoming increasingly utilized as electrolyte co-solvent in energy storage applications because of their low flammability and high conductivity [2, 3], hence there is an immense need for determination and generation of thermodynamic and transport data of such solutions. This paper reports the conductometric and thermodynamic properties for [EMIm]Br and [PrMIm]Br ionic liquids in various mass fractions of EC in water containing 0, 10, 20 and 30% at T = (298.2, 308.2 and 318.2) K and 0.1 MPa.

The molar conductivity data were analyzed by Fuoss-Onsager conductivity equation, and the values of limiting molar conductivity $\Lambda_{\circ}$ and ion association constant K_A were obtained by an iterative solution method. These results used to calculate the corresponding standard thermodynamic functions of ion association process including ΔG°_{A}, ΔH°_{A} and ΔS°_{A}. Moreover, the potentiometric measurements were performed on the galvanic cell of the type Br-ISE | [EMIm]Br (m), EC (wt.%), H_2O (1-wt)%| [EMIm]-ISE, in various mass fractions of EC in water (0, 10, 20 and 30%) over total ionic strength from 0.0085 to 2.500 $mol.kg^{-1}$. The Br and [EMIm] ion selective electrodes were prepared in our laboratory using related ionophors. The modeling of this ternary system was made based on the Pitzer ion-interaction model. The Pitzer ion-interaction parameters $\beta^{(0)}$, $\beta^{(1)}$ and C^{ϕ} were determined and employed to calculate the osmotic coefficients, excess Gibbs free energies and the solvent activity for the whole series of the studied system.

Keywords: Conductivity, Ethylene carbonate, Activity coefficient, Fuoss-Onsager equation, Pitzer model

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[3] B. Ghalami-Choobar, T. Nosrati Fallahkar, Thermophysical properties of 1-ethyl-3-methylimidazolium bromide ionic liquid in water + ethylene carbonate mixtures at T = (298.2, 308.2 and 318.2) K. Fluid Phase Equilib. 496 (2019) 42-60.

Introduction of a benzimidazole-based acidic ionic liquid : An efficient and reusable catalyst for the preparation of pyrano[2,3-d]pyrimidinone derivatives

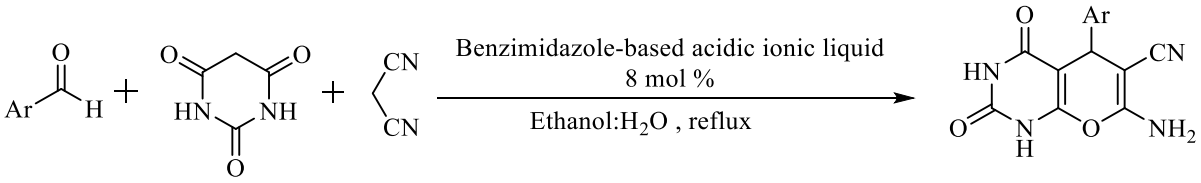
*Bahareh Abbas Khakiani, Farhad Shirini*and Hassan Tajik*
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran
Corresponding author E-mail: shirini@guilan.ac.ir

Abstract

Pyrano[2,3-d] pyrimidinone(thione) derivatives are very important because of their essential biological properties such as antihypertensive, antihepatotoxicity, antitumor [1,2], antibronchitic and anticardiotonic activities [3]. These compounds are also available as important units of some natural products such as polyethers, antibiotics, carbohydrates, phormones, iridoids and alkaloids.

Ionic liquids have received considerable interest as eco-friendly solvents, catalysts and reagents in organic synthesis because of their unique properties, such as low volatility, non-flammability, high thermal stability, negligible vapor pressure and ability to dissolve a wide range of materials [4].

In this work, a dicationic acidic ionic liquid based on benzimidazole is simply prepared and after is used for the promotion of the synthesis of pyrano[2,3-d] pyrimidinone(thione) derivatives. The main advantages in the of catalyst is ease of separation of the catalyst, high yields of the achived products and low reaction times.



Scheme 1 Synthesis of pyrano[2,3-d] pyrimidinone derivatives catalyzed by a new benzimidazole-based acidic ionic liquid

Keywords: Ionic liquids, benzimidazole, catalyst, multi-component, pyrano[2,3-d] pyrimidinone(thione)

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Introduction of a new catalyst containing an ionic liquid bridge on nanoporous Na^+- montmorillonite for the synthesis of hexahydroquinolines *via* Hantzsch condensation

Masoumeh Mazloumi and Farhad Shirini*

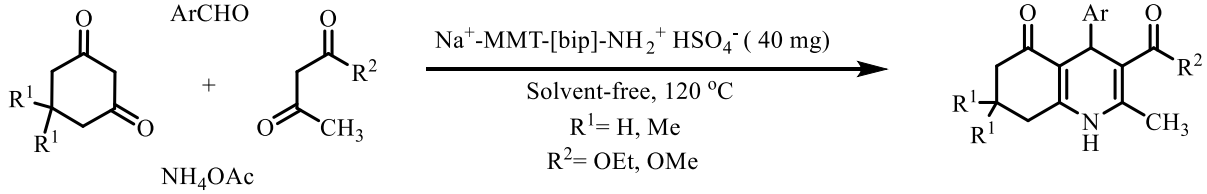
Department of Chemistry, College of Sciences, University of Guilan, Rasht, 41335-19141, Iran.

shirini@guilan.ac.ir

Abstract:

Hexahydroquinolines (HHQs), as the member of 1,4-dihydropyridines (1,4-DHPs) family, are among the most important biologically active compounds showing antihypertensive, antianginal, vasodilator and cardiac depressants activities [1]. In addition, these derivatives also show antimalarials, antiviral, antibacterial, antiasthmatic, anticancer, antipsychotic, antiglaucoma, and antifertility activities [2, 3]. Hantzsch synthesis which is included the one-pot four-component condensation of aldehydes, 1,3-diketones, *β*-ketoesters, and ammonium acetate is one of the famous methods used for the synthesis of hexahydroquinolines (HHQs). Although various reagents have been proposed for this reaction, but provided methods have disadvantages such as harsh reaction conditions, low yields and long reactions time.

In this work, a green and efficient procedure has been reported for synthesis of hexahydroquinolines *via* Hantzsch condensation using nanoporous sodium montmorillonite clay (Na^+-MMT) modified with an ionic liquid bridge (Na^+-MMT-[bip]-NH_2^+ HSO_4^-). The procedure gave the products in excellent yields in very short reaction times under solvent-free condition [Scheme 1].



Scheme 1. Synthesis of hexahydroquinolines catalyzed by Na^+-MMT-[bip]-NH_2^+ HSO_4^-.

Keywords: Na^+- montmorillonite, Ionic liquid, Hexahydroquinolines, Hantzsch condensation.

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Magnetic Fe_3O_4/GO/copper-based nanocomposite: an efficient magnetically separable catalyst for the rapid and selective acylation of amines

Farhad Shirini, Hassan Tajik,* Mehdi Zabihzadeh, Ramtin Yari Nia*

Department of Chemistry, College of Science, University of Guilan, Rasht, 41335-19141, Iran

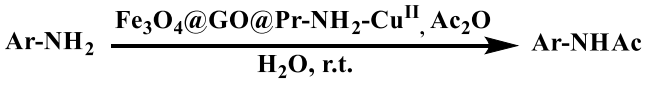
*Correspondence e-mail: *shirini@guilan.ac.ir*

In recent years, the use of magnetic nanoparticles (MNPs) as catalysts or catalyst supports (magnetic nanoparticles supported catalytic systems) in organic transformations has become a hot topic of numerous investigations. This is because MNPs can be easily (*via* external magnet) separated and recovered which is very worthwhile from the viewpoint of economic and environmental issues (green chemistry).[1]

Among the various types of MNPs, more attention has been paid to the Fe_3O_4 MNPs because of their unique properties. However, due to their higher surface energy, Fe_3O_4 MNPs may rapidly aggregate and convert to bulkier form. So, to overcome this drawback, this compound is generally coated with various materials. Graphene oxide (GO) is an excellent eco-friendly candidate for protection of Fe_3O_4 MNPs.[2] On the other hand, copper-based catalysts play an important role in chemical transformations. In the last decade, a number of copper-based catalytic systems have been used for a myriad of organic reactions.[3]

Selective protection of amines is one of the most important methods for multistep synthesis of organic compounds. So, increasingly large numbers of documents have been reported for this achievement.[4] However, further efforts are needed to introduce more efficient and cleaner methods.

On the basis of the above considerations, we were interested to investigate the applicability of magnetic Fe_3O_4/GO/Copper-Based nanocomposite as an efficient magnetically recoverable catalyst for the acylation of amines. The prepared catalyst exhibited an excellent catalytic activity. All reactions were carried out in H_2O in 88–95% yields. Selective acetylation of amines versus alcohols was carried out successfully. The catalyst was reused for 4 times without significant loss of its catalytic activity (Scheme 1).



Scheme 1. Acylation of amines catalyzed by Fe_3O_4@GO@Pr-NH_2-Cu^{II}.

Keywords: Ac_2O · Acetylation · Amines · Fe_3O_4/GO · Copper · Green chemistry.

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A novel amino acid-based deep eutectic solvent as a solvent-catalyst for the synthesis of tetrahydro-4*H*-chromene derivatives

Meysam Alipour Khoshdel, Farhad Shirini,* Mohaddeseh Safarpoor Nikoo Langarudi, Mohammad Biglari, Mehdi Zabihzadeh

Department of Chemistry, College of Sciences, University of Guilan, Rasht, 41335-19141, Iran.

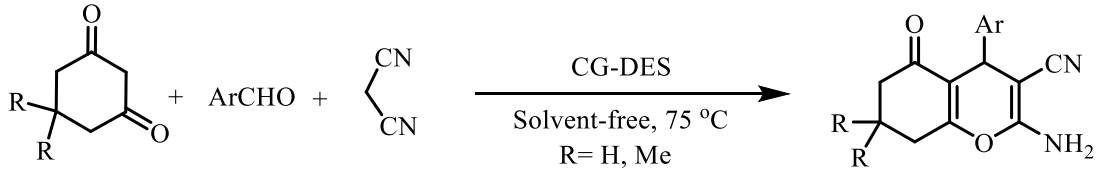
shirini@guilan.ac.ir

Abstract:

Tetrahydro-4*H*-chromenes and their derivatives are of remarkable interest because of their wide range of biological properties, such as spasmolytic, diuretic, anti-coagulant, anti-cancer and anti-anaphylactic activities [1, 2].

In recent years, synthesis and investigation of reagents shown dual solvent-catalyst characters are progressed in our research group which led to the synthesis of some novel ionic liquids (ILs).

To avoid from some disadvantages of ILs, we motivated to investigate greener compounds to use as catalyst-solvent in organic transformations, called deep eutectic solvents (DESs). These compounds possess similar physical and chemical characters like ILs, but due to utilizing more eco-friendly compounds such as amino acids in their structures, they become more environmentally-benign reagents than ILs. To survey the catalytic activity of the reagent, tetrahydro-4*H*-chromene derivatives were synthesized in the presence of CG-DES without using any organic solvent [Scheme 1].



Scheme 1. Synthesis of tetrahydro-4*H*-chromenes catalyzed by CG-DES.

Keywords: Tetrahydro-4*H*-chromenes, Deep eutectic solvents, Amino acid.

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Synthesis and Chracterization of New bis - Thiazolidine dione

*Hadiseh Yazdani Nyaki, Nosratollah Mahmoodi **

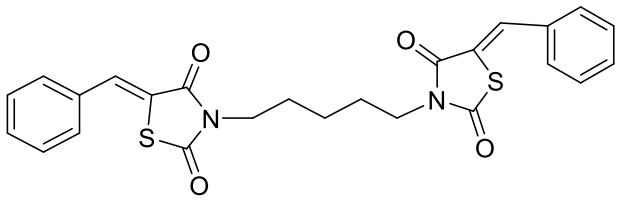
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: mahmoodi@guilan.ac.ir

Abstract

Thiazolidine-2,4-dione (TZD) is an important heterocyclic ring system that exhibit a range of pharmacological activities, but not limited to, including anti-hyperglycemic, anti-cancer, anti-inflammatory, anti-arthritic, and anti-microbial, etc [1-3] . Among them, anti-hyperglycemic is the widely studied effect of TZD derivatives that has also been extended to the development of clinically used 'glitazone' drugs such as rosiglitazone lobeglitazone, pioglitazone, and troglitazone, etc [4-6] .

In this study, a new bis-derivatives of 2,4-thiazolidione dione was prepared from starting material such as aldehyde, thiazolidine dione was connected via alkyl-linkage to improve pharmaceutical effectiveness as a bisdrug.



(*Z*)-3,3'-(pentane-1,5-diyl)bis(5-((*Z*)-benzylidene)thiazolidine-2,4-dione)

Keywords: TZD, glitazone, New bis- Thiazolidine dion, Anti –cancer

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2019
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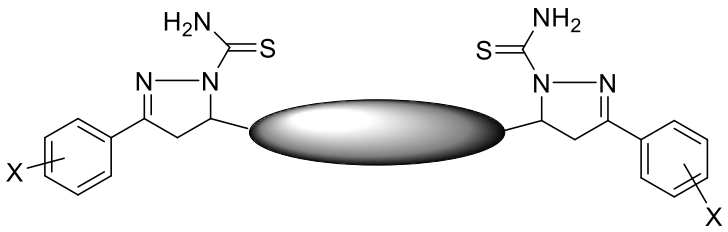
Synthesis of novel bispyrazoline thioamides derivatives linked by cyclocondensation reaction of novel chalcones

Zahra Khazaei, *Nosrat O. Mahmmodi**
Department of Organic Chemistry, Faculty of Science, University of Guilan, Rasht, Iran
**Correspondence e-mail: mahmoodi@guilan.ac.ir*

Abstract

A new series of pyrazoline derivatives were synthesized by cyclocondensation reaction of chalcones with thiosemicarbazide in AcOH and thiosemicarbazide in EtOH respectively. The pyrazolines are important examples of biologically active molecules with a five membered ring containing two atoms of nitrogen and a double bond. Reports on pyrazolines together with thioamides, reflects the biological activity that this kind of compound have displayed as anti-inflammatory [1], antitumor [2], antimycobacterial [3], antidepressants and anticonvulsants [4], antimicrobial [5], among others.

Kywords: pyrazoline, Chalcones, antimicrobial and antitumor.



Reference:

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Synthesis of Zeolite A-ZIF-8 Composite and Investigation of its Properties

Zahra Shaabanzadeh, *Alireza Khorshidi*[*], *Hadi Fallah Moafi*, *Khalil Tabatabaeian*
Department of Chemistry, Faculty of Sciences, University of Guilan, P.O. Box: 41335-1914, Rasht, Iran.

Abstract:
Metal-organic frameworks (MOFs), a new class of porous crystalline materials, have attracted great interest as a promising candidate for environmental remediation. Zeolite imidazolate frameworks (ZIFs), being classified as a new subclass of MOFs, have emerged as a novel type of highly porous materials, combining advantages from both zeolites and conventional MOFs; for example, ZIF-8 has been synthesized from 2-methylimidazole and a zinc prcursor in the sodalite form [1, 2].
In this study, Zeolite A-ZIF-8 was synthesized by inclusion of Zn^{2+} into the cages of zeolite A followed by solvo-thermal linkage of 2-methylimidazolate (MeIM) moiety.

The obtained composite was characterized by means of X-ray powder diffraction (XRD), scanning electron microscopy (SEM), and Fourier transform infrared spectroscopy (FT-IR). SEM imaging showed that nano-sized ZIF-8 crystallites were successfully formed inside and over the surface of zeolite A. Meanwhile, EDS analysis showed presence of all of the anticipated elements in the sample. FTIR analysis and XRD patterns also approved correctness of the expected structure. Potential application of this newly devised composite is currently under investigation in our laboratory.

Keywords: Metal -organic framework, Zeolite imidazolate framework, Composite, Zeolite A.

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A novel one-pot catalytic oxidative dehydrogenation: Three-component condensation reaction of 2-aminobenzimidazole with aldehyde in the presence of porous nanorods

Neda Mardazad; Alireza Khorshidi; Abdollah Fallah Shojaei*

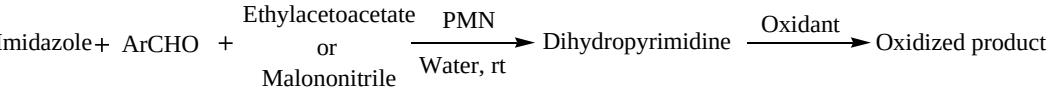
Department of Chemistry, University of Guilan, PO Box: 41335-1914, Rasht, Iran

Abstract:

At the beginning of the new century, it is widely accredited that the development of efficient, practical and environmentally friendly methods of synthesis has been recognized as one of the most important topics of modern organic synthesis [1]. As the biggest pollution problem in many synthetic organic processes is with organic solvents, the development of efficient synthetic methodologies for organic reactions in the presence of non-toxic solvents is an important challenge. It is known that water is a non-flammable, non-hazardous, non-toxic, uniquely redox-stable and inexpensive green solvent. Therefore, using water as the reaction medium has gained considerable interest [2].

In recent years, much attention has been devoted towards dihydropyrimidine (DHPM) derivatives as the most important classes of tricyclic compounds, due to their significant therapeutic and biological activities, such as antiviral, antibacterial, anti-inflammatory, anti-hypertensive, anti-tubercular, anti-malarial, cytotoxic, and DNA-topoisomerase activities [3-5].

Thus, it is necessary to further develop an efficient and convenient method to construct this type of heterocyclic compounds. Based on our ongoing efforts in exploring environmentally benign syntheses, herein we report an efficient and green procedure for the synthesis of dihydropyrimidine derivatives in presence of [Porous manganese oxide nanorods (PMN) in water.



Facile synthesis of DHPM was achieved by using Porous manganese oxide nanorods under very mild conditions. The product was then oxidized to the desired compound. Further manipulation of this reaction is currently under way in our laboratory.

Keywords: One-pot, Porous nanorods, Inorganic catalyst, Oxidative dehydrogenation.

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Rational design of building blocks to prepare three-dimensional architecture of Pd aerogel as a high-performance self-support catalyst for ethanol electro oxidation

Maryam Hajnajafi[1], *Alireza Khorshidi*[*1]

[1]Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran

[*1]Corresponding author's Email: Khorshidi@guilan.ac.ir

Absrract

Although profuse studies pursuing high-performance direct fuel cells have been accomplished since the last years, the lack of affordable anode electrocatalysts for the oxidation reaction of clean fuel has still remained as a vital challenge which greatly hampers the development of fuel cell technology [1]. Metallic aerogels have lately emerged as a state of the art and promising account for their great catalytic activity and improved durability in different electrochemical reactions [2].

By taking advantage of nanostructure engineering, we presented a very simple and efficient surfactant-free method for the synthesis of self-assembled Pd aerogels by a spontaneous one-step gelation process. In contrast with other methods, our method presents some advantages such as simplicity, quickness (within an hour), and one-pot synthesis. Pd hydrogel was prepared by reducing H_2PdCl_4 in ethanolic sodium hydroxide as a reducing agent in a rather short time. The extraordinary 3D network and high porosity of Pd aerogel was confirmed by using HR-TEM, FESEM, and XRD techniques. Due to great inner surface area, profuse open interconnected pores and electronic effects, the Pd aerogel exhibits greatly boosted electrocatalytic activity towards ethanol oxidation reaction, much higher than the commercial Pd/C catalyst in alkaline electrolyte. We believe that the Pd aerogel synthesized via a straightforward approach is not only a promising candidate for applications in electrocatalysis for direct ethanol fuel cells but also will open large opportunities for other energy-related systems.

Keywords: Aerogel, Electrocatalyst, Ethanol oxidation reaction

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Conductometric study of 1-hexyl-3-methylimidazolium Bromide ionic liquid in water + polyethylene400 mixtures at T = (298.2,and 308.2) K

Bahram Ghalami-Choobar, Maryam Souri Damirchisofla, Mojgan Shafaghat-Lonbar

Department of chemistry, Faculty of science, university of Guilan, Rasht, Iran

Corresponding author E-mail: B-Ghalami@guilan.ac.ir

Abstract

Ionic liquids (ILs) are low temperature molten salts consisting of a large organic cation and organic or inorganic anion [1]. They are classified as green solvents. Due to their significant properties such as thermal stability and their adjustable properties by suitable selections of cations and anions, ILs are considered desirable average option for chemical processes such as, solvent for polymerization, separation, biocatalysis and pharmaceutical synthesis [2]. They are also used as heat transfer fluids for processing biomass and as electrically conductive liquids in electrochemistry (batteries andsolar cells) [3].

In this research, the conductometric measurements were performed for 1-hexyl-3-methylimidazolium Bromide, [HMIm]Br ionic liquid from 0.0001 to 0.2 mol kg^{-1} in different mass fractions of ethanol in water + polyethylene400 mixtures ((w/w) % = $w_{polyethylene400}$ / $w_{mixture}$ = 0 and 10%) at T = (298.2, and 308.2) K and P = 0.1 MPa. Limiting molar conductivity (Λ_0) and ion association constant (K_A) were calculated through Fuoss-Onsager equation for studied system.

Keywords: Conductivity, 1-hexyl-3-methylimidazolium Bromide**,** Association constant**,** Fuoss-Onsager equation

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Investigation on intermolecular Interaction of Trans-aco base curcuminato exo Zirconium (IV) hydrate and Curcumin with Ct-DNA

*Mozhgan Biuki, H. Dezhampanah**

Department of Chemistry, Faculty of Science, University of Guilan, P.O. Box: 19141, Rasht, Iran,

Email: h.dpanah@guilan.ac.ir

Abstract

DNA plays a fundamental role in the storage and expression of genetic information in a cell. Various ligands interact with DNA and regulate its function, and some of them are used as antitumor or antibiotic agents. Study on the binding mechanism of small molecules and DNA plays a key role in understanding of their clinical activities and rational design of the new drugs targeted to DNA [1]. Curcumin, possesses a variety of remarkable pharmacological activity including anti-inflammatory, anti-carcinogenic and anti-oxidant activity [2].

In this study, the molecular interaction between Zirconium curcumin complex (trans-$[ZrO(curcumin)_2(H_2O)].H_2O$) and curcumin as a common food coloring additive and calf thymus DNA (ct-DNA) have been characterized at physiological pH using UV–Vis absorption and Fourier transform infrared (FTIR) spectroscopy, fluorescence spectrophotometry and molecular docking calculations. Strong hypochromic effects in absorbance and quenching in fluorescence were observed that showed strong binding of Zirconium curcumin to Ct-DNA. The binding affinity values evaluated from maximum absorption of the Zirconium curcumin spectra at the various Ct-DNA concentrations suggests that curcumin exhibits the higher binding affinity to Ct-DNA compared to the Zirconium curcumin. In addition to quenching of fluorescence by Fluorescence resonance energy transfer, it is believed that several other quenching mechanisms are occurring at the surface. Experimental data and molecular docking results suggested that the hydrogen bonds and van der Waals forces might play a major role in the binding of Zirconium curcumin to Ct-DNA. The results of FT-IR spectra and molecular docking showed that a specific binding mainly existed between Zirconium curcumin and Ct-DNA.

Keywords: CT-DNA, Curcumin, fluorescence spectroscopy.

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One-pot synthesis of 3,4-dihydropyrimidin-2(1H)-one derivatives by new magnetic nanocatalyst

Asieh Yahyazadeh, Motahare nafei, Mehraneh Aghaei-Hashjin*

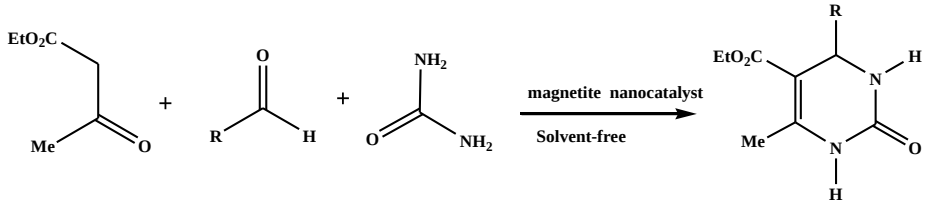
Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran

**Email: yahyazadeh@guilan.ac.ir*

Abstract

Magnetic nanoparticles (MNPs) are compounds with unique features including drug delivery systems, biosensors, environmental remediation, magnetic resonance imaging [MRI], catalysis and the ability to be utilized several times without any remarkable reduction in their activity [1].

In the present work, a new magnetically recyclable nanocatalyst was designed, prepared, and characterized by Fourier transform infrared (FT-IR) spectroscopy, X-ray diffraction (XRD) pattern, field-emission scanning electron microscopy (FE-SEM) images, energy-dispersive X-ray (EDX), vibrating sample magnetometer (VSM), and transmission electron microscopy (TEM) analyses. Then, performance and retrieval of the magnetic nanocatalyst, was investigated for the synthesis of 3,4-dihydropyrimidin-2(1*H*)-one derivatives via one-pot four-component reaction under solvent-free conditions. 3,4-Dihydropyrimidin-2(1*H*)-ones (DHPMs) have been reported to possess diverse pharmacological activities such as antiviral, antibacterial and antihypertensive activity, as well as efficacy as calcium channel modulators and α_{1a}-antagonists. The simple and direct method for the synthesis of DHPMs reported by Biginelli in 1893 involves the one-pot condensation of an aldehyde, a β-ketoester and a urea under strongly acidic conditions [2-3].The ability to reuse the magnetite nanoparticle, high yield, short reaction time, solvent free conditions and ease of purification of products are the important features of this process.



Synthesis of 3,4-dihydropyrimidin-2(1*H*)-one derivatives in the presence of magnetite nanocatalyst

Keywords: magnetite nanoparticles, 3,4-Dihydropyrimidin-2(1*H*)-ones, solvent-free, nanocatalyst

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The effect of insitu reduction of multilayer graphene oxide on improvement of epoxy corrosion resistance on carbon steel substrate

Masoumeh Moradi, *Somayeh Mohamadi*

Departeman of Chemistry, Fculty of Science, University of Guilan, Rasht, Iran

Abstract:

Despite great recent progress, the processing of graphene oxide (GO) sheets in polymers are often one of the most challenging steps in fabricating graphene/ polymer nanocomposites. The challenge is how to achieve high levels of dispersion and reduction of GO simultaneously, without any residual reducin agents in the composites. There are some methods for reduction of graphene oxide into reduced graphene like thermal methods in high temperatures and chemical methods by some reducing agents like hydrazine, hydroquinone and metal hydrids. These reduction methods are not applicable in many polymeric matrixs. In this work, a solvothermal method in low temperature is used for in situ reduction of GO in epoxy coating. First graphene oxide layers are homogenously dispersed in an epoxy matrix. In the second step, mild thermal treatments are carried out on composites in order to promote a thermal reduction of the graphene oxide into reduced graphene oxide by acetonitrile solvent. The occurrence of an insitu reduction of graphene oxide is confirmed by various experimental techniques, such as differential scanning calorimetry, thermogravimetric analysis and electrical resistivity measurements. Herein, we review the synthesis techniques most commonly used to produce these graphene derivatives, discuss how synthesis affects their key material properties, and highlight some examples of nanocomposites with unique and impressive properties. Finally, we discuss the outlook and remaining challenges in the field of corrosion protection.

Keywords: multilayer graphene oxid ،Corrosion resistance ،insitu reduction ،Epoxy coating ،Carbon steel

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Prediction of Liquid Phase Equilibrium data for Ternary systems (water + valeric acid + halogenated methanes) using UNIFAC Method

Mahtab Pourmohammadi*, Sina Shekarsaraee

Department of Chemistry, Faculty of science, University of Guilan, Rasht, Iran

E-mail: shekarsaraee@guilan.ac.ir

Abstract:

Lower costs and less time-consuming work can be mentioned as the advantages of theoretical research methods, instead of laboratory work. The UNIFAC method for calculation of activity coefficients is based on the group-contribution concept [1]. The basic idea is that whereas there are thousands of chemical compounds of interest in chemical technology the number of functional groups which constitutes these compounds is much smaller. Therefore, if we assume that a physical property of a fluid is the sum of contributions made by the molecule functional groups, we obtain a possible technique for correlating the properties of a very large number of fluids in terms of a much smaller number of parameters which characterize the contributions of individual groups.

Here are activity coefficients in some of multicomponent systems by these models. This information is effective in liquid extraction, design of distillation columns and etc [2]. In the present study, we investigated the effect of hydrogen bonding on extraction of Valeric Acid (VA) by selecting a family of solvents in which hydrogen bond acidity changes from zero to a maximum. Results show that chloroform which has the strongest hydrogen bond acidity, is the best solvent for extraction of VA.

Keywords: LLE Data; Ternary systems; UNIFAC Method.

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Synthesis of new derivatives of *bis*-imine compounds

*Nosratollah Mahmoodi *, Sajede Shoja, Mahsa Mohammadrezaie*

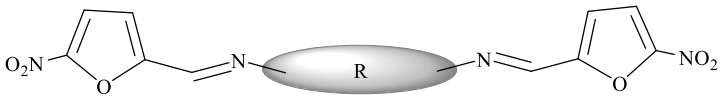
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: mahmoodi@guilan.ac.ir

Abstract

Nitroheterocyclic drugs are used for the treatment of a wide range of bacterial and protozoal diseases. The Nitrofuran group of drugs is very large and displays a wide spectrum of clinical and nonclinical applications. Nitrofurans are known to produce DNA strand breaks as a consequence of reduction of their nitro group. One of the nitrofuran drugs is nitrofurazone. This drug is used primarily against gram-negative infections of skin injuries typified by *Escherichia coli*, *Pseudomonas* and *Proteus*. For the synthesis of nitrofurazone various methods have been used. The starting material used in the synthesis may be 5-nitrofurfural diacetate, 5-nitro-2-furaldehyde, 2-furaldehyde or nitrofurfuraloxime.

In this study, reaction of various di-amines with 5-nitro-2-furaldehyde diacetate has been described, and lead to various *bis*-imine compounds. All of the novel synthesized compounds were isolated, purified and characterized by spectroscopic methods (FT-IR, ^{1}H NMR, and ^{13}C NMR).



bis(1-(5-nitrofuran-2-yl)methanimine)

Keywords: heterocyclic compound, nitrofuran, imine, nitrofurantion, nitrofurazone

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Modification of carbon based materials by poly 4-nitro-1,2-phenylenediamine and gold nanoparticles for pre-concentration of sulfur pesticides and their determination by HPLC

Mona Mohammadzadeh Dogahe, *Alireza Aiakbar**

Department of chemistry, faculty of science, university of Guilan, Rasht, Iran

Abstract

The impact effects of pesticides on living organisms and environment, have been considered by people and researchers [1]. To control the danger of pesticides, the first step is measuring the amount of these compounds in various samples. Due to trace amount of pesticides in samples, there is needed to pre-concentrate them to be measurable. There are many methods for pre-concentration. Among then, solid-phase extraction has outstanding properties [2,3]. High pre-concentration factor (PF), low consumption of solvent, cheapness and…. are the advantages of this method. Many kinds of sorbents are commercially available. In this work a new kind of sorbent is introduced. This sorbent is based on modification of carbon materials by poly 4-nitro-1,2-phenylenediamine and gold Nano particles. The prepared sorbent is used for adsorption of sulfur pesticides, which are mostly used as fungicides. By this these compounds are concentrated and cleaned up. After that, these pesticides are eluted by a little amount of MeOH and injected to HPLC system. The kind of sulfur compounds and their concentrations are determined by comparing the areas of the chromatogram peaks with standards areas.

Keywords: poly 4-nitro-1,2-phenylenediamine, solid-phase extraction, HPLC, sulfur pesticide.

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Application of photocatalytic ozonation process using MoS_2 nanocatalyst for efficient removal of organic dyes from aqueous media

*Nadia Gerivani, Naz Chaibakhsh**

Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran

Corresponding author E-mail: nchaibakhsh@guilan.ac.ir

Abstract:

Wastewaters are major environmental concerns of the dye-consuming industries. Although organic dyes are widely used in the industry but the untreated effluents containing dyes have carcinogenic, mutagenic and harmful effects on the aquatic life. In recent years, many techniques have been developed for the removal of synthetic organic dyes. Among these methods, photocatalytic ozonation process has shown promising results due to its high efficiency.

In this study, MoS_2 nanosheets were synthesized via the hydrothermal method and characterized in terms of particle size and morphology. *Acid Blue* 113, commonly used as a textile dye, was photocatalytically degraded using MoS_2 nanacatalyst under irradiation of visible light (white light emitting diode (LED) lamp) using ozonation. Response surface methodology (RSM) based on central composite rotatable design (CCRD) was employed to study and optimize the treatment process. The results showed that MoS_2 and visible light (VL) had a synergetic effect when they were used together. The effects of several operating parameters such as pH, the amount of MoS_2 and irradiation time were also examined. At the optimum conditions of pH=7, 45 mg nanocatalyst, 17 min and 0.40 $g.l^{-1}$. h^{-1} of ozone, complete removal of the dye was achieved. The proposed system can be effectively applied to the treatment of wastewaters containing organic dyes.

Keywords: Photocatalysis, Dye degradation, MoS2, Ozonation, Optimization, Acid Blue 113.

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2019
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Study on the synthesis of chromene-indole hybids as bilogically active structural frameworks

Manouchehr Mamaghani, Nesa Haghgoo and Elham Saberikhah*

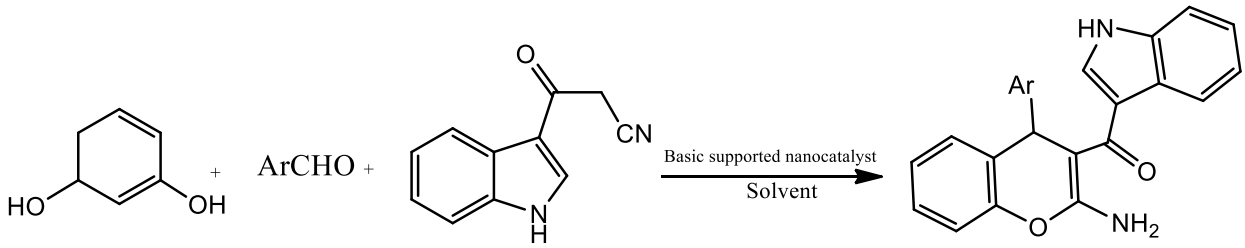
Department of Chemistry, Faculty of Sciences, University of Guilan, P.O. Box 41335-1914, Rasht, Iran

**E-mail: m-chem41@guilan.ac*

Abstract:

Indole derivatives have been reported to exhibit a wide range of biological activities. Indole nucleus occupies a unique position in heterocyclic chemistry due to its noticeable pharmacological properties and thus stands as an important scaffold in drug design. On the other hand, chromene derivatives are important group of heterocycles with diverse biological properties and therapeutic application which have attracted many attentions. The natural chromenes also display a diverse range of valuable biological properties such as antimicrobial and, antiviral activities [1-4]. At present research we wish to report a facile protocol for the synthesis of densely functionalized chromenes by the reaction of resorcinol, arylaldehydes and cycnoacetylindole in the presence of basic nonocatalyst.

Keywords: Chromene, indole, aminochromene, chromene-indole hybrid



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1,4-dihydropyridine derivatives Synthesis of three-component A novel one-pot

*Nesa Roshani Talesh, Kurosh Rad-Moghadam**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Abstract:

Six-membered heterocyclic compounds are very important in the realm of organic chemistry. Research on heterocyclic compounds with biological and pharmacological activities continues to arouse great interest [1]. Recently, chemists have devoted considerable attention to 1,4-dihydropyridine compounds, due to their important roles such as medical, biological, and pharmacological activities. They are also used as key drug-like compounds [2]. 1,4-Dihydropyridine derivatives have applications as calcium channel blockers for the treatment of cardiovascular diseases including hypertension. They are also used as antidiabetic agents, anti-tumor, geroprotective, anti-therosclerotic, and bronchodilator [3]. Therefore, synthesis of these compounds has captivated much interest. In this background, we develop here a new method for the synthesis of 2-amino-6-(4-hydroxy-2-oxo-2*H*-chromen-3-yl)-4-phenyl-1,4-dihydropyridine-3-carbonitriles *via* the three-component reaction between an arylaldehyde, malononitrile, and 3-iminoacetyl-4-hydroxycoumarin. All the products are new compounds.

Keywords: 1,4-Dihydropyridine, Heterocyclic compounds, 3-Iminoacetyl-4-hydroxycoumarin, Multicomponent reactions.

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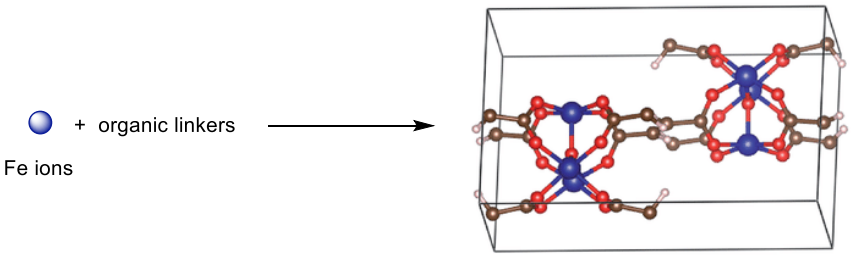
MOFs as Reusable Solid Catalysts for Cross-Coupling Reactions

*Nasibeh kohansal, Mehdi Sheykhan**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran
Corresponding author E-mail: sheykhan@guilan.ac.ir

Abstract:

Recently metal organic frameworks (MOFs), due to their reusability, easy preparation, clean reactions and facile purification, have gathered special momentum in biochemistry, pharmaceuticals and environmental industry. Thus far, growing interest has been focused on either modification or design of such catalysts which drive reactions of choice to the desired target molecules.[1] Of the other virtues associated with these catalysts is their aptitude to be structurally altered by selecting different metal ions owing to the tunable electron transfer property between metal ions and the parent MOF; thus capable of promoting different reaction pathways. Zinc, copper and iron are normally used as the nodes of MOFs since they are among inexpensive and accessible metals and also apt to commence radicalic reactions which are prevalent on the front of organic chemistry. Herein, we are focusing our attention on fabrication of heterogeneous catalysts based on iron ions and their use in execution of cross coupling reactions.[2]



Keywords: Metal organic frameworks, Heterogeneous, Iron.

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Tuning the photophysical properties of the designed dye-sensitized solar cells

Hossein Roohi, Nafiseh Mohtamedifar

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Abstract:

Dye sensitizers play an important role in dye-sensitized solar cells (DSSCs)[1]. One of the most significant aspects in the development of dye-sensitized solar cells is the exploration and design of high-efficiency and low-cost dyes[2]. In this work, three new metal-free organic dyes donor-π-acceptor dyes (D-π-A) used in dye-sensitized solar cells were designed by density functional theory (DFT) and time-dependent DFT (TDDFT) methods. The electronic, structural and optical properties of the studied dyes were investigated. The LUMO and HOMO energy levels of dyes used in DSSCs have a positive effect on the process of electron injection and dye regeneration. The trend of the calculated HOMO–LUMO energy are in good agreement with the photophysical data. Key parameters corresponds to the short-circuit current density (Jsc) including light-harvesting efficiency (LHE), injection driving force (ΔG^{inject}) and total reorganization energy (λ_{total}) were discussed. In addition, the estimated values of open-circuit photo-voltage (Voc) for these dyes were computed. The calculated results of these dyes revealed that the D3-L1 dye can be used as a potential sensitizer for TiO_2 nanocrystalline solar cells due to its best electronic and optical properties and good photovoltaic parameters.

Keywords: Dye-sensitized solar cells, Photovoltaic parameters, HOMO–LUMO energy

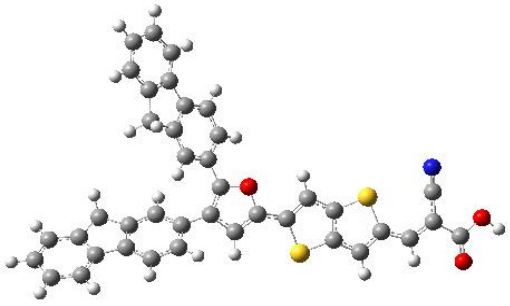

Fig.1. Optimized molecular structure D3-L1 dye.

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2019
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Synthesis of new tripod dispersant agent based on the propyl sulfamic salts

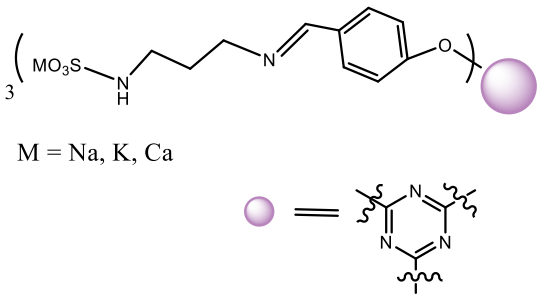
Nosratollah Mahmoodi, Niloufar Akbari*

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: mahmoodi@guilan.ac.ir

Abstract

Here, we report synthesis of new dispersant agent from reaction of cyanuric chloride, 4-hydroxybenzaldehyde and diamines [1-4]. The resulting tripod sulfamic acids were sulfonated, and converted to corresponding salts and subsequently isolated and purified. The structures were identified by IR, ^{1}H NMR, ^{13}C NMR. The synthesized compounds could be used in industry as anti-dispersant agent either for organic compounds as well for inorganic compounds.



M = Na, K, Ca

(3-(((E)-4-((4,6-bis(4-((E)-((3-(sulfoamino) propyl) imino) methyl) phenoxy)-1,3,5-triazin-2-yl) oxy) benzylidene) amino) propyl) sulfamic salts

Keywords: Tripod propyl sulfamic acid; Dispersant agent; cyanuric chloride; Diamine; Anti-dispersant agent

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2019
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Synthesis of new bis-, and tris-sulfonamid derivatives and considering their biological activitties

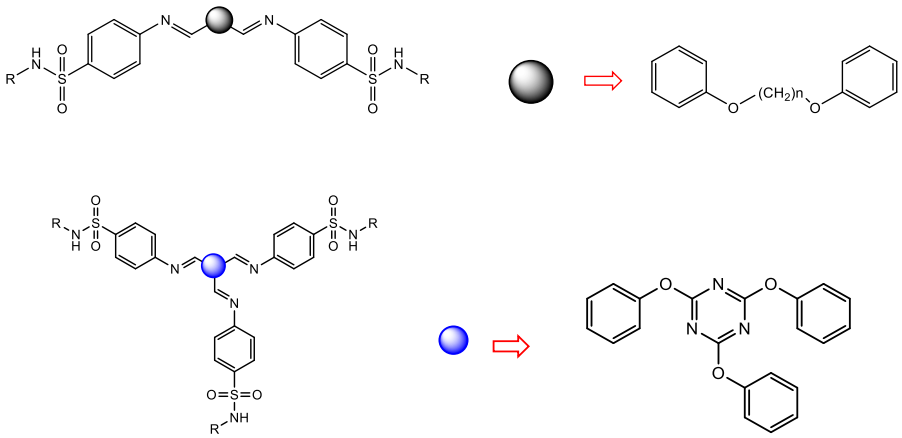
*Nosratollah Mahmoodi *, Ammar Sheykhi, Niloofar Sadeghpour*

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: mahmoodi@guilan.ac.ir

Abstract

The sulfonamide structural class is dominant within the pharmaceutical industries.
In 2016 sulfonamides represented 15% of the top 100 most prescribed drugs, with therapeutic properties against infectious and neurological diseases [1]. This is due to their potential structural features which are capable of multiple interactions with various biological targets. Also, sulfonamides are generally stable, easy to synthesize, and have maximized pharmacological benefits such as oral absorption and low side effects. A new series of novel aromatic and heterocyclic bis- and tris-, sulfonamide Schiff bases were prepared by reaction of several heterocyclic sulfonamide pharmacophores with some premade bis and tris aldehydes according to our previous publication [2]. The resulting products were separated purified and characterized by TLC, M.P, IR, ^{1}H NMR, ^{13}C NMR. These Schiff bases containing heterocyclic moieties can have beneficial interactions within the active sites of enzymes and they may show an increased inhibitory action. This is the reason why we report here this type of synthesis. The biological activities of all of the synthesized compounds were considered in comparison to standard medicines.



Keywords: bis sulfonamide; Tris sulfonamide; Schiff bases ; cyanuric chloride; Diamine; sulfonamide drugs

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Inhibition of mild steel corrosion in hydrochloric acid using novel phenylcarbazide-based Schiff bases

Homayoon Eslomi Zadeh, Asadollah Mohammadi, Somayeh Mohammadi**
Department of chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Abstract:

Generally, organic compounds containing oxygen, nitrogen or sulfur heteroatoms, particularly in the form of aromatic rings (pyridine, benzene, thiazole, etc.) and p-conjugated systems, can exhibit excellent inhibition efficiency. A survey of the literature revealed that Schiff bases, containing the -C=N- group, are an effective type of corrosion inhibitors for metals in acidic media.

Novel phenylcarbazide Schiff base derivatives were synthesized and their corrosion inhibition properties on mild steel in 1.0 M HCl were studied through experimental measurements. Weight loss, electrochemical impedance spectroscopy and potentiodynamic polarization results indicate that all compounds exhibit a good inhibition effect. Meanwhile, the adsorption process obeys the Langmuir adsorption isotherm model, and thermodynamic parameters were calculated and discussed. Scanning electron microscopy and X-ray photoelectron spectroscopy analyses confirm the adsorption and protective abilities of the three studied inhibitors on mild steel in HCl. UV-vis spectroscopic studies show that the corrosion inhibitors interact with mild steel in HCl solution to form Fe-inhibitor complexes.

According to the experimental results, the inhibition mechanism was deduced.

Keywords: Corrosion, Phenylcarbazide, Schiff base, Weight loss

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Investigation on intermolecular interaction of Cobalt (II) phthalocyanine tetrasulfonic acid tetrasodium salt with HSA and BSA

Authors: Hamid Dezhampanah[*1], Athena Maboodi[1]*

Addresses: [1]Department of Chemistry, Faculty of Science, University of Guilan P.O. Box 1914, Rasht 0098, Iran.

**Corresponding author: E-mail: h.dpanah@guilan.ac.ir*

Abstract

Phthalocyanines are among the important organic macrocycles, possessing varied applications due to photochemical, photophysical, optical, and electrochemical properties, biological functions, aswell as high stability. These compounds are extensively used as pigments and dyes and they aremodels for biologically important species such as porphyrins, hemoglobin, and chlorophyll. Pcs can be used in chemical sensors, especially for the detection of NO_2 in optoelectronic devices, solar cells, and other applications. [1]

In this research interaction of human (HSA) and bovine serum albumins (BSA), as drug carriers with Cobalt (II) phthalocyanine tetrasulfonic acid tetrasodium salt were investigated using fluorescence and UV-vis absorption spectroscopy. The fluorescence emission of HSA and BSA were quenched by this Phthalocyanine complex that has been analyzed for estimation of binding parameters. The titration of Phthalocyanine solution by various amount of HSA and BSA were also followed by UV–Vis absorption spectroscopy and the corresponding data were analyzed by suitable models.

The binding constants (K) were determined from the changes in the Q-band maximum of the Phthalocyanine spectra at the various HSA and BSA concentrations. The results revealed that this Phthalocyanine complex has an ability to bind strongly to HSA and BSA by forming 1:1 complex which indicated that the binding process occurs spontaneously and demonstrated that human and bovine serum albumins provide very good binding via hydrogen bonds, van der Waals forces and hydrophobic interactions and the secondary structure of serum albumins are changed.

Keywords:

Phthalocyanine; serum albumins (BSA/HSA); Florescence Spectroscopy

Reference:

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[2] Shubhashis Datta, Niharendu Mahapatra, Mintu Halder Department of Chemistry, Indian Institute of Technology Kharagpur, Kharagpur 721 302, India.

C-H Bond Activation of Unactivated Arenes via an MOF-catalyzed Reaction

*Azadeh Sadat Shoaee-Moafi, Mehdi Sheykhan**

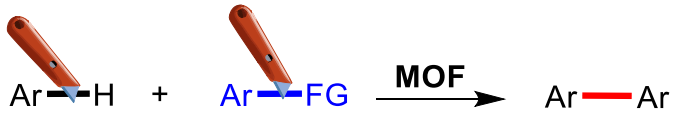
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: sheykhan@guilan.ac.ir

Abstract:

C-H bonds as well as C-C bonds are ubiquitous bonds in the world of organic chemistry, activation of which has been the subject of extensive studies thus an overarching issue for synthetic chemists [1]. Besides, cross coupling reactions which lead to the longer carbon chains have also piqued much interest in the past decade [2]. The most common catalysts hitherto used for C-C bond formation through a C-H bond activation have been found to range from Pd to Rh and Ru [3]. Due to the high cost of these transition metals their use has been almost limited and instead more economical metals such as Fe, Co, Ni and Cu have found special places in this area [4]. Herein, we turned our attention to the exploitation of an inexpensive MOF as an effective catalyst in the formation of C-C bonds. In this respect, we managed to activate cheap unreactive arenes via MOFs without any pre-functionalization which is considered as a noticeable privilege in terms of Green Chemistry.

Keywords: Metal Organic Framework**,** C-C bond formation, heterogeneous catalyst**,** C-H activation



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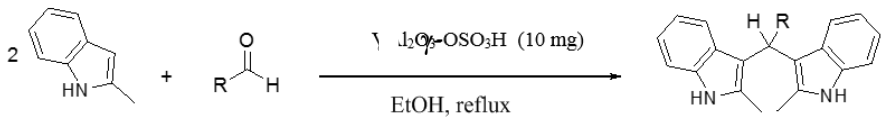
Modification of gamma alumina and its application as a heterogeneous catalyst.

Alireza Khorshidi, Elmira Hajati*

Department of chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran

Corresponding author's E-mail: Khorshidi@guilan.ac.ir

Because alumina has been widely employed as a catalyst or as a catalyst support, a considerable amount of research has been devoted to elucidating the nature of its catalytic properties. In general, alumina has been regarded as an acid-type catalyst, and recently, Pines and Haag have shown how these acid properties serve as a basis for explaining the role of alumina in a number of catalytic applications [1]. However, despite a general agreement as to the acidic nature of alumina surfaces, an exact chemical description of this acidity has not been achieved, and it seems clear that additional research will be required before a thorough understanding of the catalytic chemistry of alumina can be realized. It is well known that there are two general classes of aluminas, which are of catalytic interest. The So-called "eta" and "gamma" modifications are perhaps the most common. Both eta alumina, which is obtained by the thermal decomposition of bayerite, and gamma alumina, the decomposition product of boehmite have been regarded as having tetragonally deformed spinel lattices, but are structurally dissimilar in that the tetragonal character of eta alumina is considered to be much weaker than that of gmma alumina [2]. Numerous indole derivatives occur in many pharmacologically and biologically active compounds. In particular, bis(indolyl)methane possess a wide range of biological activity and their synthesis has received a considerable amount of interest. Generally, bis(indolyl)methanes are prepared by the condensation of indoles with various aldehydes or ketones in the presence of either protic or Lewis acids; many other methods have also been devised for their preparation [3]. We functionalized gmma alumina with $-OSO_3H$ groups. The catalyst was characterized by FT-IR, XRD, SEM, EDX and used in the preparation of bis(indolyl)methanes.



R: 4-nitrophenyl, 2-chlorophenyl, 3-nitrophenyl

Keywords: catalyst; gmma alumina; indole; functionalization

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Solubility and tie-line data for hydrocarbon -alcohol -deep eutectic solvent (DES) system

A. Ghanadzadeh Gilani[*], *Behnaz Mohammadi Khanghah*

Department of Chemistry, Faculty of science, University of Guilan, Rasht, Iran

**aggilani@gmail.com*

Abstract:

Solvents are fundamental to most areas of chemistry including; synthetic, analytical pharmaceutical, food, flavor chemistry, and coating industries. Utilizing a solvent as a reaction medium allows control of reaction conditions including, pressure, pH, temperature, concentration and kinetics. Many molecular solvents common in use are harmful to human health and the environment. Researchers tried to start studies on solvent free chemistry, where reaction systems use a system component as the mobile phase, but this approach has some special problems with it. Over the last two decades, there has been increasing interest in the application of ionic liquids (ILs). On the other hand, the "green" character of ILs has often been questioned. Abbot et al introduced Deep Eutectic Solvents (DESs), as analogues of ILs in 2003 [1-4]. In this work, the feasibility of a DES as a novel extracting agent for the separation of the mixture {hydrocarbon + alcohol} is tested. In order to select the proper solvent for this separation a solubility test of the DES has been done at room temperature and atmospheric pressure. The selected DES was characterized by measurement of density and viscosity at atmospheric pressure and room temperature. Next, the Liquid-Liquid Equilibria (LLE) of the ternary systems {hydrocarbon + alcohol + DES} was determined at mentioned condition above. Besides, the solute distribution coefficient and selectivity values were calculated and compared to LLE data available in literature for the studied ternary system with other solvents. Finally, the experimental data were successfully correlate using UNIQUAC and NRTL models.

Keywords: Liquid-Liquid Equilibria (LLE), Deep Eutectic Solvents (DESs), hydrocarbon, NRTL, UNIQUAC.

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Synthesis and Characteristics of MgO nanoparticles as Antibacterial Agent

*Parvin Moshiri, Zeinab Moradi-Shoelili**

Department of chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: zmoradi@guilan.ac.ir

Abstract:

Bacterial pollution is a great risk for human health. Nanotechnology offers a way to develop new inorganic antibacterial agents [1]. Previous studies have shown that the powder samples with a small crystallite size showed greater antibacterial activity than those with a large crystallite size [2]. Among the metal oxide nanoparticles, magnesium oxide (MgO) has been widely used in various areas such as electronics, adsorption, catalysis, ceramics, petrochemical products, reflecting and antireflecting coatings, detection and remediation of chemical waste and warfare agents due to its unique solid of high ionic character, simple stoichiometry and crystal structure [3]. In this study, MgO nanoparticles were prepared by wet chemical method using solutions of magnesium nitrate ($Mg(NO_3)_2.6H_2O$) and sodium hydroxide (NaOH) as precursors. Then prepared MgO nanoparticles were tested for antibacterial activity against gram positive and gram negative bacteria using agar disk diffusion method. MgO nanoparticles can be used in drug substances and purification of toxic waste.

Keywords: MgO; nanoparticles; Antibacterial activity

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Synthesis of biphenyl derivatives using metal-organic framework

*Nima Alizadeh, Mehdi Sheykhan**

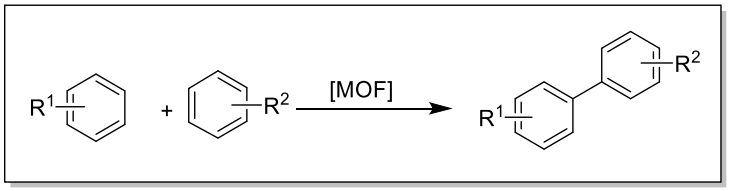
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: sheykhan@guilan.ac.ir

Abstract

The biphenyl nucleus is found in many natural and synthetic products that display a wide range of biological activities [1]. There are several main cross-coupling reactions which allow the synthesis of biphenyls consisting palladium-catalyzed coupling of aromatic organometallics with aryl halides [2]. Metal-Organic Frameworks (MOFs) are coordination polymer compounds formed from metal as a node and organic ligands as a linker. Adjustability of cavity size, ability to loading diverse functional groups in their structure as well as versatile metal-ions that can be exchanged in their structure make them useful catalysts for a variety of organic transformations [3]. Herein, a novel method in the synthesis of biphenyl derivatives was devised using MOF catalysis.

Keywords: Metal-Organic Framework; Biphenyl, C-C Coupling



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Thermodynamic study of the ($CaCl_2$ +glycerol +water) ternary system based on potentiometric measurements at 298.2K

Bahram Ghalami-Choobar, Toba Nasiri-Lohesara, Hadis Faridi-Haftkhani
Department of chemistry, Faculty of science, university of Guilan, Rasht, Iran
Corresponding author E-mail: B-Ghalami@guilan.ac.ir

Abstract:

In recent years, there has been a growing interest in the measurement or prediction of the thermodynamic properties of electrolyte in mixed solvent systems because of their applications in various areas like in industry, biochemistry, environmental chemistry, oceanography, geochemistry and separation processes [1-3]. Thermodynamic study of (salt + alcohol + water) system is useful to understand several biodiesel post-production processes [4].

In this research, the thermodynamic properties of ($CaCl_2$ + glycerol +H_2O) system were determined based on potentiometric technique. The electromotive force measurements were carried out by using self-made electrods on the galvanic cell of type: Ag-AgCl|$CaCl_2$ (m), glycerol (w), H_2O (1-w)|Ca-ISE in various mass fractions of glycerol in water (0, 0.10) in the molality ranging from 0.01 to 4.000 $mol.kg^{-1}$ at 298.2K and P= 0.1 MPa. Termodynamic properties modeling was implemented using the Pitzer ion-interaction model. Subsequently, unknown parameters were determined and utilized to calculate the mean activity coefficients of the system under investigation.

Keywords: Potentiometric method, $CaCl_2$, glycerol, activity coefficient, Pitzer model

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Design a targeting drug delivery system for Gemcitabine hydrochloride based on biocompatible nano structures

Havva Rezaee[1], *Reza Ansari*[2], *Mostafa Shourian*[3], *Seyyed Mohsen Asghari*[4]

[1]*Department of Chemistry, Faculty of Sciences, University of Guilan.*

[2] *Professor in Analytical Chemistry, Department of Chemistry, Faculty of Sciences, University of Guilan.*

[3]*Assistant Professor in Biophysics, Department of Biology, Faculty of Sciences, University of Guilan.*

[4] *Associate Professor in Biochemistry, Department of Biology, Faculty of Sciences, University of Guilan.*

Abstract:

In recent years, the use of nanoparticles in drug delivery systems has received much attention, because they have the ability to deliver drugs to different parts of the body at intermittent intervals. Chitosan (CS) is a natural biopolymer with properties such as non-toxicity, biodegradability, biocompatibility, and so on. In this study, Chitosan (CS) -Alginate (AL) core-shell nanoparticles were developed for Gemcitabine hydrochloride (GEM) delivery to improve the chemotherapy efficacy in breast cancer model. Designed hydrogel networks prepared according to Box-Benkehen analysis as a pH-sensitive hydrogel so we use this property to monitor the release of drug in different pH profile. The encapsulation and loading capacity of the drug in the optimum formulation was 32.0% and 8.30%, respectively. Hydrogel had a particle size of 146 nm and a zeta potential of -16 mV. In vitro release profile of the formulation was investigated in different phosphate buffer solutions. The results show that the presence of alginate shell leads to controlled release of the drug in the medium (pH 6.8) and the hydrogel network doesn't experience the burst release. The Gem-CS-AL NPs also exhibited stronger cytotoxicity, compared with GEM NPs with an increased accumulation of GEM in the MCF-7 cells. Importantly, the Gem-CS-AL NPs showed a higher anti-cancer efficacy in MCF-7 tumor model than the GEM NPs. Overall, the CS-AL core-shell nanoparticles could be a promising nanocarrier for GEM delivery to improve the chemotherapeutic efficacy of Breast cancer.

Keywords: Sodium alginate, Box-Benkehen analysis, Gemcitabine hydrochloride, Chitosan, Hydrogel

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Kinetics Study of the Heterogeneous Oxidation of o-Phenylenediamine over Cu-Ni Bimetallic Organic Framework

Khadije RahmanZadeh, Zeinab Moradi-Shoeli*

Department of chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: zmoradi@guilan.ac.ir

Abstract:

Peroxidases, such as HRP, are a class of oxidoreductase enzymes that catalyze biological reactions using peroxides, such as hydrogen peroxide (H_2O_2) and alkyl hydroperoxide (ROOH). Peroxidases can catalytically scavenge the highly reactive peroxides to form water. Through this catalytic reaction, peroxidases play an important role in biological systems to protect the living organisms from cellular oxidative damage. The intrinsic drawbacks of natural enzymes such as high cost of preparation, purification and storage and also easy denaturation under harsh conditions seriously limit the application of natural enzymes. Thus, the synthesized catalysts with enzyme-like characteristics have attracted great interest. Metal organic frameworks (MOFs) are microporous materials composed of metal ions and organic ligands. In this work, we prepared a heterogeneous Cu-Ni bimetallic organic framework which was tested as catalysts in the oxidation reaction. The structure of the synthesized Cu-Ni MOF was characterized by FT-IR spectrum. Synthesized Cu-Ni MOF showed intrinsic peroxidase property in oxidation of OPD to 2,3–diaminophenazine (DAP) using hydrogen peroxide as oxidant, at room temperature. Kinetic data was collected for the catalytic oxidation reaction by monitoring the UV–vis spectra which showed the Michaelis–Menten model yielding kinetic parameters *K*m (Michaelis–Menten constant) and *V*max (maximum rate of reaction).

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Keywords: o-phenylenediamine; 2,3-diaminophenazine; Cu-Ni bimetallic organic framework

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One-pot three-component synthesis of pyrano[2,3-*d*] pyrimidinedione derivatives catalyzed by DABCO-based catalyst in aqueous medium

Ramtin Yarinia, *Farhad Shirini,* Mohaddeseh Safarpoor Nikoo Langarudi, Narges Seyyedi*

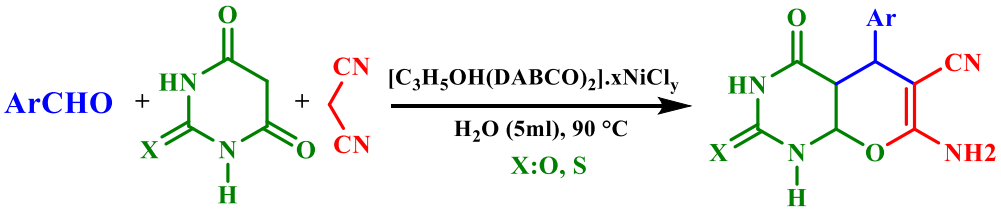
Department of Chemistry, College of Science, University of Guilan, Rasht, 41335-19141, Iran

*Correspondence e-mail: *shirini@guilan.ac.ir*

Abstract:

Pyrano[2,3-*d*] pyrimidinones are regular structural subunits in a variety of important natural products, including carbohydrates, alkaloids, polyether antibiotics, pheromones, and iridoids. These compounds have received considerable attention over the past years due to their wide range of biological activities such as antitumor, anti-bacterial, and anti-hypertensive. Hence, introduction of novel and efficient synthetic methods to the preparation of these compounds is important.[1]

1,4-Diazabicyclo[2.2.2]octane (DABCO) is a small diazabicyclic molecule with weak alkalescence and mediumhindrance that is used as an organocatalyst in the synthesis of many biological compounds and recently, it has been used in the preparation of some eco-friendly catalysts.[2] As a part of our continuing interest on designing environmentally benign catalyst for various chemical transformations, herein we have introduced an efficient catalyst based on DABCO for the synthesis pyrano[2,3-*d*]pyrimidinone derivatives in water as green medium. The prepared catalyst showed an excellent catalytic activity. Short reaction times, good yields, tolerability of various functional groups and low cost of the catalyst are the main advantages of the present method (Scheme 1).



Scheme 1. $[C_3H_5OH(DABCO)_2].xNiCl_y$ catalyzed the synthesis of pyrano[2,3-*d*]pyrimidinones.

Keywords: DABCO, Multi component reactions, Pyran derivatives, Green Synthesis, Aqueous medium.

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Development of selective chloroform sensor with transition ZnO-NiO nanocomposites

Ramin alizadeh tajan, Abdollah Fallah Shojaei

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: ramin.alizadeh969@gmail.com

Abstract

As one of the earliest discovered and most widely applied semiconducting sensors materials, zinc oxide with a wide band gap of 3.37 eV and a large binding energy [9] has become widely used in various forms of sensors [1-4]. In this work reports the synthesis and detailed investigation on ZnO-NiO nanocomposite type chloroform sensor prototype. The sensor material was structurally and morphologically characterized by X-ray diffraction technique and scanning electron microscopy, respectively. The gas sensing behaviour of the fabricated sensor prototype was investigated for varied concentration of test gases at different temperature. The cross-response of this sensor to other gases, viz. methane and carbon mono-oxide was also investigated, which showed good selectivity, excellent response and reproducibility to chloroform at 150 ◦C.

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Highly sensitive ammonia gas sensor based on NiO/ZnO core/shell nanocomposites

*Rezvane Rahmanpour siahgalde, Abdollah Fallah Shojaei**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: a-fallah@guilan.ac.ir

Abstract

A sensor is often defined as a "device that receives and responds to a signal stimulus." This definition is broad [1]. Recently, many studies have confirmed that sensing materials constructing of two or more metal oxides show better sensing properties than that of a single metal oxide [2]. P-n junction is formed between p-type NiO and n-type ZnO enhancement of gas sensing [3]. In this work the pure ZnO nanoparticles and NiO/ZnO core/shell nanocomposites (NCs) were prepared by sol-gel technique. The structural and morphological studies of resulting materials were characterized by X-ray diffraction (XRD), Micro Raman, high-resolution transmission electron microscope (HRTEM) and scanning electron microscope (SEM) respectively. The gas sensing characteristics of ZnO and NiO /ZnO NC were investigated for different volatile organic compound (VOC) vapors at room temperature. The gas sensing results confirm that NiO/ZnO NC shows high selectivity, sensitivity, good stability and fast response time towards ammonia at room temperature.

Keywords: Nano composite, gas sensing, room temperature, NiO/ZnO

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Conductometric study of 1-buthyl-3-methylimidazolium Bromide ionic liquid in water + ethanol mixtures at T = (298.2, 308.2 and 318.2) K

Bahram Ghalami-Choobar, Roghayeh Darvish

Department of chemistry, Faculty of science, university of Guilan, Rasht, Iran

Corresponding author E-mail: B-Ghalami@guilan.ac.ir

Abstract

Ionic liquids, organic salts that are liquid below 100 °C [1]. The most important property, which introduces ionic liquids as good alternatives for organic solvents, is very low vapor pressure as well as high conductivity, thermal stability, wide liquid range and high solvation capacity [2]. Among the properties of ionic liquids, conductivity is important due to their electrolytic nature [3].

In this research, the conductometric measurements were performed for 1-buthyl-3-methylimidazolium Bromide, [BMIm]Br ionic liquid from 0.0001 to 0.2 mol kg^{-1} in different mass fractions of ethanol in water + ethanol mixtures ((w/w) % = $w_{ethanol}$ / $w_{mixture}$ = 0 and 10%) at T = (298.2,308.2 and 318.2) K and P = 0.1 MPa. Limiting molar conductivity (Λ_0) and ion association constant (K_A) were calculated through Fuoss-Onsager equation for studied system.

Keywords: Conductivity, 1-Buthyl-3-methylimidazolium Bromide**,** Association constant**,** Fuoss-Onsager equation

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Spectroscopic Study of the Interaction of Trans Aco Base (curcuminato) Exo Zirconium IV Hydrate and Curcumin with Human Serum Albumin

Zahra Shabanzade, H. Dezhampanah, M. Esmaili*

Department of Chemistry, Faculty of Science, University of Guilan, P.O. Box: 19141, Rasht, Iran,

Email: h.dpanah@guilan.ac

Abstract

This study was conducted to investigate the mechanism of the interaction between Human serum albumin (HSA) and complex of curcumin and curcumin by means of various spectroscopic techniques and molecular docking calculations. Förster energy transfer measurements, synchronous fluorescence spectroscopy, and docking studies showed that complex of curcumin and curcumin to the tryptophan residues of HSA in short distances Molecular docking results showed that complex of curcumin and curcumin were bound in the hydrophobic cavity of HSA and were surrounded by active amino acid residues via forming several hydrogen and van der Waals bonds. Furthermore, as shown by the synchronous fluorescence and Fourier transform infrared spectroscopy, complex of curcumin and curcumin could lead to the conformational changes of HSA, which might affect its physiological function.

Keywords: HSA, Curcumin, Fluorescence quenching; UV_Vis, Molecular Docking Study

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Synthesis of new pyrazol and pyrimidine-fused spiro[indolin-3',4-dihydropyridine]s under catalysis of a new guanidine-based ionic liquid

*Zahra Mohammadpour Gildeh and Kurosh Rad-Moghadam**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Spiro[indolin-3',4-dihydropyridine] is the privilege heterocyclic framework of numerous pharmacologically important molecules. Compounds built up of this scaffold have attracted much attention and consequently a surge of research efforts have been directed toward the synthesis of these products. Despite more of the methods so far developed for synthesis of these valuable compounds have their own merits some suffer from one or more limits such as requiring long reaction times, harsh conditions, expensive catalysts, and complicated precautions to prevent the pollution of environment. Therefore, there is still room to develop greener and more efficient methods for synthesis of spiro[indolin-3',4-dihydropyridine]s by using readily recoverable catalysts such as polyfunctional ionic liquids. In this background, we develop here a new method for the synthesis of some new pyrazol and pyrimidine-fused spiro[indolin-3',4-dihydropyridine]s *via* a three-component reaction between isatins, 5-amino-1*H*-pyrazole, and pyrimidine-4,6-diones under catalysis of a new ionic liquid derived from 1,1,3,3-tetramethyl guanidine [1-3].

Keywords: 1,4-Dihydropyridine, Heterocyclic compounds, 3-Iminoacetyl-4-hydroxycoumarin, Multicomponent reactions.

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Construction of CuO-modified zeolitic imidazolate framework-9 with efficient peroxidase-like activity for detection of H_2O_2

Zohre Ebrahimpour-Azbari, Zeinab Moradi–Shoeili

Department of Chemistry, Faculty of Sciences, University of Guilan, P.O. Box 41335–1914, Rasht, Iran

Abstract

Zeolitic imidazolate frameworks (ZIFs) are a class of metal-organic materials built by tetrahedral metal ions and diffrent imidazolate ligands. Own to the porous structure, exceptional thermal and chemical stability, ZIFs is considered to be promising candidates in various fields. In this work, an efficient CuO-modified zeolitic imidazolate framework-9 (ZIF-9) catalyst was successfully prepared at room temperature under mild condition. The structure of the synthesized ZIF-9/CuO was characterized by FT-IR spectrum. The prepared ZIF-9/CuO catalyst was observed to possess peroxidase-like activity, allowing for the catalytic oxidation of the chromogenic molecule o-phenylenediamine (OPD) to 2,3–diaminophenazine (DAP), at room temperature. The oxidation was evidenced by a color change in the presence of H_2O_2 using UV–vis spectroscopy. Based on the efficient peroxidase-like activity, the nanostructure ZIF-9/CuO nanocatalyst/OPD substrate system could be use for the determination of H_2O_2 concentration in aqueous solution.

Keywords: ZIF-9, CuO, Zeolitic imidazolate framework, Peroxidase-like, H_2O_2 detection.

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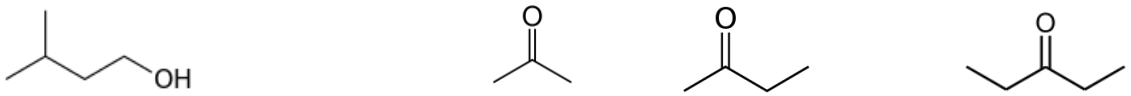
Modified dielectric permittivity models for binary liquid mixtures of (alcohol + ketones)

Zohre Mohammadalipoor, A. Ghanadzadeh Gilani

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran
zohrehmohamadalipoor@gmail.com

Several dielectric permittivity models were modified and used to evaluate and analysis of permittivity of the selected binary systems at different temperatures. Thus, In order to predict the permittivity data for binary mixtures of (alcohol + ketones), several mixing rules were applied. The relative excess permittivity, $\Delta\varepsilon = \varepsilon_{12} - (x_1\varepsilon_1 + x_2\varepsilon_2)$, was evaluated. x_i is the mole fraction of each of the components, ε_i is the permittivity value of the pure components. In this work, experimental permittivity data for three systems containing amyl alcohol and ketones (Fig. 1).were compared to those estimated by several mixing rules. The predicted and experimental excess permittivity data were compared and shown in Fig. 2.



Amyl alcohol Dimethyl ketone methyl ethyl ketone diethyl ketone

Fig. 1 The chemical structures of the chosen liquids

Permittivity Model	RMSD	a Interaction factor
Looyenga	**0.240**	**2.17**
Bottcher-Bordewijk	**0.239**	**2.16**
Bruggeman asymmetric	**0.238**	**2.17**
Peon-Iglesias	**0.241**	**2.17**
Iglesias-Peon	**0.241**	**2.17**
Lichteneker-Rother	**0.261**	**2.12**
Kraszewski	**0.230**	**2.19**
Ideal	**0.196**	**2.24**

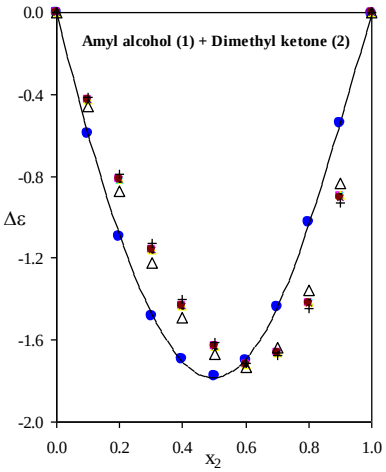


Fig.2. Experimental and predicted permittivity increments for binary mixtures of (amyl alcohol + dimethyl ketone) at T = 298.2: (●

Synthesis of some new derivatives of 1,2,4-triazolo[4,3-a]pyridines and related heterocycles via one-pot multicomponent oxidative cyclization

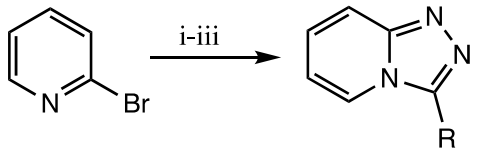
Nosrat O. Mahmmodi, Sarah Poormoradkhan, Meysam Pasandideh Nadamani*

Department of Organic Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

**Correspondence e-mail: mahmoodi@guilan.ac.ir*

Triazolopyridines are a significant system of a fused-ring heterocycle.[1] The 1,2,4-triazolo[4,3-a]pyridine structure extensively exists in many compounds with various pharmaceutical properties, e.g. anti- antiproliferative,[1] antibacterial,[2] inflammatory,[3] antithrombotic,[4] antidepressant/antipsychotic,[5] and antiviral activities [6]. A simplistic and organized approach to synthesis 1,2,4-triazolo[4,3-a]pyridines and related heterocycles has been completed via one-pot condensation of readily available 2-hydrazineylpyridine with corresponding aldehydes monitored by I_2-sources facilitated oxidative-cyclization. This one-pot MCRs is appropriate to a variety of aromatic, aliphatic, and α,β-unsaturated aldehydes, and can be suitably conducted on the gram scale.

Keywords: 1,2,4-Triazolo[4,3-a]pyridine; Multicomponent; Oxidative cyclization; I_2-sources.



i) NH_2NH_2, H_2O, ii) EtOH, ArCOH, iii) Oxidative reagent

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Development of a highly selective and colorimetric probe for detection of Cu2+ based on an azo chromophore

Sobhan Asadpour[1], *Asadollah Mohammadi*[*1], *Hossein Ghafouri*[2]
[1]*Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran*
[2] *Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*

Abstract:

Colorimetric chemosensors are rapidly evolving in the detection of ions in decades. These sensors used for quantitative analysis of ionic species in various fields, including the chemical industry, physiology, environment, and medical diagnostics. In this work, a highly selective azo-based probe was designed and synthesized for detection of Cu2+ in aqueous DMSO solution. The designed probe includes the azo unit (- N=N-) and the pyrimidine unit as the fluorophore and a binding site, respectively. The designed probe displayed a remarkable colorimetric response from light yellow to orange in the presence of Cu2+. Meanwhile, the sensing details were evaluated using UV–vis spectroscopy. The mechanism of Cu2+ interaction with the probe was investigated using the FT-IR, 1H NMR titration experiments and Job's plot. Through titration experiment, the detection limit (LOD) for Cu2+ sensing was found to be micro molar (μM) level. Furthermore, Job's plot based on spectroscopic data showed one-to-one stoichiometry for the interaction of Cu2+ ions with the probe. The results indicate that the probe is a simple and useful probe for selective sensing of Cu2+ ions in experimental and real industrial samples.

Keywords: Chemosensors, Azo chromophore, Pyrimidine, Job's plot.

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A Facile approach to the synthesis of indole-pyridopyrimidine hybids as biologically important motifs

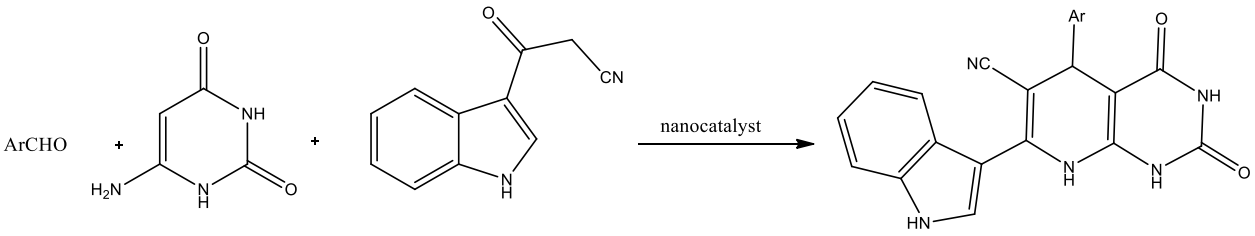
Manouchehr Mamaghani, Setare Bahramkhani and Sahar Dastmard*

*Department of Chemistry, Faculty of Sciences, University of Guilan, P.O. Box 41335-1914, Rasht, Iran *E-mail: m-chem41@guilan.ac*

Because of biological and medicinal properties of pyridopyrimidines, synthesis of these heterocycles has attracted the interest of organic and medicinal chemists. Fused pyrimidine systems, in particular pyrido-pyrimidines, attracted organic chemists very much bercuse of their biological and chemotherapeutic importance. The pyridopyrimidine scaffold is a well-known pharmacophore in drug design, and it is associated with a wide rang of biological properties [1-2].

In continuation of our recent studies on the synthesis of pyridopyrimidines [3-5], we report here a convenient method for the synthesis of polyfunctional pyridopyrimidines by the reaction of arylaldehydes, 6-aminouracil and cyanoacetylindole in the presence of nanocatalysts. Details of this study will be discussed in the presentation.

Keywords: pyridopyrimidine, pyrido[2,3]pyrimidine, 6-aminouracil (6-aminopyrimidine-2,4(1H,3H)-Dione.



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Functionalization of natural silica of the Caspian Sea and its application as a heterogeneous catalyst

*Sajjad gholampour, Alireza Khorshidi**

[1]*Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran*

Corresponding author's Email: Khorshidi@guilan.ac.ir

Abstract

Sands are natural granular materials that are composed of crushed pieces of minerals and rocks. The composition of the components in the sand is very diverse and depends on the geological structure of the study area, but the main component of the sand, especially in coastal areas, is silica (Silicon dioxide, SiO2), which is commonly found in quartz mineral form[1]. Some types of sand contain minerals such as magnetite, chlorite, gluconate and gypsum. Magnetite sands have a black color and usually have volcanic origin. Other minerals in the sand include alumina and titanium dioxide. In all of these metal oxides, if acid resistance exists, surface hydroxyl groups can be used to modify surface properties. On the other hand, dihydropyridines play a vital role in the biological field. Antimicrobial activity, anticancer, antihypertensive, anticonvulsant, anti-tumor and vasodilator are among these activities. Hantzsch has synthesized dihydropyridine derivatives about one hundred years ago. In the last two decades, the importance of medicinal properties and their therapeutic benefits has been considered as a successful and useful drug in the treatment of certain heart conditions, such as angina and high blood pressure. Drugs like nifedipine, nicardipine, amlodipine and flaldipine are very effective in treating heart disorders. These compounds also act as calcium channel blockers[2]. The purpose of this study is to use surface hydroxyl groups, especially silanol groups present in the surface of silica to modify the surface of sand granules and use them as heterogeneous catalysts in the synthesis of dihydropyridines[3]. A simple and general synthetic method for the synthesis of 1,4-dihydropyridines via three- or four- component condensation of aldehydes, 1,3-dicarbonyl compounds, and ammonium acetate was developed. Short reaction times, excellent yields, simple work-up and reusability of catalyst are some advantages of this method.

Keywords: catalyst, chlorite

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Basic isoreticular metal-organic framework-3 (IRMOF-3) porous nanomaterial as a suitable and green catalyst

Shabnam Sohrabnezhad, Sahar Moghadamy*

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

In the previous decade, a lot of consideration has been paid to metal-organic frameworks (MOFs) made by connecting metal units with organic ligands through coordination bond [1]. MOFs have been given much attention from both scientific and commercial aspects regarding their application to gas storage, separation, drug delivery, adsorption, gas/chemical sensing and catalytic reaction. MOF-assisted organic synthesis using organic–inorganic hybrid micro-channels has been utilized not only to accelerate a number of synthetic reactions, but also it is a green catalyst to increase reaction rate and yields. Also, MOFs have been considered as flexible precursors for synthesis of different nano-materials and novel multifunctional nanocomposites hybrids with preferable functional characteristics compared to their initial components [2]. MOF-based structures demonstrate various advantages such as high surface area, adjustable pore size and the simplicity of processing, tunability and use of stable alternative materials.

In this work, $CoFe_2O_4$/IRMOF-ZnO was synthesized. Initially IRMOF-3 as one of the known selective and afficient metal-organic frameworks (MOFs) was successfully magnetized with $CoFe_2O_4$ nanoparticles and then Zno assembled on the CoFe2O4/IRMOF at room temperature. The composite possess high crystallinity, porosity characteristic, rapid magnetic response and good stability.

The prepared materials were characterized by X-ray diffraction (XRD), Fourier transform infrared (FT-IR), *Field emission* scanning electron microscopy (FESEM).

Keywords: Metal-organic frameworks; Porous materials; MOF catalysts; $CoFe_2O_4$ nanoparticles; IRMOF3; Magnetic metal-organic frameworks

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Fabrication of photoelectrochemical sensor based on TiO_2 nanotube arrays modified with silver doped ZnO quantum dots for determination of biological compound

*Saeed Hasani, Sepideh Tajyani, Majid Arvand**

Electroanalytical Chemistry Research Laboratory, Faculty of Chemistry, University of Guilan, Rasht, Iran

Corresponding author Email: arvand@guilan.ac.ir

Abstract

Quantum dots owing to their unique properties have been the subject of extensive investigations in different areas of science and technology in the past two decades. In this study, preparation of the electrochemical sensor for the selective and sensitive determination of glycine (gly) was reported. Gly is an essential component of important biological molecules, a key substance in many metabolic reactions, the major inhibitory neurotransmitter in the spinal cord and brain stem, and an anti-inflammatory, cytoprotective, and immune modulating substance. This sensor was investigated by modifying a titanium dioxide nanotube arrays (TiO_2 NTAs) with Ag@ZnO quantum dots (QDs). At first, TiO_2 NTAs were synthesized by electrochemical anodizing in an organic medium containing ethylene glycol, ammonium fluoride and water, followed by calcination in the furnace. Afterward, Ag@ZnO QDs were deposited on TiO_2 NTAs by casting method. The combination of Ag@ZnO with TiO_2 NTAs exhibited a superior photocurrent than that of bare TiO_2 NTAs/Ti electrode that was attributed to the efficient separation of electron hole pairs and rapid electron transfer. By injection of gly the photocurrent of the photoelectrochemical (PEC) sensor raised up. This response presents gly as a sacrificial electron donor to scavenge the hole and inhibit the recombination of photogenerated electron–hole pairs. Moreover, the as-fabricated PEC sensor exhibited an outstanding analytical performance with a high sensitivity, excellent selectivity, good stability and reproducibility, which opens up a new promising signal on the PEC sensor with enhanced sensing performances for the evaluation of gly in pharmaceutical products with satisfactory results.

Keyword: Photoelectrochemical sensor; Titanium dioxide nanotube; ZnO Quantum dots; Glycine

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A magnetic nano-composite of halloysite: An efficient heterogeneous catalyst for the synthesis of pyrano[2,3-*d*]pyrimidines

Kurosh Rad-Moghadam, Saeid Zamani

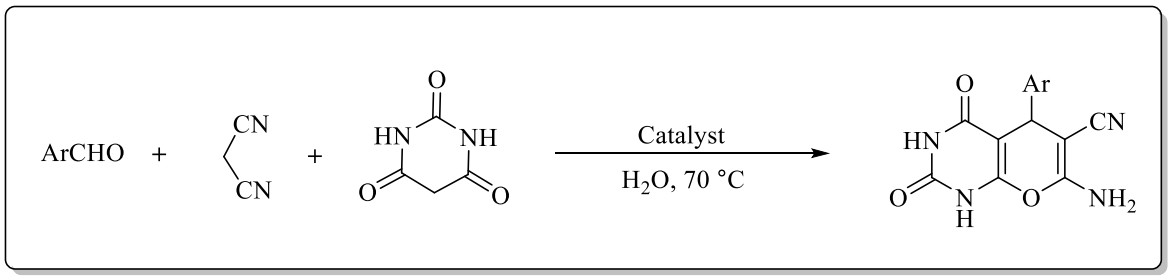
Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: radmm@guilan.ac.ir

Abstract

The chemistry of heterocyclic compounds has remarkable importance in organic chemistry. A wide range of heterocyclic ring systems has been studied due to their pharmacological properties and clinical applications. Due to the diverse biological and medicinal properties of pyrano[2,3-*d*]pyrimidinones, there is an immense interest in the synthesis of such compounds. These compounds with an uracil moiety have antibacterial, antitumor, anti-bronchitic, cardiotonic, vasodilatory and bronchodilatory activities [1-4].

In this communication, we describe a new method for synthesis of pyrano[2,3-*d*]pyrimidines *via* three component reaction of aromatic aldehydes, malononitrile and barbituric acid in the presence of water as solvent and a catalytic amount of nano-catalyst at 70°C (scheme1). Easy work-up procedure, milld and environmentally friendly conditions, excellent yields and short reaction times are some of the advantages of this procedure. The nano-catalyst is magnetic and robust enough to be easily retrieved several times without appreciable change of its chemical structure and decrease of its catalytic activity.



Scheme 1. One-pot synthesis of pyrano[2,3-*d*]pyrimidines derivatives.

Keywords: Halloysite; Barbituric acid; Aromatic aldehydes; Malononitriles; Water.

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Improved fuel cell with enhanced electron transfer for power generation from microbial biodegradation

Samaneh. Zomorodi, *M. Farahmand*, *M. Arvand*[*]

Electroanalytical Chemistry Laboratory, Faculty of Chemistry, University of Guilan, Rasht, Iran

[*]*Corresponding author E-mail: arvand@guilan.ac.ir*

Abstract

Development of clean, alternative and renewable energy resources become essential in recent years due to various factors that affect human's life, such as environmental pollution, natural resources depletion and energy consumption increase. Microbial fuel cells (MFCs) have become a promising green approach due to their capacity to harvest electrical power from organic substances using the microorganisms as biocatalysts. Though the current and power yields are relatively low at present, it is expected that with improvements in technology and knowledge about these unique systems, the amount of electric current and electric power which can be extracted from these systems will increase tremendously providing a sustainable way of directly converting lignocellulosic biomass or wastewaters to useful energy. In these systems, the interaction of bacteria with the anode surface, the resistance of electron flow, and substrate oxidation essentially depend on the properties of anode materials. Therefore, the anode is the defining element that can critically affect the overall performance of MFC.

Compared with carbon materials and other metal materials; titanium possesses many advantages, including nontoxicity, good biocompatibility, anti-corrosion and most importantly good dimensional stability. In this work, we reported a new finding that titanium exhibits good electrocatalytic activity as anode of MFC when it is polymerization-treated. Electrochemical measurements demonstrate that the as-synthesized PEDOT/TiO_2 exhibits excellent electrocatalytic activity for the charge transfer on anode, providing the cell with a maximum power density of 95 mW/m^2, which is strikingly higher than the bare TiO_2 anode (1.9 mW/m^2). Two-chamber MFC with the nanocomposite modified titanium exhibits excellent electrocatalytic activity for the charge transfer on anode which is much higher than that of MFC using the common commercial titanium anode. These results suggest that the fabricated device has excellent potential as a power source.

Keywords: MFC; Exoelectrogenic bacteria; Modified titanium anode; Renewable energy

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Influence of pore structure of SBA-15 and KIT-6 on their performance as support for semiconductors

Seyed Meraj Eram, M. A Zanjanchi

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: zanjanchi@guilan.ac.ir

Abstract

Mesoporous materials have shown many applications such as adsorbents, sensors, drug delivery, separation and especially catalysts due to their high specific surface area, uniform pore diameter, excellent morphology and chemical stability for recyclability [1]. SBA-15 is well-ordered mesoporous silica with 2D hexagonal structure and KIT-6 is a cubic mesoporous with three-dimensional connections with a network of interconnected transverse channels. The purpose of this study is to upload certain semiconductors in their structure and to record the observations [2]. Mesoporous KIT-6 was synthesized by hydrothermal synthesis method using pleuronic P123 (E020-P070-E020) as structure directing agent and n-butanol as cavity expander in a mildly acidic environment [3]. Mesoporous SBA-15 was also synthesized using non-ionic surfactant P123 in highly acidic environment by hydrothermal synthesis method [4]. The materials synthesized were characterized by X-ray diffraction, nitrogen adsorption (BET and BJH), scanning electron microscopy and thermogravimetric analysis. The XRD results show that both mesoporous materials show good long-range ordering. The surface area was obtained 860 m^2/g and 560 m^2/g for KIT-6 and SBA-15, respectability. The work is in progress to upload the nickel oxide and other semiconductors into the structure and evaluate the photocatalytic performances.

Keywords: Mesoporous, KIT-6, SBA-15, Semiconductor

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Application of photocatalytic ozonation under visible light to remove dyes from aqueous solutions

Seyede Fateme Bagheri, *Naz Chaibakhsh**

Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran

Corresponding author E-mail: nchaibakhsh@guilan.ac.ir

Abstract:

Azo dyes are organic compounds, which contain the colouring azo function (N=N-). Although these dyes are widely used in the industry but they are harmful to the environment. In recent years, development of new approaches, technologies or designs with the objective to solve environmental problems or to improve existing systems in this field have increased. The focus of the researcher is now to enhance the efficiency of conventional methods and reduce their cost or limitations by merging them and make the methods more economical and environment friendly. One of these development can be found in the advanced oxidation processes (AOP) with application of different technologies. Among them photocatalytic ozonation process is an interesting method. In this study, *Acid Blue* 113, commonly used as a textile dye, was photocatalytically degraded using hematite nanaoparticles under irradiation of visible light (white light emitting diode (LED) lamp). Response surface methodology (RSM) based on central composite rotatable design (CCRD) was employed to study and optimize the treatment process. The experiments showed that hematite and visible light (VL) had a synergetic effect when they were used together. The effects of several parameters such as pH, the amount of hematite and reaction time were also examined. At the optimal conditions of pH=7, 47.87 mg catalyst and 8.82 min, ozone 0.60 $mg.h^{-1}$, 100% of the dye was removed. The proposed method can efficiently degrade the dye and can be applied to the treatment of wastewaters containing synthetic dyes.

Keywords: Photocatalysis, Dye degradation, Hematite, Ozonation, Optimization, Acid Blue 113

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Photoelectrochemical determination of biological compound based on quantum dot nanocaomposite modified TiO_2 electrode

*Seyedeh Mahdiye Khatami, Sepideh Tajyani, Majid Arvand**

Electroanalytical Chemistry Research Laboratory, Faculty of Chemistry, University of Guilan, Rasht, Iran

**Corresponding author Email:arvand@guilan.ac.ir*

Abstract

Photoelectronchemical sensor is a new kind of developing analytical device based on the photoelecto-chemical properties of matrials. Because of its remarkable sensitivity, inherent miniaturization, portability and easy integration, photoelectrochemical analysis is becoming a promising analytical technique. In photoelectrochemical sensing, light is utilized to excite the photoactive species whilst electrical signal is transduced as the detection readout. Benefiting from the efficient separation of the stimulation source and detection signal results in high sensitivity of this method than that in electrochemical or chemilumine-scent techniques, which leads to the greatly reduction of a large amount of unwanted background signals.

Titanium dioxide nanotube (Ti-NTs) were grown on titanium foils by electrochemical anodization in water-ethylene glycol solution containing ammonium fluoride. The anodization was conducted in the constant 25 V for 2 h, and then the as-prepared Ti-NTs electrode was calcinated at 450 °C for 2 h. Ag-SnO_2 quantum dots was synthesized from 2.5 g of tin chloride pentahydrate and 0.125 g silver nitrate. The photoelectro-catalytic oxidation behaviour of quercetin was studied in the present work using the Ag-SnO_2 modified TiO_2-NTs electrode.The results showed remarkable enhanced UV light photoelectrochemical response of the Ag-SnO_2 QDs modified TiO_2-NTs in comparison with TiO_2-NTs. Under the optimum conditions, the designed photoelectrochemical sensor exhibited a good linear range of quercetin concentrations with a low detection limit.

Keyword: Photoelectrochemical sensor; Titanium dioxide nanotube; Quantum dots; Quercetin

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Introduction a green molten salt based on pyrrolidine as an efficient catalyst for the synthesis of pyrano[2,3-*d*]pyrimidinone derivatives

*Shaghayegh Khedmatgozar Asadi, Nader Daneshvar, Farhad Shirini**

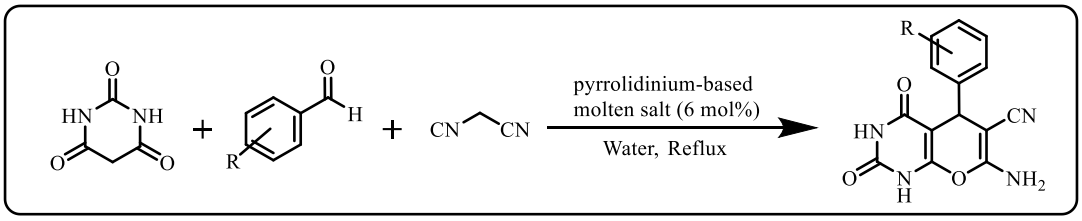
Department of Chemistry, College of Sciences, University of Guilin, Rasht, Iran.

shirini@guilan.ac.ir

Abstract:

The main purpose of green chemistry is to design chemical processes or production of products that reduce or eliminate dangerous substance from the environment [1]. To achieve this goal, ionic liquids (ILs) have been focused by many researchers in recent years because of their properties such as non-flammable, recyclability, low vapor pressure, high thermal stability, and high ability to solubilize different material [2]. ILs are defined generally as salts with organic cations and inorganic or organic anions. Molten salts are ILs with melting point above 100 °C [3].

Pyrano[2,3-*d*] pyrimidineone derivatives are the production of reaction between an aldehyde, barbituric acid and malononitrile. Because of their biological activities such as antiallergic, antihypertensive, cardiotonic, vasodilator and herbicidal activitiesactivities have received more attention from chemists [4]. In this study, we have easily prepared a new molten salt based on pyrrolidine and after characterization using various techniques, it was used as the catalyst for the promotion of the synthesis of pyrano[2,3-*d*]pyrimidinone derivatives in water media. This method has some important advantages which of them high purity of the obtained products, short reaction times, reusability of the catalyst are the most important ones [Scheme 1].



Scheme 1. Synthesis of pyrano[2,3-*d*] pyrimidinone derivatives using a pyrrolidinium-based molten salt.

Keywords: Ionic liquid, Molten salt, Pyrrolidine , Pyrano[2,3-*d*]pyrimidine, Water media

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Synthesis and application of magnetic cellulose / polyaniline nanocomposite for dye removal

Shima khosravi, Reza Ansari, Azadeh Asodollahi

Department of Chemistry, Faculty of Sciences, University of Guilan

Abstract:

The purpose of this study was to prepare magnetized cellulose polyaniline nanocomposite (MCP) for dye removal from aqueous solutions. The cellulose was first magnetized in the presence of Fe(III) chloride and Fe(II) sulfate via co-precipitation method. Polyaniline was synthesized by chemical polymerization [1,2]. Then, polyaniline was dissolved in formic acid and coated on the surface of magnetized cellulose via cast solution method. The prepared material termed as MCP was then applied for adsorptive removal of dye in a batch system. Methylene blue was selected as a test probe for dye removal efficiency. FE-SEM, XRD, VSM and FT-IR techniques were employed for characterization of MCP. Different parameters such as pH, exposure time, adsorbent dosage, temperature, and initial dye concentration were investigated for obtaining the optimal dye removal conditions. For evaluating the adsorption capacity of the synthesised adsorbent and the mechanism of dye removal, isotherm, kinetics and thermodynamic studies were performed.

Keywords: Removal; dye; magnetic cellulose; polyaniline; nanocomposite

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Fe_3O_4@WSS@Ag°: An Efficient Catalyst for the Synthesis of Biologically Active Pyrano[2,3-d]pyrimidine Derivatives

Sedigheh Azad and Kurosh Rad-Moghadam

Department of Chemistry, School of Sciences, Guilan University,Rasht, Iran

Abstract:

Pyrano[2,3-*d*]pyrimidines are a class of annulated uracils that have received great attention during the past years because of their wide range of biological activities. Compounds made of this ring system have shown various pharmacological activities such as antitumor, cardiotonic, hepatoprotactive, antihypertensive, antibronchitic, and antifungal activities. As a result, much efforts have so far been devoted to the synthetic manipulation of uracils and in this direction numerous methods were developed for synthesis of pyrano[2,3-*d*]pyrimidines from three-component reaction of arylaldehydes with malononitrile and barbituric acid. However, most of these methods suffer from some disadvantages such as long reaction times and tedious synthetic procedures. Therefore, the development of improved methods for the synthesis of these compounds is of current importance. Here we describe the fabrication of a new nano-catalyst composed of fine silver nanoparticles immobilized on the amylose coating of magnetite nanoparticles [1].The as-prepared nano-composite, denoting here as Fe_3O_4@WSS@Ag°, showed an efficient catalytic activity in the three-component reaction between an aromatic aldehyde, malonitrile, and barbituric acid in ethanol at room temperature to give the desired pyrano[2,3-*d*]pyrimidines. This method has the advantages of a simple operation, mild reaction conditions, high yields, using less toxic and low cost bio-compatible catalyst [2,3].

Keywords: Pyrano[2,3-*d*]pyrimidine, Silver nanoparticles, Three-component synthesis, Barbituric acid, Magnetic nanoparticles

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Solvatochromism and spectroscopic properties of an azoquinolin dye

Ali GhanadzadehGilani, Talieh Momtaz

Department of chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: aggilani@guilan.ac.ir

Abstract:

Dyes can be classified as azo, anthraquinone, arylmethane, acridine, cyanine, phthalocyanine, nitro, nitroso, quinoneimine, thiazole or xanthene dyes according to the type of chromophore group on the dye molecule. Azo dyes contain one or more azo groups (N=N) having aromatic rings. They are the largest dye class of synthetic dyes [1,2]. Azo dyes have been extensively used in various fields, such as dyeing of textile fibers, coloring of different materials and advanced applications in organic synthesis.

In this work, we investigate an azo dye based on its absorption and emission solvatochromic behavior in different environments. For this purpose, the spectral behavior of a heteroarylazo dye is investigated in liquid solvents. One of the main goals of the work is to determine the effect of the type (position) on the spectral properties of dyes and the totomeric equilibrium. Using these data, one can predict the nature and contribution of different types of interactions in different solvent systems. For the purpose stated herein, a hydroxyazoquinoline dye has been used to compare and investigate the structural effects on solvent-soluble interactions and the spectral properties of the dye in organic solvents [3,4].

Keywords: Azo dyes, Azo-Hydrazone Tautomerism, Solvatochromism.

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Efficient synthesis of 2,3-Dihydroquinazolin-4(1*H*)-One Derivatives Using Fe3+-Montmorillonite K10 as an Green and Reusable Heterogeneous Catalyst

*Aliasghar Ahmadian, Asieh Yahyazadeh**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: yahyazadeh@guilan.ac.ir

Abstract

Nitrogen-containing heterocyclic scaffolds are quite common fragments in drugs and biologically active compounds. 2,3-Dihydroquinazolin-4-one (DHQ) belongs to the class of nitrogen-containing heterocyclic compounds representing a core structural component in various biologically active compounds. In the past decades, several methodologies have been developed for the synthesis of the DHQ framework, especially the2- substituted derivatives [1]. In this study was reported a clean, useful and efficient protocol to synthesize the 2,3- Dihydroquinazolin-4(1*H*)-one derivatives involving aromatic aldehydes with anthranilamide using Fe3+-Montmorillonite K10 in under reflux condition and ultrasound irradiation. Fe3+@mont as a heterogeneous recyclable Lewis acid catalyst under solvent-free condition was successfully established. The application of an inexpensive, easily available, reusable, and easy work-up catalyst that produces high yields under short reaction times [2]. The ultrasound is a useful tool in the design and development of green methods and promotion of organic chemistry. The combination of sonication conditions and lewis acidity of the recyclable catalyst promoted present reactions [3].

Keywords: Ultrasound irradiation ; Fe3+-Montmorillonite K10 ; 2,3- Dihydroquinazolin-4(1*H*)-one

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compounds Investigation of the stability of ion-molecule complexes of some organic containing nitrogen

Hossein Roohi *, *Alireza Safari*

Department of Chemistry, Faculty of Science, University of Guilan, P.O. Box 98135-674, Rasht, Iran

**Corresponding author. E-mail : hroohi@guilan.ac.ir*

Abstract

Because of the role of hydrogen bonds in biology and chemical reactions, it is important to predict the features of this bond for many scientists. The hydrogen bond is the result of a change in the diffusion density of the electron donor and accepter molecules [1,2].

Anion-π interactions have attracted a lot of attention in the last few years. There is a lot of experimental and theoretical investigations that suggests that this interaction plays a significant role in different parts of chemistry, such as molecular recognition, anion transport and etc. [3].

In this research, the effect of N**…**H hydrogen bond on the strength and characteristics of anion-π interactions has been studied by quantum chemical calculations in various types of s-triazine complexes. All the structures were optimized using M062X/6-311++G(d,p) level of theory. Also, all the required calculations were performed using the mention method. In order to explain the characteristics of the interaction and better interpretation of the geometrical changes and bonding parameters in the under study complexes, the Bader's quantum theory of atoms in molecules (AIM) and natural bond orbital (NBO) analysis were taken under study. Furthermore, molecular electrostatic potential (MEP) was used for the determination of the areas with positive and negative electrostatic potential. The obtained results indicate that the stronger N…H hydrogen bond leads to increase in the electrostatic potential and anion-π interactions.

Keywords: hydrogen bond; Anion-π interaction; s-triazine

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Prediction of Liquid Phase Equilibrium data for Ternary systems (water + butyric acid + halogenated methanes) using UNIFAC Method

Fatemeh Rouhi, Sina Shekarsaraee*

Department of Chemistry, Faculty of science, University of Guilan, Rasht, Iran

E-mail: shekarsaraee@guilan.ac.ir

Abstract:

Lower costs and less time-consuming work can be mentioned as the advantages of theoretical research methods, instead of laboratory work. The UNIFAC method for calculation of activity coefficients is based on the group-contribution concept [1] .The basic idea is that whereas there are thousands of chemical compounds of interest in chemical technology the number of functional groups which constitutes these compounds is much smaller. Therefore, if we assume that a physical property of a fluid is the sum of contributions made by the molecules functional groups, we obtain a possible technique for correlating the properties of a very large number of fluids in terms of a much smaller number of parameters which characterize the contributions of individual groups.

Here are activity coefficients in some of multicomponent systems by these models. This information is effective in liquid extraction, design of distillation columns and etc [2]. In the present study, we investigated the effect of hydrogen bonding on extraction of Butyric Acid (BA) by selecting a family of solvents in which hydrogen bond acidity changes from zero to a maximum. Results show that chloroform which has the strongest hydrogen bond acidity, is the best solvent for extraction of BA.

Keywords: LLE Data; Ternary systems; UNIFAC Method.

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The effect of metal impurities on the performance of nanoparticles Zinc Oxide for Formaldehyde sensor

Faeze Dehghannejhad, Abdollah Fallah Shojaei

Department of chemistry, Faculty of Sciences, University of Guilan, Rasht.

E-mail: a.f.shojaie@guilan.ac.ir

Abstract

Developmet of a gas sensor with high sensitivity ,good selectivity and great stability is a necessity for providing social and enviro mental requirements.In this project ,One step developed hydrothermal methad was used for synthesizing Al- doped ZnO nano composites ,Ni-doped ZnO nano composites , pure ZnO and composition of ZnO with Ni and Al methods .For studying structural features of nano composites and the interaction of nano particles , Fourier-transform infrared spectroscopy (FTIR) , studied using X-ray diffraction (XRD), Energy-dispersive X-ray spectroscopy (EDX) and scanning electron microscopy (SEM) were used . The sensor properties of Al- doped ZnO nano composites were studied in order to detect ethanol. Also experiments of gas sensors reveal that the Al-doped ZnO nano composite sensor have remarkable revenue versus pure ZnO nano particles. One of the important propertise of Al –doped ZnO sensor , is ,sensing formaldehyde at room temperature, which can getthe best response. The sensitivity of nano composites were linear in concentration range of 10-200 ppm and the detection limit of the designed sensor was 10 ppm . The selectivity of Al –doped ZnO nano composite was tested against several volatile materials , such as, acetaldehyde , ethanol , formaldehyde ,chloroform , N-hexane ,diethylether , dimethyle, aceticacid and etc.

Key words: Sensor – Zinc Oxide –Formaldehyde –Hydrothermal process.

Loading of CuO in mesoporous KIT-6: characterization and application

Farhad. Golrokh and M. A. Zanjanchi

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: s-fgolrokh@msc.guilan.ac.ir

Abstract

KIT-6 possesses large readily tunable pores with thick pore walls, high hydrothermal stability, high specific surface area and large pore volume. These materials are expected to be superior to mesoporous structures with one or two-dimensional channels due to better dispersion of catalyst and faster diffusion of reactants and products during reaction in the 3D interconnected mesopores [1]. The ordered mesoporous KIT-6 was prepared via a simple one-step hydrothermal method by using triblock copolymer P123 as the structure directing template and tetraethyl orthosilicate (TEOS, $C_8H_{20}O_4Si$) as silica source [2]. The Kit-6 mesoporous materials was loaded with different amount of CuO. They are prepared by post-synthesis methods at different conditions using different sources of CuO. copper (II) oxide (CuO) is of particular interest because of their interesting properties and promising applications in many applications including catalysis and photocatalysis [3]. The structural of the products were characterized by X-ray diffraction (XRD), FT-IR, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), N_2-adsorption-desorption analysis (BJH). The photocatalytic activity of the products were investigated for the degradation of methylene blue pollutant under visible light irradiation. The 20% CuO/KIT-6 sample showed high photocatalytic activity and 96% of MB was degraded within 120 minutes. The photocatalytic degradation of MB for all the products followed a first-order kinetics.

Keywords: KIT-6; CuO; Photocatalytic; Pollutant

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Synthesis, characterization and application of a new curcuminato complex of Cu(II)

Fahimeh Ahmadi[1], *Alireza Khorshidi*[*1]

[1]*Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran*

Corresponding author's Email: Khorshidi@guilan.ac.ir

Abstract

Naturally occurring curcumin, [1,7-bis(4-hydroxyl-3-methoxyphenyl)1,6-heptadiene-3,5-dione], is a major component of the Curcuma species. It is obtained from the rhizome of Curcuma longa Linn, which is commonly used as a yellow coloring and flavoring agent in foods. Recent studies have shown that curcumin possesses a specific property of binding to metals and as a multipotent agent for combating to potent biological as well as pharmacological activities[1]. Research analysis postulates that the biological properties of curcumin are significantly enhanced upon coordination with some metal ions. On the other hand, heterocyclic compounds such as pyridine, phenanthroline, bipyridine, etc. have shown extended biological activities when coordinated with metal ions [2].

Thus, specific biological and pharmacological activity of curcumin, in combination with those of bipyridine and transition metal ions in daily life, may result in new medicinal pharmacophores with lower toxicity and side effects. Attention in our present endeavor has been given to preparation, structural elucidation and antimicrobial activity of three heteroleptic complexes with Ni(II), Cu(II) and Zn(II) metal ions bearing curcuminato/bpy mixed ligand [3].

Hereby we report the synthesis, characterization and application of a new Cu(II) complex containing curcuminato ligand. $[Cu(bipy)_2(curc)]Cl$ was obtained in a good yield and characterized by using FTIR and ^{1}Hnmr spectroscopy. Biological activity of the obtained complex was also studied and showed promising results.

Keywords: Curcumin; Complex; Coordination; Compound; Copper

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A convenient synthesis of novel fused chromene derivatives using nanocatalyst

Manouchehr Mamaghani, Firouzeh Hamidi and Elham Saberikhah*

Department of Chemistry, Faculty of Sciences, University of Guilan, P.O. Box 41335-1914, Rasht, Iran

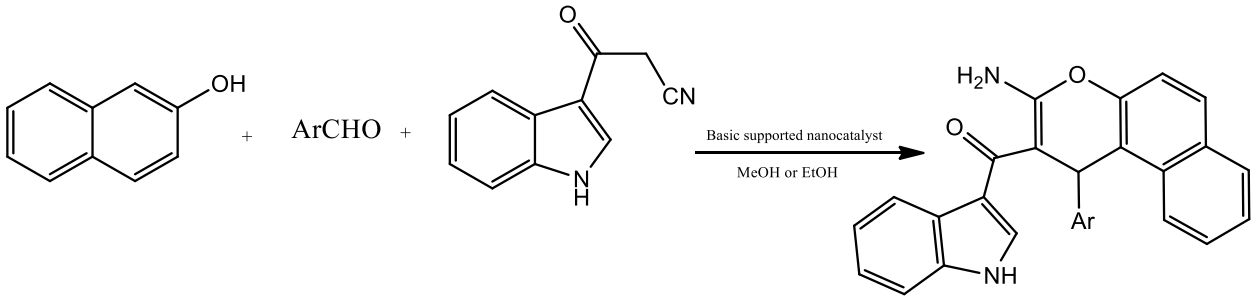
**E-mail: mchem41@guilan.ac*

Abstract

Benzopyran or chremene is a bicyclic organic compound that results from the fusion of a benzene ring to a pyran ring. This valuable heterocycle with various levels of saturation and oxidation is very common in nature. Chromene derivatives as an important class of organic compounds with diverse biological properties and therapeutic application have attracted many attentions. They are prominent natural products, widely distributed among many plants. Natural derivatives of chromene also exhibit a wide range of valuable physiological activities [1-4].

On the other hand, heterogeneous catalysts have been extensively used for acceleration of organic reactions. The efficiency of heterogeneous catalysis in organic synthesis can be improved by using nanocatalysts due to thier high specific surface area, facile workup and recyclability. At present study an efficient method was developed for the synthesis of indole substituted benzo[*f*]chromenes by the reaction of β–naphtol, arylaldehydes and 3-cyanoacetylindole in the presence of basic supported nanocatalyst. In this presentation the details of this novel method will be discussed.

Keywords: chromene, benzo[f]chromene, indole



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Introduction of a molten salt based on 2,2'-bipyridine as an efficient catalyst for the preparation of 5-arylidine barbituric acid derivatives

*Gilda Aleaba, Nader Daneshvar, Farhad Shirini**

Department of Chemistry, College of Sciences, University of Guilin, Rasht, Iran.

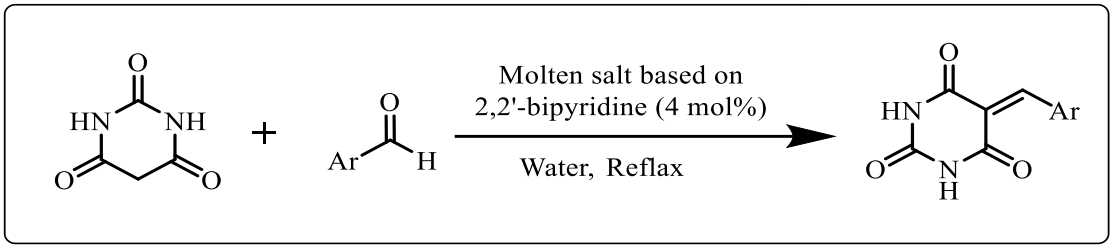
shirini@guilan.ac.ir

Abstract

Ionic liquids are salts with organic cations and organic or inorganic anions.Their use as catalysts has been studied extensively since they are non-flammable, non-volatile and recyclable. Also, most of them are classified as green solvents. Molten salts are ionic liquids with melting points above 100 °C. The properties of molten salts as a solvent for chemical processes differ from those of aqueous and organic solvents [1, 2].

The derivatives of 5-arylidene barbituric acids are an important class of hypnotic and sedative compounds. It is well known that 5-arylidene barbituric acids could be prepared by mixture of aromatic aldehyde, barbituric acid and an ionic liquid because of their negligible vapor pressure, tunable polarity, high thermal stability, good solvating ability, and ease of recyclability [3].

In this study, we have demonstrated an easy and efficient method for the synthesis of 5-arylidine barbituric acid derivatives using a bipyridine-based molten salt as green catalyst in water. Short reaction times, appropriate yields and clean reactions make this procedure an attractive alternative to the existing methods [Scheme 1].



Scheme 1. Synthesis of 5-arylidine barbituric acid derivatives using a bipyridine-based molten salt.

Keywords: Ionic liquid, Molten salts, 2,2'-Bipyridine , 5-Arylidine barbituric acids, Water media.

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Synthesis of Quinazolnone and derivatives

Mojtaba Hassanipour, *Asieh Yahyazadeh**

Department of Chemistry, Faculty of Science, University of Guilan, Rasht, Iran

Corresponding author E-mail: yahyazadeh@guilan.ac.ir

Abstract

Quinazoilnone derivatives are highly bioactive heterocyclic compounds with wider range of microbial activities such as anti-malarial, anti cancer, anti-inflammatory, anti-hypertensive, anti-convulsant, anti-HIV, ect. Solid supported microwave synthesis of some 3-substituted-4-(2*H*)-quinazolinones has been carried out by the reaction of anthranilic acid, formaldehyde and primary aromatic amines. The usaage of hazardous reagent and organic solvents has been avoided. The reactions were conducted in presence of acidic alumina where formahehyde entered into cycloaddition to yield the quinqzolinone derivatives. The synthesized quinazolinone derivatives showed moderate to promising antibacterial and antifungal acivities Nitrogen-containing heterocyclic scaffolds are quite common fragments in drugs and biologically.

Fe3+@mont as a heterogeneous recyclable Lewis acid catalyst under solvent-free condition was successfully established. The application of an inexpensive, easily available, reusable, and easy work-up catalyst that produces high yields under short reaction times [2]. The ultrasound is a useful tool in the design and development of green methods and promotion of organic chemistry. The combination of sonication conditions and lewis acidity of the recyclable catalyst promoted present reactions [3]

Keywords: cyclisation, heterocycles, quinazolinones, solid support Fe3+-Mont

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Study of pnicogen bonds in complexes and effect of electronegative atoms such as F,Cl on it

Hossein Roohi *, *Sajjad Fallahdoust*

Department of Chemistry, Faculty of Science, University of Guilan, P.O. Box 98135-674, Rasht, Iran

**Corresponding author. E-mail : hroohi@guilan.ac.ir*

Abstract

The newest member of an ever-expanding list of intermolecular interactions is the pnicogen bond, a Lewis acid−Lewis base attractive interaction in which a pnicogen atom (N, P, or As) acts as the Lewis acid. In this respect, the pnicogen bond is analogous to some of the more familiar intermolecular interactions such as the hydrogen bond and the halogen bond [1]. Noncovalent interactions play a very important role in supramolecular chemistry, molecular biology, and materials science. Traditionally, research in this field has focused on the most common and well-known noncovalent interaction, the hydrogen bond. However, in the last few decades, interest in the halogen bond and more recently, the pnicogen bond has increased significantly [2]. In this research, we examine the effect of substituents in H_nPX_m (X=F,Cl, n,m =1-3) on the strength and characteristics of pnicogen bond interactions of P…N (triazide) complexes has been studied by quantum chemical calculations. All the structures were optimized using M062X/6-311++G(d,p) level of theory. Also, all the required calculations were performed using the mention method. In order to explain the characteristics of the interaction and better interpretation of the geometrical changes and bonding parameters in the under study complexes, the NBO and AIM analyses are performed.

Keywords: Pnicogen bond; Triazine; H_nPX_m; DFT

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Physics Abstracts

PHYSICS ABSTRACT
Authors:

آمنه نجفی زاده	آرش مالک پور	آصف میرزائی	امین امامی
تینا فتحعلی پور	زینب چوپانی دیگه سرا	حورا حسین زاده کمائی	فائزه حاجی کریمی
حدیث نامور صدیق	حدیثه محمدی	رضا رمضانی مژدهی	ریحانه نظری
سبحان یوسفی تاجانی	سحر نوایی	سمیرا گنجی	سید محمد افتخاری
شهین گلچین ماسوله	صدیقه هادی پور	عطیه جمالی شادهی	سیده فرانک حجازی تکلیمی
فرح زاد تبسمی	فرشته رجبی	فرناز کارپرور	زینب قایم منیری
کیانوش کوبنی چناری	ماجده مهین زاد	مجید صفری سخاوت	محبوبه حسینی نژاد
محمد زارعی	محمد صحرایی	محمد ملائی	محمدرضا مهدوی
مریم تجدد	منیژه رفیعی رودسری	مهدی نجدی	مهدیه قهرمانی زرج آباد
مهران بادروح	نگین زمانی	هانیه مهری	هنگامه کیالاشکی

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خواص ترمودینامیکی مدل های کوانتومی برمبنای گروه های کیلی-کلاین یکانی مختلط

آمنه نجفی زاده، حسین پناهی، حسن حسن آبادی
گروه فیزیک دانشگاه گیلان، رشت
گروه فیزیک دانشگاه شاهرود

چکیده

در این کار هدف رسیدن به خواص ترمودینامیکی تولید شده توسط خانواده ای از هامیلتونی های انتگرال پذیر گروه های یکانی مرتبه اول در فضای کیلی-کلاین است. در واقع این امکان از طریق روابط جابه جایی کلی بین مولدهای آن ها از گروه کیلی-کلاین دلخواه تحت بررسی فراهم می شود. از سوی دیگر، بوسیله ی تبدیل مختصات به پارامتریزاسیون اویلری، متریک نوشته شده از کازیمیر برحسب این مختصات بدست می آید که با همان لاگرانژین ژئودوزی حرکت از فضای متناظر معادل است. از طرفی با تطبیق مختصات، لاگرانژین برحسب تکانه های کانونی نوشته می شود. بنابراین هامیلتونین در دو فرم می تواند بدست آورده شود: یکی برای ذره آزاد و دیگری برای ذره درگیر با پتانسیل انتگرالی. از اینرو، با حل هامیلتونین هریک از دو حالت در روشی متفاوت (روش های NU و SUSY QM)، مدل کوانتومی برای سیستم متناظر آن برحسب پارامتر کانترکشن (κ_1) نوشته می شود. سرانجام با پیدا کردن ویژه مقادیر برای هریک از این دو سیستم، خواص ترمودینامیکی آن ها به ترتیب با تغییر دو پارامتر λ و δ مورد بحث و بررسی قرار می گیرد. در بررسی ما، تنها می توان یک گذار فاز در نمودار ظرفیت گرمایی در نقطه بحرانی τ_0 مشاهده نمود. به عبارت دیگر، می توان بیان کرد که گذار فاز نوع دوم ممکن است برای ذره آزاد در دماهای بالا اتفاق افتد. همچنین دیگر نتایج در پایان گزارش می شود.

کلید واژه: خواص ترمودینامیکی؛ فضای کیلی-کلاین؛ هامیلتونی انتگرال پذیر؛ کانترکشن؛ پارامتریزاسیون اویلری؛ گروه های یکانی.

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بررسی دینامیکی ناپایداری ریلی ـ تیلور در همجوشی محصورشدگی لختی

آرش مالک پور، عباس قاسمی زاد

گروه فیزیک، دانشکدهٔ علوم پایه، دانشگاه گیلان

چکیده

انفجارهای درونی هدف های همجوشی محصور شدگی لختی به طور ذاتی ناپایدار است. ناپایداری های هیدرودینامیکی از جمله عوامل منفی در پیشبرد هر واکنش همجوشی هسته ای هستند که موجب کاهش آهنگ انجام این واکنش ها می شوند. معروف ترین این ناپایداری ها، ناپایداری ریلی ـ تیلور است که در ابتدا پوستهٔ انفجاری را از درون تخریب می کند و سپس از تشکیل لکهٔ داغ ممانعت به عمل می آورد. بنابراین واضح است که در افروزش نقطهٔ داغ مرکزی هدف های سوخت ICF، چگونگی کنترل این ناپایداری ها اهمیت زیادی دارد. آثار ناشی از کندگی، باعث کاهش آهنگ رشد ناپایداری ریلی ـ تیلور می شود و به عنوان عاملی مثبت در واکنش های همجوشی محصورشدگی لختی در نظر گرفته می شود بنابراین کاهش آهنگ رشد این ناپایداری به طور کلی یکی از هدف های مهم در واکنش های همجوشی هسته ای از جمله ICF می باشد. در این مقاله دینامیک ناپایداری ریلی ـ تیلور در جبههٔ کندگی هدف های سوخت ICF و آهنگ رشد این ناپایداری در حالت های مختلف بررسی شده است.

کلمات کلیدی: همجوشی محصورشدگی لختی، ناپایداری ریلی ـ تیلور، آهنگ رشد، جبههٔ کندگی، لکهٔ داغ.

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مطالعه مروری بر خواص ساختاری و الکتریکی فیلم های نازک وانادیوم اکسید و نهشت آن با روش سل-ژل

میرزائی، آصف؛ اسمعیلی قدسی، فرهاد؛ مظلوم، جمال

گروه فیزیک دانشکده علوم پایه

چکیده

ساختارهای لایه بندی شده اکسید وانادیوم به دلیل فعالیت الکتروشیمیایی، ساختار لایه ای خاص و همچنین خاصیت ترمو الکتریک بسیار عالی در سال های اخیر مورد توجه ویژه قرار گرفته است. مطالعات نشان می دهد که تغییر پارامترهای فیزیکی منجر به تغییر خواص فیزیکی فیلم‌های نازک اکسید وانادیوم تهیه شده می‌شود. خواص ساختاری نمونه‌های اکسید وانادیوم با استفاده از پراش پرتو X مورد بررسی قرار گرفته است. مطالعات نشان می‌دهد که اندازه دانه‌ها که با استفاده از رابطه دبای شرر قابل محاسبه می‌باشد، با تغییر دمای بازپخت نمونه‌ها در بازه دمایی ۴۰۰ تا ۵۵۰ درجه سلسیوس اندازه دانه‌ها از ۳۰۰ به ۵۰۰ نانومتر افزایش می‌یابد. رسانایی الکتریکی نمونه‌ها با استفاده از پروب چهار نقطه‌ای مجهز به المنت مورد بررسی قرار گرفته است. مورفولوژی سطح نمونه‌ها را می‌توان به وسیله میکروسکوپ الکترونی روبشی مورد بررسی قرار داد.. وانادیوم اکسید دارای چندین ساختار از جمله اورتورومبیک و مونوکلینیک است که فاز اورتورومبیک به علت چگالی انرژی بالایش، بیشتر مورد توجه قرار می‌گیرد. یکی دیگر از راه‌های ایجاد تغییر در خواص اکسید وانادیوم ، آلاییدن آن با یک ماده دیگر مثل آهن است. مطالعات نشان می دهد که آلایش V_2O_5 با Fe منجر به افزایش دمای گذار می‌شود.

کلید واژه: سل-ژل ، فیلم نازک ، خواص فیزیکی ، V_2O_5:Fe

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طیف سنجی هارمونیک مرتبه بالا در فاز گازی

امین امامی ، *سعید باطبی*
دانشکده علوم پایه،گروه فیزیک،رشت،خیابان نامجو

چکیده

در طرح خود کاوشگر ، آخرین مرحله از تولید هارمونیک های مرتبه بالا ، برخورد مجدد الکترون یون به عنوان روند نشانه گذاری در نظر گرفته می شود و انتشار ممکن است اطلاعات مثبتی را روی سیستم بازترکیب ، از جمله ساختار مولکولی و دینامیکی رمزگشایی کند. در قسمت اول ، ما طیف سنجی هارمونیک های مرتبه بالا از مولکول های N2O و CO2 را انجام دادیم که با توجه به قطبی شدن لیزر پیشران ، (با لیزر) تراز شده اند. ما دو روش تداخل نوری و کوانتومی به ترتیب به منظور مشخص کردن دامنه و فاز تابش اتوثانیه به عنوان تابعی از انرژی فوتون و زاویه هم ترازی اجرا کردیم.ما اثرات جدیدی را در تولید هارمونیک مرتبه بالا کشف کردیم که نمی توان با ساختار بالاترین مداری مولکولی اشغالی (HOMO) توضیح داد. در عوض ، ما دریافتیم که در طول تعامل با زمینه های لیزری ، دو حالت الکترونیکی بطور همدوست در یون مولکولی هیجان زده می شوند و یک بسته موج سوراخ را تشکیل می دهند که در یک بازه زمانی ضریب دوم در مولکول پس از یونیزاسیون تونل حرکت می کند. ما بر این حرکت الکترونیکی همدوست در داخل مولکول متمرکز شده ایم و اندازه گیری های N2O و CO2 را با هم مقایسه کردیم. تفاوت قابل توجه در رفتار فاز هارمونیک ما را به سمت توسعه یک مدل چند کانال هدایت می کند تا از وزن نسبی و فاز دو کانال درگیر در انتشار یافت شود.علاوه بر این ، ما پالسهای ساطع شده توسط این دو مولکول را مورد مطالعه قرار دادیم و یک روش ساده اما انعطاف پذیر را برای انجام شکل گیری پالس آتوثانیه ارائه دادیم. در بخش دوم ، طیف سنجی هارمونیک مرتبه بالا به سایر سیستمهای مولکولی ، از جمله برخی مولکولهای نسبتاً پیچیده ، به عنوان مثال ، SF6 و هیدروکربنهای کوچک (متان ، اتان ، اتیلن ، استیلن) گسترش یافت. این نتایج جالب بسیاری مانند تحریف فاز را که قبلاً گزارش نشده بود نشان داد.برای طرح مستقیم ، ما با استفاده از پالسهای آتو ثانیه ای با تابش همدوست XUV با یک همپوشانی لیزر مادون قرمز (IR) با تأخیر زمانی کنترل شده ، اتم های گاز کمیاب را فوتونیزه کردیم و تا حدود ۶۰ اتوثانیه تثبیت شد. ما تفاوت های مشخصی در توزیع زاویه ای اندازه گیری شده از فوتوالکترون ها ، بسته به تعداد فوتونهای IR رد و بدل شده وجود دارد. این مشاهدات که به تفسیر نظری پیوسته اند ، بینش جدیدی را در دینامیک این کلاس از فرایندهای فوتونیزاسیون چند رنگی ارائه می دهد که گامی اساسی در جهت مطالعه فوتونیزاسیون در حوزه زمان ، با رزولوشن زمان نزدیک است.

کلید واژه ها: طیف سنجی هارمونیک مرتبه بالا، HHS = high harmonic spectroscopy

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بررسی هم‌آوایی دو شناگر فعال در حضور جریان خارجی

تینا فتحعلی پور، گلناز نجفی گل‌وندانی، سیدنادر رسولی
گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

ریزشناگرهای زیستی مانند باکتری ایکولای (E.Coli)، و اسپرم در پستانداران (Spermatozoa) در سیالِ غلیظِ پیرامون خود، در عدد رینولدز پایین (Low Reynolds number) حرکت می‌کنند. این حرکت به کمک ضمائمی تاژک مانند انجام می‌شود. علاوه براین، تاژک ها در سطح داخلی دستگاه تنفسی پستانداران و ... نیز دیده می‌شوند؛ حرکت هم آوای (synchronized) این تاژک‌ها در سطح درونی دستگاه تنفسی موجب خروج مواد بیگانه ای می شود که می توانند با اشغال فضا کارکردِ حیاتی دستگاه تنفسی را مختل کنند. یک پرسش اساسی در زیست‌فیزیک تاژک‌ها این است که هم‌آوایی چگونه شکل می‌گیرد؟ آیا سازوکار موثر برآن به‌واسطه‌ی برهم‌کنش‌های هیدرودینامیکی میان تاژک‌ها است، و به منظور به حداقل رساندن اتلاف (dissipation) در سیال پیرامونِ آنها شکل می‌گیرد؟ یا با سازوکاری مرکزی توسط ارسال پیام‌های هماهنگ به تاژک‌ها، آن‌ها را به حرکت هم‌آوا وادار می‌نماید؟

به طور مشخص، اگر شناکردن دو ریز شناگرِ فعال را در کنارِ هم در نظر بگیریم، می‌دانیم که برهم‌کنش‌های هیدرودینامیکی موجب می‌شود حرکتِ دو شناگر در طول زمان به هم قفل و هم‌آوا شود. اما اگر تنها ریشه‌ی هم‌آوایی برهم‌کنش‌های هیدرودینامیکی باشد، حضور یک جریان خارجی در سیال می‌تواند هم‌آوایی را مختل کند و در نهایت به‌هم بزند. در حالی که اگر هم آوایی به‌واسطه‌ی یک سازوکار سلولی ایجاد شده باشد، وجود جریان خارجی نباید بتواند آن را کلا از بین ببرد. ما سعی می‌کنیم، در ساده‌ترینِ سطحِ ممکن مدلی حل‌پذیر برای هم‌آوایی را در حضور جریان خارجی مطالعه نماییم. امیدواریم که پاسخ این مدل ساده، مسیری را بگشاید تا بتوان مشخص کرد که آیا هم‌آواییِ مشاهده شده ی شناگرهایی در عدد رینولدز پایین، ناشی از برهم‌کنش هیدرودینامیکی است، یا تنها یک هماهنگ‌کننده‌ی بین سلولی دلیلِ پنهان آن می‌باشد.

کلیدواژه: عدد رینولدز پایین ، ریز شناگر ، بر هم کنش های هیدرودینامیکی ، معادله ی نوی-استوکس ، معادله ی استوکس ، هم آوایی ، قفل- فاز ، استوکسک

بررسی خواص ساختاری و مغناطیسی تک لایه $MnSe_2$

زینب چوپانی دیگه سرا ، میثم باقری تاجانی
گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

TMD ها از لایه هایی با اتم های فلزی، که بین لایه های اتم های کالکوژن ساندویچ شده تشکیل شده اند؛ TMDهای تک لایه به دلیل خصوصیات منحصر به فردشان کاربرد های زیادی در مدارهای مجتمع، الکترود های شفاف رسانا، فتولومینانس و الکترونیک دره ای دارد. به علت وجود برهمکنش قوی اسپین ـ مدار درتک لایه های TMD و همین طور جفت شدگی اسپین و دره باعث به کارگیری این دسته مواد در دستگاه های اسپینترونیک می شود. سنتز موفق چنین تک لایه هایی؛ تحقیقات بیشتری را در زمینه علمی برای پیش‌بینی TMDهای جدید و مطالعه خواص فیزیکی و شیمیایی آن‌ها در سال‌های اخیربرانگیخته است. با استفاده ازنظریه ی تابعی چگالی، ساختار الکترونی برای تک لایه ی $MnSe_2$ در دو فاز H وT بررسی شد؛ محاسبات با تابع تبادلی ــ همبستگی GGA با اعمال اسپین قطبیده و برای دقیق تر شدن محاسبات با تقریب هابارد انجام شد. نتایج بدست آمده از انرژی کل نشان می‌دهد که ساختار در فاز T پایدارتر است. تک لایه دوبعدی $MnSe_2$دارای گاف انرژی صفر می باشد و رفتار فلزی دارد. با رسم چگالی حالت‌ها مشاهده می‌شود که سهم اربیتال d بیشتر از اربیتال‌های دیگر است. برای بررسی خواص مغناطیسی تک لایه MnSe2، یک ابرشبکه ۲×۲ در دو حالت فرومغناطیس وآنتی فرومغناطسی درنظر گرفتیم، مشاهده شد که تک لایه ی $MnSe_2$ در حالت فرومغناطیس پایدارتر است. خواص مغناطیسی این تک لایه تحت استرین دومحوره (۱۰< ε-10) بررسی شد؛ با اعمال استرین این تک لایه تغییر فاز به حالت آنتی فرومغناطیس رخ می دهد.

کلیدواژه: نظریه ی تابعی چگالی، فرومغناطیس، فلز واسطه، استرین

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دینامیک تبدیل کننده و شار تابشی در هولورام

حورا حسین زاده کمائی ؛ سهیل خوشبین فر

گروه فیزیک، دانشکده علوم، دانشگاه گیلان

نشانی پست الکترونیک مولف مسئول: hoorahoseinzade@gmail.com

انفجار درونی در راه اندازهای مستقیم بیش از راه اندازهای غیر مستقیم در معرض غیریکنواختی تابش و در نتیجه ناپایداری های هیدرودینامیکی قرار دارند[۱و۲]. در راه اندازی غیرمستقیم، باریکه ی یونی شتاب داده شده مستقیما به هدف برخورد نمی کند، بلکه در مبدل ابتدا به اشعه ی x تبدیل شده و سپس این اشعه یx توسط بازتابش های پلانکی متعدد به صورت تابش متقارن با چگالی انرژی یکنواخت درون محفظه هولورام تابیده می شود. به طور کلی دو فرایند اصلی در راه انداز غیرمستقیم دچار اتلاف انرژی می شود،که یکی تبدیل انرژی پرتو به اشعه یx در مبدل ها(η_x) و دیگری استفاده از تابش پرتوی x به عنوان انرژی راه انداز(η_{tr})است. به همین علت بهره ی انرژی در راه انداز های غیر مستقیم نسبت به راه انداز مستقیم کمتر است. برای رسیدن به بازده تبدیل بالا،حجم ماده مبدل داغ شده باید کوچک نگهداشته شود. شبیه سازی هدف های هولورام نشان می دهد که بهره جفت شدگی با حفره ورودی کوچکتر، کاهش نسبت محفظه هولورام به کپسول، اتلاف کمتر لیزر و اثرات دیواره ی ترکیبی در هولورام افزایش می یابد. نکته ی مهم دیگر این است که انواع مناسبی از گونه های اتمی مثل طلا و گادولینیوم در دیواره هولورام می تواند پنجره ی عبوری در طیف پرتویx را کاهش داده و در نتیجه هدر رفت تشعشع را کم کند[۱و۳]. قرار گرفتن سپر های تابشی بین مبدل و هدف، تقارن تابشی را به میزان بسیار زیادی افزایش داده و در اثرآن اشعه یx در هولورام، در تمامی زوایا پخش و نهایتا انفجار درونی کپسول را به راه می اندازد[۲].

مطالعه ی HIDIF، هدف مرجع دو مبدله، بیشترین چالش راه انداز گداخت را برای افروزش عنوان کرد.چون طول پالس بسیار کوتاه ۶ns ، نقطه ی کانونی کوچک ۱/۷mm، انتقال باریکه تحت شرایط بار فضایی را نیاز دارد[۲]. برای رسیدن به بازده تبدیل بالا، حجم ماده مبدل داغ شده، باید کوچک نگداشته شود. تاکنون اهداف راه انداز غیرمستقیم، دو،چهار و هشت مبدله، توسط گروه HIDIF طراحی شده است که در همه ی آنها محفظه از طلا و مبدل های بریلیومی استفاده شده است. در راه انداز غیر مستقیم NIF هدف DT با ابعاد کپسول حدود ۱mm و محفظه ی هولورام با z بالا به طول ۱۰mm با تعداد ۱۹۲ باریکه با دو حلقه ورودی و خروجی گروه بندی شده اند. این باریکه ها در مبدل به اشعه های ایکس با انرژی ۲MJ تبدیل شده و باعث کندگی لایه ی بیرونی و ایجاد انفجار درونی می شوند[۴]. اورانیوم ضعیف شده، پیشنهاد دیگری بجای هولورام با دیواره های طلاست که بازده انتقال انرژی به اشعه ی ایکس ۷٪ و دمای تابش ۳۰۰eV را به علت افزایش توان بازتاب فراهم می آورد. ضخامت لایه ی DU (اورانیوم ضعیف شده) ۰/۶μm کمتر از لایه ی طلاست (ضخامت لایه ی طلا حدود ۳۰μm است.). در نتیجه به کارگیری آنها در مقایسه با هولوارم با دیواره طلا باعث ۴۰٪ کاهش پیش گرمایش و به علت افزایش بازتابش، باعث بهبود در انفجار درونی ساچمه می شود[۴].

کلید واژه: هولورام،مبدل،باریکه یون سنگین، شتاب دهنده-rf، شتاب دهنده القایی،لنز پلاسمایی.

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برهمکنش باریکه‌ی الکترون نسبیتی با ویگلر موج الکترومغناطیسی در حضور کانال یونی مغناطیده

فائزه، حاجی کریمی، ساعد، جعفری، پیوند، *طاهرپرور*

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

Faez.hajikarimi@gmail.com

چکیده:

لیزر الکترون آزاد وسیله‌ای است که انرژی الکترون‌های آزاد را به تابش الکترومغناطیسی تبدیل می‌کند. تابش الکترومغناطیسی در لیزر الکترون آزاد ناشی از شتاب‌دار شدن الکترون‌ها در عبور از یک میدان مغناطیسی متناوب می‌باشد، باریکه‌ی الکترونی تولید شده از شتاب‌دهنده از میان یک میدان مغناطیسی متناوب، که به‌وسبله آرایه‌ای از قطب‌های متناوب ایجاد شده و تحت عنوان ویگلر شناخته می‌شود، عبور می‌کند الکترون‌ها در اثر نوسان تابش می‌کنند. نزدیک‌ترین شکل به چنین تابشی را می‌توان تابش سینکروترونی ناشی از الکترون‌های محدود شده به حرکت دایره‌ای به‌وسیله‌ی میدان مغناطیسی در نظر گرفت. در این لیزرها برای ایجاد پایداری در حرکت باریکه‌ی الکترون‌های نسبیتی از یک میدان مغناطیسی محوری راهنما استفاده می‌شود و حضور چنین میدانی منجر به اقزایش بهره و توان سیستم می‌شود. امروزه برای رفع این مشکل، به‌جای استفاده از میدان مغناطیسی محوری از کانال یونی استفاده می‌شود. کانال یونی به‌طور جزئی اثرات بار-فضا را خنثی نموده و امکان تمرکز بیشتر باریکه را فراهم خواهد کرد. لیزرهای الکترون آزاد امروزه به عنوان درخشنده‌ترین منابع تابشی اشعه‌ی ایکس شناخته شده‌اند به طوری که می‌توانند امکان تولید پالس‌هایی همدوس، پرشدت و فوق کوتاه را در طول موج‌هایی به کوتاهی نانومتر و آنگستروم فراهم آورند. کاربردهای عملی این لیزرها در محدوده‌ی اشعه‌ی ایکس نامحدود است. در اینجا، به برهمکنش باریکه الکترون نسبیتی با یک ویگلر موج الکترومغناطیسی (مانند ویگلر لیزری) در حضور کانال یونی مغناطیده پرداختیم. مسیرهای حرکت الکترون و نرخ مبادله‌ی انرژی بین باریکه و ویگلر موج الکترومغناطیسی محاسبه شده‌است. نتایج نشان می‌دهد که سه گروه از مدارات الکترونی در این سیستم تشکیل می‌شود. ویگلرهای الکترومغناطیسی به‌واسطه‌ی طول موج ویگلری بسیارکوتاهشان (درحد میکرومتر) نسبت به ویگلرهای رایج مغناطیسی (که درحد سانتی‌متر بودند)، قابلیت دستیابی به طول موج‌های بسیار کوتاه (درحد اشعه ایکس) و با نرخ توان تابشی بالا را فراهم می‌کنند.

کلیدواژه: کانال یونی مغناطیده، مسیر حرکت الکترون، ویگلر الکترومغناطیسی، توان تابشی.

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تبدیل رادون در پردازش تصویر

حدیث نامور صدیق [۱] ، علیرضا صدرممتاز [۱] ، ابراهیم سیری پلنگ دره [۲]
[۱]دانشکده علوم، گروه فیزیک، دانشگاه گیلان، رشت، ایران
[۲]دانشکده فیزیک، دانشگاه تهران، تهران، ایران

چکیده

تبدیل رادون یک تبدیل انتگرالی است که در آن انتگرال تابعی با دامنه‌ای محدود بر روی تعدادی خطوط موازی و مستقیم محاسبه می‌شود. پردازش و حذف نویز تصویر یکی از زمینه‌های مورد علاقه تحقیقاتی است. تبدیل رادون کاربردی زیادی در پردازش تصویر و توموگرافی دارد و می‌توان آنرا در دو حالت گسسته و پیوسته تعریف کرد. محاسبه معکوس تبدیل رادون یکی از مسائل مشکل در پردازش تصویر است. در واقع محاسبه معکوس تبدیل رادون همان بازسازی تصویر موردنظر است. با تاباندن پرتوهای ایکس در جهت‌های مختلف به یک شی، می‌توان تصویر دقیقی از ساختار داخلی آن شی را تعیین کرد. از آنجایی که یکی از فرض‌های اولیه در تصویرسازی پرتو ایکس این است که در راستای خط مستقیم منتشر شود، ما از تبدیل رادون خطی استفاده می‌کنیم تا بتوان این فرض را بخوبی پوشش داد. در ادامه نیز با استفاده از نرم افزار محاسباتی متلب به بررسی الگوریتم پردازش تصویر با رهیافت تبدیل انتگرالی رادون بر روی فانتوم شیپ-لوگان که یک ابزار ریاضی در مبحث تصویرسازی است می‌پرازیم و تبدیل رادون آنرا تحت زوایای مختلف بررسی می‌کنیم و تصویری بازسازی شده از این فانتوم را تحت زاویه خاصی ارائه می‌کنیم.

کلمات کلیدی: تبدیل رادون، پردازش تصویر، توموگرافی، تصویربرداری اشعه X، فانتوم شیپ-لوگان

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سنتز نانولوله های کربنی به روش هیدروترمال و بررسی خواص الکتریکی و اپتیکی

حدیثه محمدی؛ مجید سیفی

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

چکیده

در این پژوهش نانوکامپوزیت اپتیکی نانولوله های کربنی به روش هیدروترمال توسط نانوذرات زینک نیترات با اسید سولفوریک به نسبت ۳ به ۱ عاملدار شدند و به روش هیدروترمال به کمک NH_3 نیتروژن دار گردیده اند. مشخصه یابی نانوکامپوزیت های اپتیکی توسط طیف سنجی تبدیل فوریه به مادون قرمز FTIR و مشخصه یابی XRD برای بررسی نمونه ها مورد بررسی قرار گرفت. انالیز FTIR وجود پیوندهای شیمیایی و ارتعاشی را نانوذرات اپتیکی تهیه شده را نشان میدهد. انالیز پراکندگی اشعه ایکس نشاندهنده ی دو فاز اکسید زینک و نانولوله ی کربنی در کامپوزیت است.

کلید واژه: سنتز، هیدروترمال، نانولوله

سیستم اتمی دو ترازه در حضور میدان خارجی Tavis -Cummings بررسی فشردگی آنتروپی مدل کوانتومی

رضا رمضانی مژدهی، حسین پناهی

گروه فیزیک دانشکده علوم پایه دانشگاه گیلان

چکیده:

بررسی فشردگی سیستم های اتمی دو ترازه در حضور میدان خارجی در سال های اخیر توجه خیلی از محققین را جلب نموده است. از جمله کاربرد آن، در طیف سنجی با دقت بالا، ساعت های اتمی با دقت بالا، اندازه گیری قطبش اسپین با دقت بالا، تولید کنترل کننده های کوانتومی با حالت فوتون کم، کنترل اختلال کوانتومی در اندازه گیری قطبش کوانتومی اسپین اشاره نمود. همچنین اطلاعات کوانتومی در کوانتوم تلپورتانس، رمزنگاری و پنهان کردن کدها کاربرد دارد. مطالعه فشردگی سیستم اتمی بیشتر براساس رابطه عدم قطعیت هایزنبرگ استوار است که به عنوان یک رابطه استاندارد در اندازه گیری نوسانات کوانتومی در نظر گرفته می شود ولی اطلاعات کافی از فشردگی اتم را مشخص نمی کند. از اینرو محققین روش زیباتری برای اصلاح رابطه عدم قطعیت به نام تئوری کوانتوم آنتروپی ابداع نمودند. از سوی دیگر مدل کوانتومی Tavis–Cummings (TCM) در حضور میدان کوانتومی (در کاواک کوچک) یک مدل نظری خوبی است که می توان با استفاده از تئوری کوانتوم آنتروپی بسیاری از خواص غیر کلاسیکی را دریافت نمود که از جمله اثرات دوقطبی- دوقطبی، برهمکنش بین اتم، برخورد اتمی و ... را به خوبی نشان داد و کاربرد فراوانی در اپتیک کوانتومی دارد.

بر همین اساس در این مقاله، فشردگی آنتروپی اتم ها در سیستم TCM دو اتمی در حال حرکت در درون کاواک و درهم تنیدگی بین حرکت اتمی با میدان همدوس را بررسی نمودیم. همچنین تاثیر حرکت اتمی و نقش میدان خارجی و انتخاب حالت اولیه اتمی در فشردگی آنتروپی را با رسم نمودار های آن و مقایسه با مقالات منتشر شده قبلی را بررسی نمودیم و نشان دادیم این اطلاعات در فشردگی آنتروپی و کنترل در آمیختگی اتم- میدان چقدر مهم است و در نمودارهای آن چه تاثیری می گذارد.

کلید واژه: اتم دو ترازه، مدل کوانتومی Tavis–Cummings، اطلاعات کوانتومی، آنتروپی ، فشردگی (squeezing)

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محاسبه ی انتروپی درهمتنیدگی در نظریه میدانهای کوانتومی به روش همبستگی

ریحانه نظری، کمیل بابایی، محمدی مظفر

گروه فیزیک دانشکده علوم دانشگاه گیلان

چکیده :

درهمتنیدگی یکی از مفاهیم بنیادی در مکانیک کوانتومی است که امروزه در شاخه های مختلفی از فیزیک اعم از انرژی های بالا، ماده چگال و پدیده های بحرانی و همچنین نظریه ی اطلاعات کوانتومی کاربرد یافته است. برای اندازه گیری این مفهوم سنجه های متفاوتی ارائه شده هر کدام به نوبه ی خود مزایا و نواقصی دارد. از جمله ی مهمترین این سنجه ها می توان به آنتروپی درهمتنیدگی اشاره نمود که به دلیل پیروی از قانون سطح شباهت جالب توجهی با آنتروپی سیاهچاله ها در چارچوب گرانش اینشتین دارد. در این پژوهش به مرور محاسبات مربوط به این کمیت در یک نظریه ی میدان آزاد با استفاده از روش هسته ی گرمایی خواهیم پرداخت.

محاسبه ی آنتروپی درهمتنیدگی که به عنوان آنتروپی فون نویمان برای ماتریس چگالی کاهش یافته تعریف می شود در یک نظریه ی میدان، کاری پیچیده است. انجام این محاسبات در موارد محدودی به در صورت تحلیلی ممکن است. به عنوان نمونه در یک نظریه ی میدان همدیس دو بعدی به دلیل تقارن گسترده ای که در ساختار نظریه وجود دارد می توان این محاسبه را انجام داد. همچنین در برخی از نظریات میدان آزاد (بدون اندرکنش) در ابعاد بالاتر نیز این محاسبه قابل انجام بوده و نتیجه ی معروف قانون سطح حاصل خواهد شد. روش های مختلفی برای این گونه محاسبات به کار می رود که از آن جمله می توان به روش همبستگی و هسته ی گرمایی اشاره نمود. این مطالعه به ما امکان می دهد تا علاوه بر بررسی ساختار درهمتنیدگی در برخی از نظریات میدان با مشکلات و پیچیدگی هایی که در این رهیافت وجود دارد نیز آشنا شویم. تمرکز ما بر نظریات میدان آزاد نسبیتی خواهد بود و البته نظریاتی که دارای مشتقات مراتب بالاتر نیز باشند را مطالعه خواهیم نمود.

کلیدواژه: ماتریس چگالی انتروپی درهمتنیدگی هسته گرما

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ارزیابی پارامترهای دزیمتری چشمه براکی‌تراپی ایریدیوم مورد استفاده در سرطان پروستات، توسط کد مونت‌کارلو GATE

سبحان یوسفی تاجانی، پیوند طاهرپرور

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

براکی‌تراپی روشی موثّر در پرتودرمانی است که در آن چشمه پرتوزا در داخل و یا نزدیکی تومور قرار می‌گیرد. در این روش، از چشمه‌های پرتوزای مختلفی مانند ایریدیوم-۱۹۲، ید-۱۲۵، پالادیوم-۱۰۳، کبالت-۶۰، سزیوم-۱۳۱ و ... استفاده می‌شود. ایریدیوم-۱۹۲، به دلیل نیمه‌عمر (۷۳.۸ روز) و فعالیّت آن (چند صد گیگابکرل)، می‌تواند برای درمان‌های موقّت در براکی‌تراپی مورد استفاده قرار گیرد که از مهم‌ترین کاربردهای آن در درمان سرطان پروستات می‌باشد. در این بین، برای مقاصد طراحی درمان، تعیین توزیع دُز پیرامون چشمه براکی‌تراپی موردنظر بسیار اهمیّت دارد. در این مطالعه، تابع دُز شعاعی و تابع ناهمسانگردی چشمه ایریدیوم با نام تجاری Nucletron mHDR-v1 در آب به کمک کد مونت کارلو GATE بر اساس توصیه AAPM, TG-43-U1 تعیین گردیده است. برای این منظور، این چشمه براکی‌تراپی (با درنظر گرفتن هندسه، مواد سازنده و طیف انرژی آن در مرکز یک فانتوم) شبیه‌سازی گشته و تعدادی حلقه در فواصل مختلف از مرکز چشمه برای ثبت انرژی به نهشت‌گذاشته‌شده، تعریف شد. سپس، نتایج حاصل با داده‌های منتشرشده توسط AAPM و نتایج موجود مقایسه گردید. این مقایسه، تطابق بسیار خوب نتایج شبیه‌سازی به کمک GATE را با سایر مطالعات (بیشینه اختلاف ۸درصد) نشان می‌دهد. علاوه‌براین، تابع ناهمسانگردی چشمه در فواصل و زوایای مختلف به دست آورده شد و با نتایج منتشرشده توسط AAPM مقایسه گردید. نتایج نشان می‌دهد که پارامترهای دزیمتری چشمه ایریدیوم می‌تواند به دقّت توسط کد مونت‌کارلو GATE و با انتخاب فهرست فیزیکی مناسب محاسبه شود. این پارامترها می‌توانند برای طراحی درمان براکی‌تراپی مورد استفاده قرار گیرند.

کلیدواژه: دزیمتری، ایریدیوم، براکی‌تراپی، پروستات، GATE

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سنتز گرافن اکساید و Fe3O4 به روش هیدروترمال و بررسی خواص اپتیکی و الکتریکی

سحر نوایی؛ مجید سیفی

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

چکیده

در این پژوهش نانوکامپوزیت مغناطیسی گرافن اکساید را به روش رسوب شیمیایی توسط نانوذرات مغناطیسی اکسید اهن در یک مرحله سنتز شدند.گرافن اکساید ابتدا با ClCH2 COOH و NaOH عاملدار شدندو سپس مورد استفاده قرار گرفتند.در این روش از واکنش های نمک های FeCl3 6H2O و Feso4 7H2O تحت اتمسفر گاز ارگون برای سنتز کامپوزیت مغناطیسی استفاده شد.از انالیزطیف سنجی تبدیل به فوریه مادون قرمز (FTIR) و مشخصه یابی پراش پرتو ایکس (XRD) برای بررسی نمونه ها مورد بررسی قرار گرفت.انالیز FTIR وجود پیوندهای شیمیایی و مدهای ارتعاشی کششی در کامپوزیت مغناطیسی تهیه شده را نشان میدهد.انالیز پراکندگی اشعه ایکس نشان دهنده ی دو فاز مکعبی اکسید اهن و گرافن اکساید در کامپوزیت سنتز شده میباشد.نانوکامپوزیت تهیه شده با اعمال میدان مغناطیسی خارجی به سرعت جذب اهنربا میشود و با جذب میدان مغناطیسی دوباره پراکنده میشود.ارایش صفحات گرافن اکساید میتواند یک چینش مکعبی از کره ها یا اجسام داشته باشد.

کلید واژه: سنتز، گرافن اکساید، کامپوزیت

استفاده از گسیلنده‌های بتا در تولید جریان الکتریکی به کمک باتری‌های بتاولتائیک

سمیرا گنجی، *پیوند طاهرپرور*، *پویا فیروزی*

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

شیوه‌های متفاوتی برای دست‌یابی به انرژی الکتریکی از طریق واپاشی ذرات بتا وجود دارد که به صورت معمول از نهشت انرژی ذرات بتا در مواد به منظور تولید جریان الکتریکی کمک گرفته می‌شود. مواد مورد استفاده در بیشتر موارد، مواد نیمه‌رسانا هستند و ابزاری که به کمک این روش تولید جریان می‌کنند با عنوان «باتری‌های بتاولتائیک» شناخته می شوند. در باتری‌های بتاولتائیک، تابش‌های گسیلی از ذرات بتا سبب تولید جفت الکترون-حفره‌هایی می‌شوند که میدان الکتریکی اعمالی در دو سمت نیمه‌هادی موجب جداسازی آن‌ها می‌گردد. باتری بتاولتائیک به علت چگالی انرژی بالا، عمر طولانی و کوچک‌سازی می‌تواند گزینه‌ی مناسبی برای اهداف کم‌توان مانند استفاده در شبکه‌های بی‌سیم، حسگرهای حرارتی و دستگاه‌های میکرو الکترومکانیکی باشد. از گسیلنده‌های بتای گوناگونی در باتری‌های بتاولتائیک استفاده شده است که می توان به ^{3}H، ^{147}Pm، ^{85}Kr و ^{63}Ni اشاره نمود. انتخاب رادیوایزوتوپ به کاربردهای باتری و آستانه خطر تابشی در نیمه‌هادی بستگی دارد، از آنجایی که چشمه‌ی ^{63}Ni دارای انرژی طیف بتای نرم (E_{avg}= 17keV,E_{max}= 67 keV) و نیمه‌عمر به نسبت طولانی (در حدود ۱۰۰ سال) دارد، نسبت به سایر رادیوایزوتوپ‌ها برای کاربردهای طولانی مدت مناسبتر به نظر می‌رسد. در مطالعه حاضر به کمک روش مونت کارلو، نهشت انرژی یک پرتو بتا در یک ماده نیمه رسانا، به همراه نمودار توزیع دز عمقی آن بدست آمده است. در ادامه، به کمک روابط، میزان تولید الکترون-حفره به ازای مقادیر متفاوت عمق اتصال p-n در سیلیکون محاسبه شده است. به منظور تعیین مقدار بهره‌وری این گونه باتری‌ها، میزان نشتی چگالی جریان و چگالی جریان اتصال کوتاه نیز در محاسبات در نظر گرفته شده است. باتوجه به اینکه کارآیی باتری بتاولتائیک وابسته به میزان تولید الکترون-حفره درون قطعه نیمه‌رساناست، و میزان تولید الکترون-حفره خود متأثر از عمق اتصال p-n، غلظت آلایش نیمه‌هادی، عرض ناحیه‌ی تهی و طول پخش حامل اقلیت است، در این مقاله نمودارهایی جهت تحلیل میزان تغییرات این پارامترها ارائه شده است.

کلیدواژه: ذرات بتا، باتری بتاولتائیک، آلایش نیمه‌هادی، چشمه ^{63}Ni

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برآورد سهم گرمایش لکه داغ از ذرات آلفای آزاد شده در واکنش گداخت سوخت دوتریوم-تریتیوم

سید محمد افتخاری؛ سهیل خوشبین فر

گروه فیزیک، دانشکده علوم، دانشگاه گیلان

نشانی پست الکترونیک مولف مسئول: eftekhari.m.seyyed@gmail.com

توقف ذرات باردار مانند α ، ^3T، ^3He و الکترون های داغ در پلاسمای ساچمه‌ی فشرده شده، یکی از مشکلات پایه‌ای در زمینه ICF است که شامل نهشت انرژی ذرات باردار، به ویژه ذرات آلفا در سوخت دوتریوم-تریتیوم، در طول لختی سوخت سرد و تحول سوخت در مراحل افروزش و اشتعال می‌باشد[۱]. در واقع افروزش گرماهسته‌ای زمانی اتفاق می‌افتد که خودگرمایش توسط ذرات آلفا از مجموع انرژی های اتلافی فراتر باشد. با این وجود، تمامی ذرات آلفا انرژی خود را در سوخت به نهشت نمی‌گذارند، چون بخشی از آنها می توانند فرار کنند. بنابراین، در این پژوهش به بررسی احتمال فرار و توقف ذرات آلفا خواهیم پرداخت. فرار ذرات آلفا از سوخت دوتریوم-تریتیوم افروخته در دمای بالاتر از ۱۰ keV، نه تنها بر دینامیک لکه‌ی داغ، بلکه در طراحی حفاظهایی که در فرآیند گداخت به کار می‌روند، تاثیرگذار است. چهار مدل تحلیلی شناخته برای توان ایستانندگی ذرات باردار بر اساس معادلات فیزیکی متفاوت، ارائه شده است که عبارتند از: مدل اسکاپسکی، مدل لی‌پتراسو (LP model)، مدل دینامیکی کوانتوم مولکولی (QMD model) و مدل براون-پرستون-سینگلتون (BPS model). بر اساس مدل‌های ارائه شده، توان ایستانندگی به دما و چگالی ماده و همچنین انرژی ذره فرودی بستگی دارد [۳]. با ارزیابی این مدل ها، نشان داده می شود که با افزایش دما، برد جرمی ذرات آلفا افزایش می‌یابد که این به معنی کاهش توان ایستانندگی میانگین است[۴]. مدل‌های متفاوتی برای فرار ذره آلفا توسعه پیدا کرده اند که از جمله آن ها مدل فِریلی است که با توجه به یکسان در نظر گرفتن چگالی پلاسما و سوختDT جامد، این مدل تخمین دقیقی از فرار ذره آلفا را ارائه نمی‌کند. بعد از این مدل، آتزنی مدلی را ارائه کرد که تقریبا این تفاوت چگالی را در نظر گرفت. مقایسه نمودار برد جرمی هر یک از این مدل ها نشان می دهد که برد جرمی ذرات آلفا در مدل آتزنی بیشتر از مدل های دیگر می باشد که به معنی بازده سوختن پایین تر است[۵]. بر طبق مدل LP برای اولین بار برای محاسبه توان توقف، پراکندگی با زاویه بزرگ، اثرات تجمعی پلاسما و اثرات کوانتومی مورد استفاده قرار گرفتند. در نظر گرفتن این موارد نشان داد که به عنوان مثال در دمای ۲۰keV، ذرات آلفا ۳٫۵ MeV، مقدار ۴۷درصد از انرژی خود را در سوخت DT به نِهشت می‌گذارند که با در نظر گرفتن این اثرات، احتمال نشت انرژی در ساچمه سوخت نسبت به وقتی که نِهشت انرژی در یون ها را فقط به وسیله پراکندگی کولنی با زاویه کوچک در نظر بگیریم، کاهش می‌یابد [۱،۲،۴].

با رسم منحنی برد جرمی ذرات آلفا که بر اساس مدل LP نشان داده شد که هرگاه انرژی ذره آلفا بیش از چندصد keV باشد آنگاه اتلاف انرژی ذرات آلفا به الکترون ها نسبت به یون ها غلبه می‌کند. به عنوان مثال، این اتفاق در پلاسمای ۵ keV در یک سوخت DT هم مولار، هنگامی که انرژی ذرات آلفا ۳۶۰keV باشد، رخ می‌دهد. در این دما، مطابق مدلLP، کسری از انرژی ذرات آلفا که به یون ها می رسد در حدود ۵۵ درصد است در حالی که براساس رابطه‌ی فریلی این مقدار، تنها ۳۸٫۵درصد می باشد.

کلید واژه: افروزش گرماهسته ای، لختی سوخت سرد، خودگرمایش ذرات آلفا، توان توقف، اثرات تجمعی پلاسما، نشت انرژی

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سرمایش لیزری

شهین گلچین ماسوله ، *سعید باطبی*

دانشکده علوم پایه،گروه فیزیک،رشت،خیابان نامجو

چکیده

رسیدن به دماهای بسیار پایین (نزدیک به صفر مطلق) و به تله انداختن اتم ها در یک ناحیه محدود از فضا چندین دهه است که ذهن فیزیکدانان را به خود مشغول کرده است. در همین راستا روش های بسیار هوشمندانه ای ابداع شده و این روش ها تکنولوژی های بسیار پیچیده ای به همراه داشته است.

سرمایش لیزر روشی است که توسط نور لیزر می توان حرکت اتم ها را کند کرد و دمای آنها را تا حد میکروکولن پایین آورد.

در این دما سرعت اتم ها بسیار کند شده و می توان تک تک اتمها را با دقت زیادی مطالعه کرد و ساختار داخلی آنها را مشخص کرد. این روش به طور معمول در آزمایش های فیزیک کوانتمی برای دست یابی به دما های نزدیک صفر مطلق انجام می شود، زیرا آثار کوانتومی تنها در این دما رخ می دهد.در واقع با فشار تابشی ناشی از نور لیزر اتمها را سر می کنند و اتمهای سرد برای بررسی سوالات بنیادی فیزیک ایده آل می باشد.

کلید واژه ها: سرمایش لیزری(Lc = laser cooling) ، به دام اندازی اتم ها (TA = trapping of atoms)

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اثر پلاسمای غیر حرارتی ناشی از تخلیه الکتریکی برفعالیت قارچ‌های بذرزاد برنج

صدیقه هادی پور، ساعد جعفری

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

امروزه آماده‌سازی و ذخیره سازی مواد غذایی بصورت ایمن و با حفظ مواد مغذی آن ، یکی از مهمترین چالش ها در صنایع غذایی و سلامت سبدغذایی انسان است. لزوم توسعه‌ی روشهای کارآمد و مطمئن در پردازش موادغذایی ردپای فناوری های نوین را به این صنعت باز کرده بطوریکه بهره‌وری و در نهایت موقعیت اقتصادی برتر را در این صنعت ایجاد نماید .

فناوری پلاسمای غیر حرارتی (سرد) یکی از فناوری های مدرن می‌باشد که می تواند به اصلاح مواد غذایی (بذر، خشکبار، گیاهان دارویی‌و....) بدون تخریب حرارتی و بدون تغییر مورفولوژی ذاتی مواد، بپردازد .

در چنین فناوری‌ای از هیچگونه مواد شیمیایی سمی یا آلوده‌کننده استفاده نمی‌شود و در حقیقت یک فناوری سبز (انرژی پاک) برای محیط‌زیست است.در این تحقیق ،با استفاده از فناوری پلاسما می‌خواهیم به کاهش بار میکروبی بذر برنج بپردازیم و دز موثر پلاسما را در رفع آلودگی شناسایی نماییم.

امروزه کاهش محصول برنج توسط آفات و بیماری‌ها به گونه‌ای جدی‌تر مورد توجه قرار گرفته است.بیمارگرها موجب ایجاد خسارت در مراحل مختلف از قبیل انبارداری، جوانه‌زنی بذر،استقرار گیاهچه در خاک، رشد رویشی و زایشی گیاه می‌شوند.

که در اینجا ما توسط پلاسمای غیر حرارتی تلاش بر بهبود کیفیت برنج می‌نماییم.

کلیدواژه: پلاسمای غیرحرارتی ، برنج، قارچ های بذرزاد، بیمارگرها ، جوانه‌زنی

بررسی تغییر ضخامت لایه های انتقال دهنده حفره روی عملکرد سلول های خورشیدی پروسکایت CH3NH3PbI3

عطیه جمالی شادهی ، *حمید رحیم پورسلیمانی*

آزمایشگاه نانوفیزیک محاسباتی، گروه فیزیک

دانشکده علوم پایه، دانشگاه گیلان

چکیده:

در این مقاله با روش تفاضل زمانی محدود اثر تغییر ضخامت لایه ی انتقال دهنده ی حفره (Spiro-OMeTAD) بررسی شده است. یک سلول خورشیدی پروسکایت (CH3NH3PbI3) با ضخامت مشخص و بدون لایه انتقال دهنده حفره در نظرگرفته شده است. سپس، با افزایش تدریجی ضخامت لایه انتقال دهنده حفره تغییرات نرخ تولید حاملین و چگالی جریان مدار اتصال کوتاه و منحنی های جذب و عبور بازتاب مورد بررسی قرار گرفته شده است. این نتایج پیشبینی میکنند که با افزایش ضخامت لایه انتقال دهنده حفره بازده سیستم افزایش خواهد یافت .

کلید واژه:

سلول خورشیدی پروسکایت(CH3NH3PbI3) ، تفاضل زمانی محدود، لایه انتقال دهنده حفره(Spiro-OMeTAD) ، نرخ تولید حاملین ، چگالی جریان اتصال کوتاه

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مشخصه یابی اثربخشی بیولوژیکی نسبی (RBE) در پرتودرمانی: مقایسه ای بر پرتو های بالینی ،اشعه ایکس ۶ مگاولت ، IORT و الکترون

سیده فرانک حجازی تکلیمی[۱]، سمیه غلامی[۲] ، عباس قاسمی زاد[۱] ، بهرام گلیایی [۳]

[۱]گروه فیزیک، دانشکده علوم پایه، دانشگاه گیلان
[۲]گروه رادیوتراپی، دانشکده پزشکی، دانشگاه علوم پزشکی تهران
[۳]گروه بیوفیزیک، مرکزتحقیقات بیوشیمی و بیوفیزیک، دانشگاه تهران

چکیده:

پرتودرمانی حین عمل جراحی (IORT) با اشعه ایکس کم انرژی برای درمان بستر تومور در حین عمل جراحی محافظت از پستان استفاده می شود. انواع مختلفی از پرتوها برای درمان سرطان پستان استفاده می شود. از طرف دیگر ، دوزهای فیزیکی مساوی پرتوهای مختلف همیشه اثر بیولوژیکی یکسانی ندارند.کمیت اثر بیولوژیکی نسبی (RBE) را می توان برای بیان این اختلافات استفاده کرد .

RBE برای غیرفعال کردن کولنی زایی تومور انسانی (MDA-MB-231) در ۴ دوز به ترتیب: دوز صفر ، ۲ گری ، ۴ گری و ۶ گری تعیین شد .از پرتوهای ایکس ۵۰ کیلو ولت دستگاه intrabeam (Carl Zeiss Surgical) با اپلیکاتور کروی ۵ سانتی متری و دستگاه الکترون استفاده شد.

مقادیر میانگین RBE برای اشعه ایکس 50-KV دستگاه IORT نسبت به اشعه ۶ مگاولت به عنوان تابش مرجع از حدود ۱.۱ (برای دوزهای ۲ گری) تا ۰.۴ (برای دوزهای ۶ گری) برای سلولهای MDA-MB-231 برای دوزهای یکسان متغیر است. RBE اشعه ایکس ۵۰ کیلوولت IORT و الکترون نسبت به پرتوهای ۶ مگا ولت در حال افزایش است.یافته های این مطالعه نشان می دهد که IORT می تواند نسبت به پرتوهای الکترون و فوتون ۶ مگاولت برای ایجاد آسیب در DNA سلولهای سرطانی مؤثرتر باشد.

کلید واژه:RBE، سرطان پستان، پرتو درمانی، فوتون ۶ مگاولت، IORT

مطالعه کارایی پلاسمای سرد در کنترل بیماری پوسیدگی فوزاریومی طوقه برنج در شرایط آزمایشگاهی

فرح زاد تبسمی، ساعد جعفری

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

با توجه به رشد جمعیت جهان، بیشتر کشورها در تلاشند تا در زمینه تولید محصولات کشاورزی، به‌ویژه محصولات استراتژیک(غلات و دانه‌های روغنی) کمترین وابستگی را به محصولات سایر کشورها داشته باشند تا امنیت غذایی جوامع خود را افزایش دهند. در ایران پس از گندم، برنج بیشترین نقش در تغذیه مردم را دارد.دستیابی به سطح بالای تولید محصولات استراتژیک، مزیت‌های اقتصادی فراوانی را نیز به همراه دارد. بنابراین، دانشمندان تمامی امکانات و فناوری‌های موجود و جدید را به کارگرفته‌اند تا روز به روز سهم خود را در تولید محصولات کشاورزی افزایش داده و خود را بی‌نیاز از واردات محصولات غذایی کنند. در همین زمینه، فناوری جدیدی با عنوان پلاسما مورد توجه قرار گرفته است .پلاسمای سرد به عنوان تکنیکی نوین می تواند در عرصه های مختلفی از صنایع غذایی و کشاورزی با ارائه راهکارهای مناسب و کارآمد گامی مؤثر در جهت ارتقاء اهداف این صنایع بردارد.از ویژگی های پلاسمای سرد می توان به موارد زیر اشاره نمود:اصلاح سطح مواد (بذر، خشکبار و گیاهان دارویی) بدون تخریب حرارتی و بدون تغییر مورفولوژی ذاتی مواد،میزان اثرگذاری بالا و طولانی مدت،سادگی در به کارگیری فرآیند، فرآیندی خشک و بدون استفاده از مواد شیمیایی سمی و یا آلوده کننده، صرفه جویی در مصرف آب و انرژی،امکان تیمار سطوح در فشار کم یا فشار محیط (اتمسفری)،دارای استاندارد زیست محیطی بسیار بالاوکاهش تولید گازهای گلخانه ای، صرفه جویی در زمان، کاهش هزینه های مواد و انرژی.اکنون در این تحقیق میخواهیم با استفاده از فناوری پلاسما به بررسی باکانه برنج که یکی از مهم ترین بیماری های بذر زاد برنج می باشد که با وجود گسترش جهانی قدرت همه گیری و میزان خسارت کمی داردبپردازیم اما آلودگی بذر ها به گونه های فوزاریوم عامل بیماری به خاطر زهرا به های قارچی ای که تولید می کنند می توانند برای سلامت انسان ودام خطر ناک باشند. .این بیماری یکی از قدیمی ترین بیماری های برنج در کشورهای برنج خیز دنیا خصوصا کشورهای شرقی می باشد. مطالعات نشان می دهد این بیماری در سطح وسیعی از نواحی برنج خیز دنیا انتشار داشته و میزان خسارت آن در منطقه ای از ژاپن به ۲۰٪ و در هند به ۱۵٪ می باشد.و در ایران برای اولین بار در سال ۱۳۴۳ توسط ابراهیم نسب از اطراف فومن گزارش شده است

کلیدواژه: :پلاسما ،باکانه برنج ،طوقه برنج، فوزاریوم ، زهرابه های قارچی

اصلاح سطوح مختلف با پلاسما و بررسی آب‌دوستی و چسبندگی آن‌ها

فرشته رجبی، ساعد جعفری

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

از دیرباز اصلاح سطح مواد مختلف به منظور بهبود و تغییر ویژگی‌ها و خواص سطحی آن‌ها اعم از آب‌دوستی، آب‌گریزی، چسبندگی، رنگ‌پذیری و... مورد توجه بوده است. در روش‌های مختلف اصلاح سطح مواد مختلف، همواره تغییر خواص سطحی مواد بدون تغییر در خواص اساسی آن‌ها مورد توجه بوده که برای حل مشکلات طراحی و ساخت بسیار راه‌گشاست. اصلاح سطح عملی است که برای ایجاد مشخصه‌های فیزیکی، شیمیایی و بیولوژیکی مختلف روی سطح مواد صورت می‌گیرد که عموما در مواد جامد به منظور ایجاد تغییر در زبری سطح، قابلیت آب‌دوستی و آب‌گریزی، چسبندگی و اتصال به سطح، پاک‌کنندگی سطحی، خودتمیزشوندگی، زیست‌سازگاری و واکنش‌پذیری انجام می‌گیرد. اصلاح سطح پلیمرها منجر به کاربرد بیشتر مواد پلیمر مصنوعی در زمینه‌های گوناگون شده است. روش‌های شیمیایی برای اصلاح سطح مواد، عموما با مصرف آب فراوان همراه بوده و ناسازگار با محیط زیست هستند، ازاین رو امروزه اصلاح سطح مواد با استفاده از عمل‌آوری پلاسما مورد توجه قرار گرفته است که برخلاف روش‌های شیمیایی روشی خشک، مقرون به صرفه و نیز دارای پایداری بیشتر برای تغییر در سطح پلیمرها در ابعاد میکروسکوپی می‌باشد. ازاین روش می‌توان در صنایع نساجی، پزشکی، الکترونیک، نظامی و... بهره گرفت.

دستیابی به بهترین عملکرد در زمینه اصلاح سطوح توسط عمل‌آوری پلاسمایی به پارامترهای مختلفی وابسته است که یکی از مهم‌ترین آن‌ها ماهیت گاز مورد استفاده است که به طور مستقیم برروی خواص پلاسما اثرگذار است. به عنوان مثال برای آب‌دوست کردن سطح از گازهای اکسیژن‌دار و برای آب‌گریزی یا چربی‌گریزی سطح از گازهای غیرآلی فلوئوردار استفاده می‌شود.

برای ارزیابی مقدار تاثیرگذاری اصلاح سطح روی ماده مورد نظر از روش‌های مختلفی ازقبیل طیف‌شناسی فوتوالکترونی پرتوایکس، میکروسکوپ نیروی اتمی، میکروسکوپ الکترونی روبشی، اندازه گیری زاویه تماس و ... استفاده می‌شود.

کلیدواژه: اصلاح سطح، عمل‌آوری پلاسما، سطوح پلیمری

تاثیر مدوله‌سازی فرکانس بر دینامیک درهم‌تنیدگی اتم-فوتون در یک محیط اتلافی

فرناز کارپرور، علی مرتضی پور

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده

در سال‌های اخیر محدودیت‌های الگوریتم‌های محاسباتی کلاسیک، محرکی برای توسعه محاسبات کوانتومی می‌باشد. در سال‌های اخیر محاسبات کوانتومی توجه زیادی از دانشمندان را به خود جلب کرده است. زیرا پتانسیل خوبی در زمینه پردازش، به طور ویژه به دلیل سرعت پردازش بسیار بالا، از خود نشان داده است. درهمتنیدگی کوانتومی به یک منبع بسیار مهم برای محاسبات کوانتومی، پردازش اطلاعات و ارتباطات کوانتومی [۱] تبدیل شده است. درهم‌تنیدگی کوانتومی همچنین نقش مهمی را در فرابرد کوانتومی [۲و۳]، کدگذاری [۴] و واهمدوسی در کامپیوترهای کوانتومی [۵] دارد. آنتروپی فن نویمان به این دلیل که شامل همه مولفه‌های عملگر ماتریس چگالی است به عنوان یک معیار بسیار مفید برای سنجش درهم‌تنیدگی بین اعضای یک سیستم خالص مورد استفاده قرار می‌گیرد. در این پژوهش سیستم کوانتومی مورد نظر یک اتم دو ترازی ست که فرکانس گذار آن توسط یک عامل خارجی مدوله می‌شود. اتم مورد نظر در داخل یک کاواک کوانتومی نشت کننده قرار گرفته است. درنتیجه این اتم با مدهای خلا کاواک برهم‌کنش می‌نماید. با مطالعه آنتروپی کاهش یافته اتمی نشان خواهیم داد که پارامترهای مدوله‌سازی فرکانس از قبیل فرکانس و دامنه مدوله‌سازی تاثیر قابل توجه‌ای در دینامیک درهم‌تنیدگی اتم و فوتون ساطع شده از آن خواهد داشت.

کلید واژه: درهم‌تنیدگی، آنتروپی، اتم دوترازی

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برهمکنش پالس لیزر و پلاسما و تولید اشعه تراهرتز

ساعد جعفری – زینب قایم منیری

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

تابش تراهرتز محدوده طیف الکترومغناطیسی است که بین نواحی مادون قرمز و مایکروویو قرار دارد بنابراین خواصی از هر دو ناحیه را شامل میشود. فن آوری تراهرتز در کاربرد های بسیار وسیعی نظیر :فن آوری اطلاعات وارتباطات،رویداد های غیر مخرّب،امنیت داخلی،کنترل کیفیت محصولات غذایی و کشاورزی،مونیتورینگ محیطی،تصویربرداری بافت های بیولوژیکی ومخصوصا طیف سنجی حوزه زمانی استفاده دارد. پالس لیزر در برهمکنش با محیط گازی ،این محیط را یونیده می کند. به دلیل اینکه پالس لیزر دارای ماندگاری پایین در حد فمتوثانیه است ،میزان یونیده شدن مولکول های محیط گازی به اندازه ای است که محیطی پلاسمایی تولید میشود. برهمکنش پالس لیزر با پلاسما براساس چگالی پلاسما به دو ناحیه کم چگال و پرچگال تقسیم بندی میشود.اگر چگالی الکترون های پلاسمایی کمتر از چگالی بحرانی محیط باشد،پالس لیزر توانایی نفوذ و جفت شدگی غیر خطی با پلاسما را دارامی شود.در شدت های لیزری بالا و دوره های کوتاه برهمکنش پالس لیزر علاوه بر اثرات غیر خطی ،دارای اثرات نسبیتی نیز می باشدکه دلیل اصلی پدیده های غیر خطی به نیروهای پاندرموتیو (اثرگذار)برمیگردد.این نیرو بر ذرات باردار پلاسما اثر میکند وسبب تغییر چگالی پلاسما میشود.

تابش تراهرتز میتواند با مکانیسم هایی نظیر:تابش سیکلوترونی،تابش گزار،لیزر الکترون آزاد و ... تولید شود.در این روش ها تابش تراهرتز بوسیله ی شتاب دادن پرتوهای الکترونی حاصل می شود.اما در روش تولید تراهرتز با استفاده از برهمکنش پالس لیزر با محیط پلاسمایی،می توان شدت لیزر را به هر میزان بالا برد وتراهرتز قوی تری تولید کرد،بدون اینکه ماده آسیب ببیند.

کلیدواژه: اشعه تراهرتز، پالس لیزر و پلاسما ،جفت شدگی غیر خطی، نیروی پاندرموتیو

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مروری بر بررسی خصوصیات فیزیکی فیلم‌های چگالیده شده اکسید وانادیوم تهیه‌شده با استفاده از روش اسپری پایرولیز

کیانوش کوبنی چناری، سید محمد روضاتی، فاطمه مقیمی

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک
Corresponding author E-mail: kianoshkobani1995@gmail.com

چکیده

فیلم‌های نازک اکسیدوانادیوم درساخت بسیاری از دستگاه‌های فیلم نازک حالت جامد استفاده می‌شود، مانند باتری‌های لیتیم با ظرفیت بالا[۱]سیستم‌های نمایشگر[۲]، فیلترهای رنگی[۱-۲]،کاتالیزورها[۱-۳]،پنجره‌های هوشمند وحسگر گاز[۱-۴].در ساخت فیلم‌های نازک پارامترهای رسوب نقش مهمی در خصوصیات میکروسکوپی وماکروسکوپی دارند. بنابراین، انتخاب پارامترهای رسوب مناسب برای تهیه فیلم های اکسید وانادیوم برای موارد کاربردی بسیار مهم است[۱-۴].

در این مقاله، فیلم‌های نازک اکسید وانادیوم با استفاده از روش اسپری پایرولیز روی زیرلایه شیشه‌ای لایه‌نشانی شدند[۱].ابتدا، مقدار مشخصی از وانادیوم کلراید در آب‌مقطر حل شد تا محلول اولیه تهیه شود.درتمامی نمونه‌ها فاصله‌ی نازل تا زیر لایه ۳۵ سانتیمتر بوده و از هوای فشرده تمیز با فشار ۳ پاسکال به عنوان گاز حامل استفاده شد.در مرحله‌ی اول،نمونه‌ها در دمای زیرلایه مختلف(T_{sub}) ۳۰۰، ۴۰۰، ۴۵۰ و ۵۰۰ درجه سانتی‌گراد با غلظت محلول وسرعت اسپری محلول ثابت به ترتیب ۰/۱ mol/L و ۱۰ mL/min تهیه شدند.خصوصیات نمونه‌ها با استفاده از آنالیزهای پراش پرتوایکس (XRD) ،میکروسکوپ الکترونی روبشی (SEM) و روش‌های طیف‌سنجی (UV-Visible) انجام شد. الگوهای XRD نشان‌داد که فیلم‌های تهیه شده دارای ساختار پلی‌کریستالی هستند و عمدتا متشکل از فازهای تتراگونال b-V_2O_5 و O_9V_4 باجهت‌گیری ترجیحی در راستای ۲۰۰هستند. آنالیز اثر هال همچنین نشان از نیمرسانای نوع n نمونه ها بجز نمونه‌های تهیه شده در دمای ۳۰۰ و ۴۰۰ درجه سانتیگراد، غلظت محلول ۰/۱ مول بر لیتر و آهنگ شارش ۱۰ میلی لیتر بر دقیقه دارد [۱].

کلیدواژه: وانادیوم‌اکسید، اسپری پایرولیز، فیلم نازک

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تهیه و بررسی خواص فیزیکی نانوساختارهای بر پایه اکسید کبالت تهیه شده به روش سل-ژل

ماجده مهین زاد، جمال مظلوم، فرهاد اسمعیلی قدسی

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

چکیده: نیمرساناها در بسیاری از ادوات پیشرفته از جمله حسگرها، سلول‌های خورشیدی، پنجره‌های هوشمند و فوتوکاتالیست‌ها مورد توجه بوده و تحقیقات گسترده‌ای در زمینه ساخت و مشخصه‌یابی نیمرساناها با هدف بهینه سازی ویژگی‌های ساختاری، الکتریکی، نوری و الکتروشیمیایی آن‌ها انجام می‌شود. در سال‌های اخیر، نانوفیبرهای نیمرسانا با کاربردهای وسیع و ویژگی‌های شیمیایی و فیزیکی مطلوب به دلیل تخلخل و مساحت سطح بالا مورد توجه قرار گرفته‌اند. در پژوهش حاضر، نانوفیبرهای کبالتیت منیزیم ($MgCo_2O_4$) با استفاده از تکنیک الکتروریسی سل-ژل تهیه گردید. مشخصه‌یابی نانوفیبرهای سنتز شده از قبیل پارامترهای ساختاری، ریخت‌شناسی، ترکیب شیمیایی و خواص اپتیکی با استفاده از الگوی پراش اشعه ایکس (XRD)، میکروسکوپ الکترونی روبشی گسیل میدانی (FESEM)، پاشندگی انرژی اشعه ایکس (EDS)، طیف‌سنجی تبدیل فوریه مادون قرمز (FTIR) و طیف‌سنجی بازتاب پخشی (DRS) مورد مطالعه قرار گرفت. مطالعات پارامترهای میکروساختاری نانوفیبرهای تهیه شده به روش ویلیامسون-هال انجام شد. نتایج حاصل از XRD نشان می‌دهد که اندازه بلورک نمونه‌های تهیه شده و شدت قله‌های پراش با افزایش دمای کلسینه، افزایش می‌یابد. نتایج تصاویر FESEM بیانگر آن است که کلسینه شدن نمونه‌ها موجب کاهش قطر نانوفیبرها می‌شود. مطالعات اپتیکی کاهش مقدار گاف نواری را با افزایش دمای کلسینه نشان می‌دهد. طیف‌های EDS حضور عناصر Mg، Co و O را تایید می‌کنند.

کلید واژه: نانوفیبرهای کبالتیت منیزیم، سل-ژل، ویژگی‌های ساختاری، گاف نواری.

طراحی و ساخت دستگاه لایه نشانی به روش الکتروترموفورز

مجید صفری سخاوت، فرهاد اسمعیلی قدسی

آزمایشگاه لایه نشانی سل-ژل، گروه فیزیک، دانشکده علوم پایه

پوشش دهی الکتروترموفورز تکنیکی شامل استفاده همزمان از دو روش الکتروفورز و ترموفورز می باشد که برای نهشت پوشش های نانومتری در فازهای محلول روی بسترهای رسانا استفاده می شود. بدین منظور دستگاهی طراحی و ساخته شد که قادر است با تکنیک الکتروفورز، ترموفورز و نیز تکنیک ترکیبی الکتروترموفورز (که تواماً از دو روش ذکر شده استفاده می کند) عمل نهشت را انجام دهد. تکنیک الکتروفورز اشاره به حرکت ترکیبات یا ذرات باردار در یک سل حاوی نانو ذرات تحت تاثیر جریان الکتریکی دارد. ترکیبات شیمیایی دارای بار الکتریکی با توجه به نوع بار الکتریکی به سمت قطب آند و یا کاتد حرکت می نمایند. همینطور قادر به انجام رسوب دهی الکتروشیمیایی از طریق یک جریان الکتریکی است که لایه ای اصولاً فلزی بر روی سطح نشانده می شود. که نهشت یک لایه ی فلزی روی یک جسم، با برقراری بار منفی روی بستر (کاتد) و فرو بردن در محلولی که شامل یک نمک فلز مورد نظر است، انجام می گیرد. اگرچه معمولاً برای نهشت از جریان مستقیم استفاده می شود اما جریان پالسی نیز به عنوان یک جایگزین مناسب مطرح است. با تکنیک الکتروفورز قادر خواهیم بود بر روی بستر های رسانا (مانند ITO) پوشش هایی در مقیاس نانومتر ایجاد کنیم. همینطور روش ترموفورز که بر اساس یک گرادیان دمایی بین دو الکترود، ذرات مختلف واکنش های متفاوتی نسبت به گرادیان دما نشان می دهند و می توانیم بر روی انواع بسترها نهشت انجام دهیم.

از ویژگی های دستگاه طراحی شده میتوان به دو مد کاری جریان مستقیم و جریان پالسی با تولید پالس های سینوسی، مثلثی و مربعی با فرکانس های بین ۰ تا ۴۰۰ کیلوهرتز و ایجاد گرادیان دمایی از ۱ تا ۱۲۰ درجه سلسیوس اشاره کرد. همینطور می توان قطعات الکتروکرومیکی تولید شده توسط دستگاه را برای مقایسه پایداری آن در چرخه های الکتروشیمیایی تا هزاران بار تست نمود.

مبادله درهم‌تنیدگی بین دو اتم سه‌ترازی آبشاری

محبوبه حسینی نژاد[1] و علی مرتضی پور[1] و علیرضا نورمندی پور[2]

[1] دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

[2] دانشگاه صنعتی سیرجان، دانشکده علوم ، گروه فیزیک

Corresponding author E-mail: mahboubehnezhad69@gmail.com

چکیده

در دهه‌های اخیر مفهوم درهم‌تنیدگی کوانتومی توجه بسیار زیادی را به خود جلب نموده است. اصل برهم‌نهی یکی از اساسی‌ترین ویژگی‌های مکانیک کوانتومی است. هنگامی که اصل فوق برای سیستم‌های مرکب اعمال شود، می‌تواند منجر به مفهوم درهم‌تنیدگی شود. درهم‌تنیدگی به عنوان مهم‌ترین منبع در ارتباطات و اطلاعات کوانتومی شناخته می‌شود. امروزه هم به لحاظ نظری و هم به لحاظ تجربی امکان تبادل درهم‌تنیدگی بین زیرسامانه‌های کوانتومی به وجودآمده است، این عمل به‌عنوان مبادله درهم‌تنیدگی[۱و۲] شناخته می‌شود. در این تحقیق دو اتم سه‌ترازی[۳] آبشاری یکسان را در یک محیط اتلافی در نظرمی‌گیریم که هرکدام با یک میدان لیزری جفت کننده همدوس برهم‌کنش می‌کنند. علاوه براین، هرسامانه دستخوش یک گسیل خودبه‌خود از تراز بالاتر به تراز پایه می‌شود که این می‌تواند منجر به درهم‌تنیده شدن آن اتم با گسیل خودبه‌خود مذبور شود. نشان می‌دهیم که با اندازه‌گیری‌ای موسوم به اندازه‌گیری حالت بل روی فوتون‌های ساطع شده از اتم‌ها، می‌توان این دو اتم مستقل را درهم‌تنیده نمود. به عبارت دیگر با اندازه‌گیری حالت بل درهم‌تنیدگی بین هر اتم با گسیل خودبه‌خودش را به درهم‌تنیدگی اتم-اتم تبدیل می‌کنیم که به این کار مبادله درهم‌تنیدگی می‌گویند.

کلید واژه: درهمتنیدگی، مبادله درهمتنیدگی، اتم‌های سه ترازی

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مقایسه عملکرد سلول خورشیدی آلی ناهمگون حجمی بر پایه P3HT:PC_60 BM، MEH-PPV:PC_60 BM و PCPDTBT:PC_70 BM

محمد زارعی ؛حمید رحیم پور سلیمانی

آزمایشگاه نانوفیزیک محاسباتی، گروه فیزیک

دانشکده علوم پایه، دانشگاه گیلان

چکیده:

در این مقاله با استفاده از تفاضل محدود حوزه زمان عملکرد سلول خورشیدی آلی ناهمگون حجمی بر پایه P3HT:PCBM، MEH-PPV:PCBM و PCPDTBT:PCBM بررسی شده است. میزان جذب نور و نرخ تولید حاملین و چگالی جریان اتصال کوتاه در هر کدام از لایه ها تعیین شده و سپس اطلاعات مربوط به جذب ، بازتاب و عبور هر کدام از ساختار ها را مورد بررسی قرار گرفته است.نتایج این شبیه سازی،پیش بینی می کند که برای لایه فعال با ضخامت200 nm،سلول خورشیدی آلی بر پایه PCPDTBT:PCBM عملکرد بهتری نسبت به دو لایه فعال دیگر دارد.

کلید واژه: سلول خورشیدی آلی، نرخ تولید حاملین، چگالی جریان اتصال کوتاه، P3HT:PC_60 BM، MEH-PPV:PC_60 BM، PCPDTBT:PC_70 BM.

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آنتروپی درهم‌تنیدگی و بسط جرمی

صحرایی،محمد؛ دکتر بابایی؛ دکتر محمدی مظفر

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

چکیده:

در مجموعه کارهای بکنشتاین و هاوکینگ نشان داده شده است که آنتروپی سیاه چاله متناسب با مساحت افق است[۱]. در [۲]، سردنیکی با استفاده از محاسبات عددی برای یک نظریه میدان اسکالر بدون جرم حقیقی آزاد در حالت پایه با در نظر گرفتن زیرسامانه‌ای از درجات آزادی درونی یک کره فرضی، نشان می‌دهد آنتروپی درهم‌تنیدگی متناسب با توان دوم شعاع کره است. از آنجایی که آنتروپی کمیتی فزونور است این نتیجه کاملا غیرمنتظره بود. اما می‌توان آن را بازتابی از موضعیت نظریه میدان مورد استفاده دانست. از آنجایی که در حالت پایه آنتروپی گرمایی صفر است موضعیت نظریه میدان ایجاب میکند که آنتروپی هر دو زیر سامانه متناسب با فصل مشترک دو زیرسامانه باشد. در[۳] محاسبات سردنیکی به نظریه میدان االسکالر جرم‌دار حقیقی آزاد تعمیم داده شده و نشان داده می‌شود که می‌توان از عکس جرم میدان به عنوان پارامتر بسط اختلالی برای محاسبه آنتروپی استفاده نمود. با انجام محاسبات برای یک کره درهم‌تنیده با شعاع R در حالت پایه و بسط تا مرتبه سوم، مشاهده می‌شود که آنتروپی محاسبه شده شامل یک جمله اصلی متناسب با سطح یک جمله ثابت و جملاتی از مرتبه $O(1/R)^2$ می باشد.

کلیدواژه: آنتروپی درهم‌تنیدگی، قانون سطح، بسط جرمی

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مروری بر بررسی فیلم‌های نازک اکسید وانادیوم والایش آن با فلوئور به روش اسپری پایرولیز

محمد. ملائی , سید. محمد. روضاتی , فاطمه. مقیمی
گروه فیزیک،دانشگاه گیلان

وانادیوم ترکیبات زیادی با اکسیژن مانند وانادیوم مونوکسید, وانادیوم دی‌اکسید وپنتوکسیدوانادیوم به دلیل شرایط اکسیداسیون مختلف وانادیوم ایجاد می‌کند و بسته به ساختار آن‌ها خصوصیات خاصی از خود نشان می‌دهند[2-1]. در دمای بحرانی از نظر ساختاری، کریستالوگرافی لایه ها نشان می‌دهد که اکسید وانادیوم همراه با انتقال نیمه‌هادی به فلز قابل برگشت است که خصوصیات نوری و الکتریکی آن را تغییر می‌دهد. دربین ترکیبات احتمالی اکسیدهای وانادیوم فازپایدار پنتوکسیدوانادیوم دارای شکاف باند نوری گسترده, پایداری شیمیایی و حرارتی خوب است و خواص حرارتی عالی آن ، پنتوکسید وانادیوم را به عنوان کاندیدای مناسبی برای یافتن کاربردهایی در نمایشگرهای الکتروکرومیک، سنجش گاز و دستگاه‌های الکترونیکی تبدیل می‌کند. برای بررسی تاثیرمیزان آلایش برروی خصوصیات ساختاری الکتریکی و نوری در ساختارهای مختلف اکسید وانادیوم ، می‌توان مقدار مناسبی از ماده فلوئور به پیش ماده اضافه کرد[5-2]. فیلم‌های نازک اکسید وانادیوم و فلوئور دوپ شده بر روی زیرلایه های شیشه ای میکرو اسلاید دردمای 400 °C باروش اسپری پایرولیز تهیه شدند.فیلم های اکسید وانادیوم با استفاده از محلول آبی آمونیوم متاونادات ۰/۱ میلی آمونیوم رسوب شدند. محلول تهیه شده مورد استفاده برای رسوب فیلم‌های اکسید دوپ فلوئورین با اضافه کردن جداگانه وزنی 0/1وزنی, ۰/۱۵ وزنی و ۰/۲۰ از فلوئورید آمونیوم با محلول آبی ۰/۱ مولار آمونیوم متاونادات تهیه شد.

نتایج پراش اشعه ایکس نشان داد که فیلم‌ها در مراحل مختلف V_2O_5-β و V_2O_5 و V_3O_7 قرار دارد. مورفولوژی سطح و شکاف باند این فیلم ها به دلیل سطوح مختلف دوپینگ فلوئور میتواند اصلاح شود. میانگین انتقال قابل مشاهده [500-800nm] از فیلم‌های اکسید وانادیوم به دلیل غلظت کم دوپینگ فلوئور کاهش یافته است[1].

کلید واژه : اکسید وانادیوم, فلوئور, اسپری پایرولیززز, دوپینگ

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تزریق باریکه در یک شتابدهنده سینکروترونی

مهدوی، محمدرضا ؛ طاهرپرور، پیوند

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

چکیده:

توسعه ساخت شتابدهنده ها از شتابدهنده های خطی آغاز گشت و در ادامه به منظور کاهش هزینه به واسطه افزایش طول در شتابدهنده‌های خطی برای دستیابی به انرژی های بالاتر، شتابدهنده‌های دایره ای مانند سیکلوترون، سینکروترون و غیره مورد توجه قرار گرفت. شتابدهنده های دایره ای با توجه به نوع ذره شتاب یافته و بیشینه انرژی، به انواع متفاوتی مانند چشمه های نور سینکروترونی و یا برخورددهنده های هادرونی بزرگ تقسیم می‌گردند، که مورد اول، کاربردهای گسترده ای در زمینه های متفاوت علم شامل؛ پزشکی، علم مواد، فیزیک، و غیره یافته و مورد دوم به تولید ذرات زیر اتمی و مطالعات مربوط به فیزیک ذرات بنیادی اختصاص یافته است. در این شتابدهنده ها، برای محدود کردن ذرات در یک مسیر دایره‌ای، از میدان های مغناطیسی تولید شده توسط مگنت ها (آهنرباها) و برای شتابدهی از میدان های الکتریکی استفاده می‌شود. اجزای اصلی یک شتابدهنده دایره‌ای عبارتند از چشمه الکترون/یون، میدان الکتریکی، میدان مغناطیسی، سیستم های کانونی/ واکانونی کننده، ناحیه رانش و در برخی موارد یک پیش-شتابدهنده به منظور ورود باریکه الکترون/یونی به حلقه اصلی شتابدهنده از تکنیک های خاصی استفاده می‌شود که تحت عنوان تزریق (Injection) باریکه شناخته می‌شوند. تزریق عبارت است از؛ فرآیند انتقال باریکه ذرات به حلقه شتاب دهنده دایره ای یا حلقه انباشت، به منظور حداقل شدن تضعیف پرتو و قرار دادن ذرات تزریق شده بر روی مسیر صحیح. این فرایند به کمک ترکیبی از آهنرباهای سپتوم و یا کیکر انجام می‌گردد. سپتوم ها به کمک یک میدان ایده آل یکنواخت، سبب افزایش میدان به همراه جدایی دو ناحیه به منظور تزریق باریکه می‌شوند. در مواردی بامیدان‌های قوی‌تر از آهنربای کیکر استفاده می‌شود، در واقع آهنربای کیکر زمان جداسازی پرتو را برای تزریق / استخراج فراهم می‌کنند. در این مقاله با معرفی و شبیه سازی شتابدهنده APS(Advanced Photon Source) به کمک کد ELEGANT به معرفی روش تزریق باریکه در حالت روی-محور پرداخته شده است و نتایج دینامیک باریکه در حالت بدون تزریق و با تزریق مورد ارزیابی قرار گرفته است.

کلیدواژه: شتابدهنده، APS، تزریق، ELEGANT

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محاسبه دز لوتشیم_۱۷۷ و رادیوم_۲۲۳ برای درمان متاستاز استخوان

مریم تجدد ،علیرضا صدرممتاز

گروه فیزیک – دانشکده علوم پایه - دانشگاه گیلان

چکیده:

در درمان سرطان با رادیو دارو، تعیین دز بافت های درگیر از جمله مراحل بسیار مهم و اساسی در پروتکل درمانی است .رادیوم و لوتشیوم از رادیوداروهای مهم و اساسی در درمان متاستاز استخوان ناشی از سرطان های سینه و پروستات است.هدف از این پژوهش مقایسه دز جذبی رادیوداروهای لوتشیم (بتازا) و رادیوم(آلفازا) در مغز استخوان و بافت نرم بافت های درگیر متاستاز استخوان است. با کمک برنامه MCNPX فانتومی برای مدل استخوان پا طراحی شد و مقادیر دز رادیوم و لوتشیوم محاسبه شد.نتایج نشان داد که رادیوداروی رادیوم که رادیونوکلئیدی آلفازا با برد کم در بافت است نسبت به رادیوداروی لوتشیم که بتازا است تاثیر بسیار ناچیزی بر مغز استخوان و بافت نرم باقی می گذارد و بالاترین دز جذبی را در استخوان قشری که محل چشمه است باقی می گذارد.اما رفتار این دو رادیودارو در تابش های گاما ،متفاوت است.رادیوم به دلیل مقادیر بالاتر انرژی گاما بیشترین دز جذبی در مغز استخوان و بافت نرم را ایجاد میکند.بر همین اساس رادیوم ۲۲۳ به دلیل اینکه حجم بسیار زیادی از دز را فقط در استخوان قشری باقی می گذارد گزینه مناسب تری نسبت به لوتشیم در درمان متاستاز استخوان ناشی از سرطان های پروستات و سینه است

کلیدواژه: MCNPX,bone metastases,lutetium 177,radium 223,Dose

نقش پلاسمای سرد غیر حرارتی در درمان زخم ها و بیماری های پوستی

منیژه رفیعی رودسری، ساعد جعفری

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

بیماری سرطان به دلیل تکثیر بیش از حد سلول ها به وجود می آید. در روش های درمانی معمول مثل جراحی، شیمی درمانی و رادیوتراپی علاوه بر سلول های سرطانی تعدادی از سلول های سالم نیز از بین می روند. با استفاده از پلاسمای سرد می توان سلول های سرطانی را از بین برد و یا اندازه ی تومور را کاهش داد بدون آنکه سلول های سالم مورد حمله قرار بگیرند. به این منظور از دستگاه جت پلاسما استفاده می شود که با تاباندن پلاسمای سرد به پوست سرطانی، بافت سرطانی از بین برده می شود. البته دستگاه جت پلاسما ممکن است سطح پوست را لمس کند و یا لمس نکند. همچنین پلاسمای سرد با غیر فعال کردن باکتری ها باعث کاهش عفونت زخم و بهبود مناسب آن می شود. همینطور باعث توقف خونریزی و استریلیزه شدن بافت می شود . از پلاسمای غیر حرارتی بسته به نوع بیماری می توان در مناطق مختلف استفاده کرد. از جمله بهبود زخم، بیماری های پوستی، بهداشت بیمارستان، عقیم سازی، درمان های ضد قارچ، مراقبت از دندان، آرایشی و بهداشتی، از بین بردن سلول و بافت سرطان. تعامل پلاسما جت با سلول ها و بافت های زنده بدن موجب می شود که در روند هایی نظیر استریلیزلسیون، درمان زخم، انعقاد خون و سفید کردن دندان ها کاربرد دارد پیدا می کند. یکی دیگر از پیشرفت های جالب اخیر تخریب پروتئین ها توسط جت های پلاسما تحت فشار جوی است و این برای پاک سازی ابزار های پزشکی کاربرد دارد.

کلیدواژه: سرطان، پلاسمای سرد، دستگاه جت پلاسما، سرطان پوست

بررسی حالت پایه و تاثیر کرنش بر مغناطش VSe_2 تک لایه

مهدی نجدی، میثم باقری تاجانی

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

دیکلکوژنیدهای فلزات واسطه، TMD، به دلیل داشتن خاصیت مغناطیسی و قطبیدگی وخاصیت فرومغناطیسی ذاتی موجود در آن ها بسیار مورد توجه قرار گرفته اند و به خاطر ویژگی های خاصی که دارند می توان از آن ها در نسل جدید ترانزیستور ها، منبع های هیدروژنی و دستگاه های اسپینترونیکی استفاده کرد. ما در این تحقیق خصوصیات مغناطیسی تک لایه ی VSe_2 را با استفاده ازنظریه ی تابعی چگالی(DFT) و از لحاظ ساختاری این ماده را در دوفاز Tو H بررسی می کنیم. بررسی ما نشان می دهد که فاز T یک فرومغناطیس و فاز H یک نیمه رسانای اسپینی است. نتایج برآمده ازمحاسبات نظری و تجربی دیگر نشان می دهد تک لایه VSe_2 فلز می باشد. از این رو ما در محاسبات جمله ی هابارد(U=1,2,3) را در نظر گرفته ایم .با بررسی چگالی حالت ها (DOS)نشان خواهیم داد که مغناطش این تک لایه بیشتر به اتم وانادیوم (V) وابسته است و اوربیتال d اثرگذاری بیشتری بر مغناطش تک لایه دارد. در ادامه ما به تاثیر کرنش (Strain) بر روی ماهیت مغناطیسی تک لایه خواهیم پرداخت و نشان می دهیم که کرنش باعث تغییراتی در مغناطش تک لایه VSe_2 شده و باعث افزایش مغناطش وانادیوم و کاهش مغناطش سلنیوم می شود.

کلیدواژه: تک لایه یVSe_2، مغناطش، چگالی حالت ها،پایداری

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بررسی خاصیت پیزوالکتریک روی تک لایه h-NbN

مهدیه قهرمانی زرج آباد، حمید رحیم پور، میثم باقری تاجانی

گروه فیزیک-دانشکده علوم-دانشگاه گیلان

چکیده:

در این مقاله با بهره گیری از نظریه تابعی چگالی(DFT)، ویژگی ساختار کپه ایی سنگ نمک NbN را بررسی کردیم. دو تک لایه از این ساختار در فاز های h-NbNو s-NbN در جهت های(۱۰۰)و (۱۱۱)و با اعداد همسایگی CN=3 و CN=4 در نظر گرفته و به بررسی خواص فیزیکی، اپتیکی، الکتریکی و... هریک پرداختیم. هم چنین نشان دادیم که، تک لایه h-NbN یک شبکه لانه زنبوری(Hexagonal) با هیبریداسیون نوع کمیاب sd^2-sp^2 و یک نیمه رسانا با خصوصیات پیزوالکتریک و فوتوکاتالیست در نانو مقیاس میباشد؛ گاف گسترده، در طیف فونونی این ساختار و هم چنین انرژی کم ناشی از اتصال اکسایتون، آن را برای استفاده در سلول های خورشیدی حامل گرما مناسب میکند. ساختارs-NbN هم یک فلز و یکی از باریک ترین ابر رساناهایی است که تاکنون شناخته شده است. اثر پیزوالکتریک مربوط به این واقعیت است که، یاخته واحد، مرکز وارونی نداشته باشد. بنابراین هیچ ساختاری با شبکه متقارن، نمیتواند خواص پیزوالکتریسیته از خود نشان دهد. هم چنین میدانیم؛ اعمال یک میدان الکتریکی یکنواخت، باعث ایجاد کرنش در ساختار میشود (و برعکس) بنابراین، با محاسبه کرنش اعمال شده به ساختار در میدان های الکتریکی متفاوت، میتوان ضریب پیزو الکتریک (dij) و متناظر با آن (eij) و سایر پارامترهای پیزوالکتریسیته را برای هر ساختار محاسبه کرد. در سال های اخیر مواد پیزوالکتریک کاربردهای فراوانی در دستگاه های برداشت انرژی، سنسورها، مبدل و محرک های الکتریکی و مکانیکی و ... داشتند و به طور عمده به صورت سرامیک، پلیمر و کامپوزیت های پیزوالکتریک یافت می شوند. در این مقاله؛ ثابت شبکه، گاف نواری، باکلینگ، انرژی چسبندگی، پارامترهای پیزوالکتریک و ... برای تک لایه h-NbN محاسبه و اثر برهمکنش اسپین مدار بر روی ترازهای انرژی بررسی گردید.

کلیدواژه: نظریه تابعی چگالی، مواد دو بعدی، پیزوالکتریک، پارامترهای پیزوالکتریسیته، میدان الکتریکی

مطالعه مروری بر خواص اپتیکی و ساختاری فیلم های نازک اکسید منیزیم تهیه شده با روش سل-ژل

بادروح، مهران ؛ اسمعیلی قدسی، فرهاد؛ محمودی چناری، حسین

گروه فیزیک دانشکده علوم پایه

چکیده

در این مقاله خواص اپتیکی و ساختاری فیلم‌های نازک اکسید منیزیم که با روش سل-ژل تهیه شده مورد مطالعه قرار گرفته است. اثر دمای باز پخت و همچنین تاثیر غلظت مولاریته روی خواص اپتیکی، ساختاری و مورفولوژی فیلم ها مورد بررسی قرار گرفته است. خواص اپتیکی فیلم‌ها به کمک طیف‌سنجی فوتولومینسانس (PL)، فروسرخ تبدیل فوریه (FTIR)، مریی- فرابنفش (UV-Visible) و همچنین مورفولوژی سطح فیلم‌ها با استفاده از میکروسکوپ الکترونی روبشی (SEM) و خواص ساختاری فیلم‌ها به کمک پراش پرتو X (XRD) مورد مطالعه قرار گرفته است. با افزایش دما، گاف نواری به میزان اندک کاهش می‌یابد. همچنین افزایش دما ضخامت فیلم‌ها را کاهش می‌دهد، ولی افزایش مولاریته از۰/۱ تا ۱ مولار ضخامت و زبری فیلم‌ها را افزایش داده است. نتایج آنالیز XRD نشان می‌دهد، فیلم نازک اکسید منیزیم بازپخت شده در دمای ۵۰۰ درجه سلسیوس ساختار آمورف دارند. پودرهای اکسید منیزیم ساختار مکعبی fcc دارند و با افزایش دما از ۵۰۰ به ۶۵۰ درجه سلسیوس، ساختار بلوری آنها بهبود می‌یابد. تصاویر SEM از فیلم‌ها نشان می‌دهد که با افزایش دما تخلخل کاهش می‌یابد اما با افزایش مولاریته محلول تخلخل فیلم‌ها افزایش داشته است. غلظت ۰/۴ مولار یک فیلم یکنواخت با ساختار بدون تخلخل و ذراتی با سایزnm ۴۳را نتیجه داده است که برای استفاده از اکسید منیزیم به عنوان لایه دی الکتریک مناسب‌تر است.

کلید واژه: سل-ژل ، فیلم نازک ، خواص فیزیکی ، MgO

حالت‌های پایدار سامانه دو کیوبیتی با بسامد مدول شده در حضور اتلاف

نگین زمانی[1] و علی مرتضی پور[1] و علیرضا نورمندی پور[2]

[1]دانشگاه گیلان ، دانشکده علوم پایه ، گروه فیزیک

[2]دانشگاه صنعتی سیرجان، دانشکده علوم ، گروه فیزیک

Corresponding author E-mail: Negin zamani93@gmail.com

چکیده

می‌دانیم که تمام سامانه‌های کوانتومی باز هستند. به این معنی که همه‌ی سامانه‌های کوانتومی ناچار به برهم‌کنش با محیط اطراف خود هستند. دراثر این برهم‌کنش این سامانه‌ها دچار واهمدوسی شده که این امر موجب از بین رفتن منابع کوانتومی از جمله درهم‌تنیدگی می‌شود [۱]. برای دست‌یابی به محاسبات کوانتومی موفق، باید حالت‌های درهم‌تنیده پایدار داشته باشیم. ازاین‌رو تلاش برای رسیدن به حالت‌های درهم‌تنیده پایدار یک امر بسیار ارزشمند می‌باشد. در سال‌های اخیر تلاش زیادی از سوی دانشمندان برای منکوب نمودن همدوسی و همچنین تحقق حالت‌های درهم‌تنیده پایدار انجام شده است [۱-۳]. از سوی دیگر مدوله‌سازی [۴] فرکانس یک روش بسیار جالب برای خلق اثر های غیر قابل انتظار در برهم‌کنش اتم-میدان شناخته می‌شود. در این پژوهش قصد داریم تا به طورنظری تاثیر مدوله‌سازی فرکانس را بر دینامیک دو کیوبیت یکسان در یک کاواک الکترودینامیک کوانتومی دارای طیف تابش لورنتسی، مورد بررسی قرار دهیم. نشان می‌دهیم که با تنظیم پارامترهای مدوله سازی از قبیل فرکانس و دامنه مدوله سازی می‌توانیم به وضعیت‌هایی در سامانه دست یابیم که درآن‌ها حالت‌های درهم‌تنیده اولیه باگذشت زمان دستخوش هیچ‌گونه تغییری نگردند. به عبارت دیگر به حالت‌های پایدار می‌رسیم.

کلیدواژه: حالت پایدار، درهم‌تنیدگی، مدوله‌سازی فرکانس، کیوبیت

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ارزیابی عملکرد فیلتر رِیج در پروتون درمانی

مهری، هانیه؛ طاهرپرور، پیوند

دانشگاه گیلان، دانشکده علوم پایه، گروه فیزیک

Corresponding author E-mail: haniyeh.mehri7@gmail.com

چکیده

پروتون درمانی یکی از روش‌های درمان انواع سرطان است و تقریبا برای درمان تمام انواع تومورهایی که به شکل سنتی با پرتو ایکس و الکترون درمان می‌شوند، استفاده شده است. از سودمندترین کاربردهای پروتون درمانی می‌توان به درمان تومورهایی اشاره کرد که در نزدیکی اندام حساس و بافت‌های سالم قرار دارند. پروتون‌ها، شبیه به تمامی ذرات باردار، باعبور از ماده، یک کاهش سریع انرژی در انتهای مسیرشان ثبت می‌کنند، که وابسته به انرژی پروتون‌ها، این تخلیه زیاد انرژی در عمق‌های متفاوت ماده روی می‌دهد. برای پرتوهای پروتونی تک انرژی، در ابتدا با افزایش عمق، مقدار دز به کندی افزایش می‌یابد، اما در انتهای برد این افزایش دز به صورت تیزتری ادامه می‌یابد. این افزایش تند در انتهای برد ذره، قله براگ نام دارد. قله براگ یک دسته باریکه پروتونی تک انرژی، برای پوشش کل حجم هدف، خیلی باریک است. به منظور ایجاد پوشش عمقی گسترده تر، می‌توان قله براگ، را با روی هم قرار دادن چندین پرتو با انرژی‌های متفاوت، پهن تر نموده و ناحیه ای با نام SOBP شکل داد. در عمل، یکی از روش‌های تولید ناحیه SOBP، استفاده از فیلترهایی با نام فیلتر ریج است. فیلتر ریج از مواد با عدد اتمی پایین مانند آلومینیوم ساخته می‌شود، که شامل دندانه‌های بسیار ریزی با ضخامت‌های مختلف هستند. این ضخامت ها از طریق عمق معادل آب محاسبه می‌شوند. در این تحقیق، با استفاده از کد شبیه سازی مونت‌کارلو GATE به شبیه‌سازی یک فیلتر ریج در مسیر عبور یک باریکه پروتونی پرداخته شده است. در ادامه و پس از گذر باریکه پروتونی از فیلتر ریج، باریکه به یک فانتوم آبی برخورد می‌نماید. به منظور ارزیابی اثرات ریج، از میزان نهشت انرژی در فانتوم آبی و دز عمقی استفاده شده است. در انتها، نتایج حاصل از تغییرات دز عمقی در یک فانتوم آبی با و بدون فیلتر ریج با یکدیگر مقایسه شده است.

کلید واژه: پروتون تراپی، فیلتر ریج، GATE

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جفت شدگی فضا زمانی پالس آتو ثانیه

هنگامه کیالاشکی ، *سعید باطبی*
دانشکده علوم پایه،گروه فیزیک،رشت،خیابان نامجو

کوتاهترین پالس کوتاه تولید شده تا به امروز از مرتبه ی چند ده آتوثانیه است که بصورت قطار پالس تولید و به نیم دوره ی لیزر واداشته تقسیم میشود که در حوزه ی فرکانس طیفی با مرتبه ی هارمونیک فرد را میدهد.بعبارتی میتوان گفت کوتاهترین پالس نوری تولید شده توسط HHG در گازها در ناحیه فرا بنفش/ x-rayنرم است که در دامنه ی صد آتوثانیه و با پهنای باند چند ده یا چند صد ev میباشد، پالس آتو ثانیه طی یک مدل سه مرحله ای تولید میشود و سهم دو مسیر کوتاه و بلند الکترون در این مدل در محاسبات ما نیز مورد توجه است ؛ در مدل سه مرحله ای داریم : هنگامیکه اتم در معرض نوردهی میدان لیزر شدید قرار میگیرد، الکترون در حالت پایه میتواند از سد پتانسیل اتم که توسط لیزر خمیده شده تونل زنی کند، در پیوستار انتشار یابد و به حالت پایه برگردد .در این مرحله فوتون XUV تولید میشود که دو مسیر اصلی وجود دارد که منجر به یک انرژی فوتون یکسان خواهد شد: مسیر کوتاه و مسیر بلند که با زمان کوتاه و بلند سفر الکترون در پیوستار مشخص میشود.به میزانی که پالسهای ما کوتاهتر و از نظر طیفی گستره تر شوند تقریبی که برای شکل موج بعنوان محصول خالصی از مکان و محصول خالصی از زمان مینوشتیم دیگر کاربردی نیست در نتیجه نیاز است که ما به هم پیوستگی مشخصه های زمانی و مکانی پالس آتوثانیه را درنظر بگیریم (جفت شدگی یا اعوجاج فضا زمانی باید در نظر گرفته شوند). آنچه نشان خواهیم داد مکان فوکوس و واگرایی پالسهای تولید شده اغلب شدیدا وابسته به فرکانس است که منجر به ابیراهی کروماتیک در پهنای باند پالس آتوثانیه میشود.استدلال ما برای بررسی این اعوجاج برگرفته از یک مدل آنالیزی ساده بر اساس اپتیک گاوسی و بر پایه ی وابستگی شدت و فرکانس به فاز دوقطبی و محاسبات عددی انتشار است. سپس آنچه تا کنون پیشبینی کردیم با محاسبات عددی و حل معادله ی وابسته به زمان شرودینگربرای پاسخ اتم منفرد و حل معادله ی انتشار برای پاسخ محیط ماکروسکپیک راستی آزمایی میگردد.

کلید واژه ها: جفت شدگی فضا زمانی بالا (STC = spatio temporal coupling ، تولید هارمونیک مرتبه (HHG = high harmonic generation)

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Biology Abstracts

BIOLOGY ABSTRACT
Authors:

Esfandiar Marza	*Afshin Kharamani*	*Elham Alipour*	*Elahe Mahjoubi*
Anahita Afsah Sahebi	*Aisan Bakhshayesh*	*Behnush Ashubi*	*Parvaneh Kazemi*
Paria hashemnia	*Pouya tofigh*	*Mostafa Ghorbani*	*Hamed Alizadehfar*
Habibullah Paeiz	*Reza Sadeghi*	*Roxana Ehsani*	*Roksana Raefi*
Zahra Rahmani	*Zahra Rezaei*	*Zahra Faizi*	*Zahra Eftekhari*
Zahra Badihyan	*Zeynab Mahmoudi*	*Saeed Sari Mohammadlee*	*Somaye Mohammadi*
Sevda Zarei, Hossein Ghafouri	*Shamim Nejati*	*Arefeh Tajik*	*Ali Sarvi*
Ali Hamrahi	*Alireza Esmaeili*	*Fateme zeinali*	*Fatemeh Moradi*
Fatemeh Vahedi	*Fatemeh Heidari*	*Fariborz Sayyadoghly*	*Kosar Rezaee chamani*
Koorosh Jahanban	*Laya Javadi*	*Mohaddeseh Baravordeh*	*Mohadeseh Salehzadeh*
Mohammad Sadeghi Komachali	*Mohammad Hafi Balagafsheh*	*Mohammad Reza Sohrabi*	*Moammadreza Ajamian*
Morteza Mohammadi	*Marzieh Pourbaba*	*Maryam Mohammadi Shahrestani*	*Maryam Malbusi*
Mozhdeh Doosti	*Mehdi Jahanbakhsh*	*Mahdi ghasempoor*	*Mahdis Kohsarian*
Mahdieh Sobh Zahedi	*Nahid Sharifi*	*Niloofar Jahandar Shamami*	*Hediye Fadakar*

Anatomical studies of genus *Capparis* L. (Capparaceae) in Iran

Esfandiar Marza, Akbar Norastehnia and Mina Khorasani
Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Capparis L. (250 species) is the largest genus of the family Capparaceae, distributed in pantropical region. De Candolle (1824) proposed the first sectional classification for the genus and included all the old world species in sect. *Eucapparis*. Boissier (1843) introduced 2 new species, *C. parviflora* and *C. mucronifolia*, for the flora orientalis area. Later, Zohary (1960) reported five species with some varieties in Iran. In Flora Iranica, Hedge and Lamond (1970) cited two species, *C. cartilaginea* Decne. and *C. spinosa* with three variety, var. *spinosa*, var. *parviflora* and var. *mucronifolia*. These varieties were later recognized as separate species by Saghafi Khadem (2000) in Flora of Iran. Inocencio et al. (2006) recognized four species for this group in Iran, *C. cartilaginea*, *C. sicula* Veill., *C. mucronifolia* and *C. parviflora* (two subspecies). These different classifications reflect the taxonomic complexities present in this group. Anatomical studies on other groups of *Capparis* were successfully proved to provide useful tools for resolution of taxonomic problems associated with *Capparis* species. Hitherto, no anatomical investigation has been conducted on members of this genus in Iran. The main scope of the present study is to test the applicability of anatomical characters in resolving the problems associated with species delimitation in this group. Plant materials were collected from their natural habitats and different Herbaria. The plant samples were fixed in ethanol alcohol 70% for 30 days, cross sections were made using commercial razor blades. The sections were stained with Congo red and methyl blue and then mounted on microscopic slides. The quantitative and qualitative characteristics were compared by using a light microscope and photographs were also measured using Image.J software. Our results revealed that the number and thickness of palisade layers, thickness of collenchyma and parenchymatous cortex, number and size of vascular bundles and presence of trichomes are valuable characters for determining taxa in this genus.

Keywords: *Capparis, Anatomy, Iran*, Taxonomy, *Vascular bundle.*

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Association of Fibroblast Growth Factor-1 (FGF-1) gene variety and its serum concentration with the consequence in vitro fertilization and embryo transfer (IVF-ET)

Afshin Kharamani and Farhad Mashayekhi

Department of biology, Faculty of Science, University of Guilan, Rasht,
Corresponding author E-mail: afshinkharamani@msc.guilan.ac.ir

Abstract

Infertility is a disorder of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse. Fertility requires the production of a viable oocyte, transportation through the fallopian tube, and fertilization by a viable spermatozoan. Implantation is a crucial step for establishing pregnancy, requires molecular and cellular events resulting in uterine growth and differentiation, blastocyste adhesion, invasion and placental formation. Successful implantation of the blastocyst into the endometrium is essential for reproduction. Implantation is a complex process which requires synchronization of events in the developing embryo and receptive endometrium, and involves factors such as immune cells, cytokines, growth factors and cell adhesion molecules. Fibroblast Growth Factor-1 (FGF-1) exerts mitogenic, morphogenic, and angiogenic activities in various cells and tissues throughout embryonic, fetal and postnatal development. FGFs are a family of multifunctional mitogenic polypetides that induce endothelial cell migration and promote the formation of blood vessels and the patterning of early branching events. FGFs affect embryo implantation and support improved endometrial trophoblastic interaction. The aim of this study is to evaluate the association between maternal genotype of FGF-1 and in vitro fertilization and embryo transfer (IVF-ET) outcome. One hundred IVF^+ and 100 IVF^- women were included in this study. DNA were extracted from blood cells and will be genotyped using ARMS-PCR. Allele and genotype frequency will be calculated and analyzed using MedCalc software.

Keywords: *FGF*-1; polymorphism; implantation; IVF-ET

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Design and Construct of Biosensors based on Choline Oxidase for Detections of Choline by Using Graphene oxide and Molybdenum Nano-Composites

Elham Alipour[1*]*-Mostafa Shourian*[2]*, Zeinab Solimanisardo*[3]

1 Department of Biology, Faculty of Sciences, University of Guilan

[2]Assistant Professor in Biophysics, Department of Biology, Faculty of Sciences,University of Guilan

[3] Department of Biology, Faculty of Sciences, University of Guilan

Abstract:

Biosensors based on direct electrochemistry of enzymes, so called third generation, have some advantages over other types. They usually offer better selectivity by operating in a potential range close to the redox potential of the enzyme itself, thus being less exposed to interfering reactions. Choline oxidase (ChOx) as a redox protein is frequently used as biosensing element for quantitative determination of choline. Choline is often considered as a biomarker of cholinergic activity in the brain tissue, especially in early clinical diagnosis of Alzheimer's and Parkinson's diseases.By immobilizing choline oxidase (ChOx) on the modified electrode, the enzyme direct electron transfer has been achieved. The modified electrode exhibited a pair of well-defined cyclic voltammetric peaks at a formal potential of -0.395 V versus Ag/AgCl in 0.2 M phosphate buffer solution at pH 7.0. This peak was characteristic of ChOx-FAD/$FADH_2$ redox couple. The modified glassy carbon (GC) electrode was modified by functionalized graphen oxide (Gox) and molybdenum nano-composites (Mon) for realizing the electron transfer of ChOx. Through oxygen oxidizes ChOx ($FADH_2$) the concentration of the reduced form of enzyme (ChOx-FADH2) is decreased while its oxidized form (ChOx-FAD) is increased. Therefore at the electrode surface, the oxidation peak height is reduced while the cathodic peak height is raised. Oxygen molecules are reduced at Mon/Gox/GC electrode in the same potential window. Both molecular oxygen and enzyme prosthetic group (FAD) contribute to increasing the cathodic peak current. By addition of choline to the oxygen-saturated PBS, the cathodic peak current was decreased. Choline oxidation is catalyzed by ChOx. The concentration of oxidized form of enzyme (ChOx-FAD) is decreased while its reduced form (ChOx-$FADH_2$) is increased. The reduction peak height becomes smaller while the oxidation peak height becomes larger. The decrease in cathodic current can also be due to the consumption of dissolved oxygen.

Keywords: Choline oxidase, electron transfer, Choline

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MiR-331 expression level changes in breast cancer women

E. Mahjoubi[1], S. Talesh Sasani[2], F. Fakor3

1- MSc student University of Guilan

2- Assistant Professor University of Guilan

3-Associate Professor Guilan University of Medical Sciences

According to the latest estimates of global cancer incidence and mortality, breast cancer is the second most common malignancy overall and the fifth most frequent cause of cancer related death. Cancer is a disease involving multi-step changes in the genome. microRNAs (miRNAs) are endogenous non-coding small RNAs which regulate gene expression in a sequence-specific manner. miRNAs are often discussed in relation to cancers either as oncogenes or their ability to down-regulate tumor suppressor genes through binding to 3'-UTR of the target mRNAs leading to mRNA degradation or translational repression. A recent study also reported that, miR-331 was overexpressed in malignant breast tumors. Further analysis also revealed that the level of miR-331 might provide valuable information for the differential diagnosis of benign and malignant breast tumors. The miRNA encoding gene is located at the chromosomal position of 12q22. MiR-331-3p is a member of the miRNA-331 family, with a length of around 21 nucleotides and has been found to down-regulate *HER-2* in breast cancer cells. Considering the important role of miR-331 in breast cancer pathogenesis and also due to the high prevalence of this cancer in Iran the aim of this study was to assessment of miR-331 expression changes in breast cancer women.

Keywords: miR-331, microRNAs, breast cancer, Real-Time PCR

Methods: Breast tissue samples were prepared from patients and healthy control groups. The RNA was extracted using Trizol reagent followed by polyA adenylation to miRNAs and cDNA synthesis. RT-PCR was performed and the PCR products was electrophoresed on 2% gel agarose. *U6* gene was used as housekeeping gene. Primers for real time PCR were designed, synthesized and the specificity of the binding of primers was confirmed.

Results: The results of this study showed that expression level of miR-331-3p was altered and may be used as a biomarker for detection of breast cancer. Although future studies are needed.

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Colorimetric assay for detection of Hg2+ Based on Enhancement of Peroxidase-like Activity of MCFS-rGO composit

Anahita Afsah Sahebi[1], *S. Shirin Shahangian*[1] *, *Reza H. Sajedi*[2]

1. *Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*
2. *Department of Biochemistry, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran*

Abstract:

Nanozymes have attracted much attention as emerging alternatives for artificial enzymes over the past decade. Compared with natural enzymes, nanozymes are advantageous in several aspects, such as excellent robustness, higher stability, facile and cost-effective large scale production. Furthermore, colorimetric assay is a sensitive, inexpensive and simple method for the identification of ions and biomolecules in the biological and biomedical fields. Hg^{2+} ions, which are generally considered one of the most toxic heavy metal ions, can interact strongly with various types of enzymes, such as glucose oxidase and horseradish peroxidase, and blocking their active sites, as well as Hg^{2+} is a serious environmental contaminant that can cause severe damage to the immune and nervous systems. Practically, mercury is utilized in the cosmetic industry and skin lightening agents possess mercury-containing ingredients but the unsafe levels of mercury in these products can cause serious damage to the human body, so Hg^{2+} monitoring is highly critical. The catalytic activity of MCFS-rGO as a peroxidase mimetic nanocomposite followed typical Michaelis–Menten kinetics and exhibited higher affinity to H_2O_2 as the substrate compared to that of natural horseradish peroxidase. Herein, we report a novel, simple, and sensitive Hg^{2+} sensor based on the stimulation effect on the peroxidase-like activity of MCFS-rGO. The peroxidase-like activity of this nanozyme can be markedly enhanced by Hg^{2+} as seen by deeper color and increased absorbance at 652 nm. The linear range of Hg^{2+} detection in this assay was within the range of 18 to 572 μM (R = 0.9903). The method has a detection limit (LOD) of 0.34 μM which is much below the allowed level in cosmetics (5 μM). This approach is label-free, simple, time-consuming and offers detection with the naked eye, also it displays excellent sensitivity and selectivity in Hg^{2+} detection, thus it has potential applications for the detection of mercury ions in environmental and cosmetic samples.

Keywords: Nanozymes; Peroxidase-like activity; Hg^{2+} sensor; Colorimetric assay

Genetic stability evaluation of tetanus vaccine strain

Aisan Bakhshayesh, Zivar Salehi, Mojtaba Noofeli, Soheila Moradi bidhendi

Abstract:

Many of bacterial diseases can be prevented by use of bacterial vaccines. Quality control of vaccine strains is directly associated with the safety and efficacy of inactivated whole bacterial vaccines. The assessment of genetic stability is one of the essential elements to guarantee the quality of vaccine strains. The causative agent of Tetanus disease is Clostridium tetani (C. tetani), an anaerobic agent spore forming bacterium whose natural habit is soil, dust and intestinal tracts of animals. Tetanus vaccines for human and veterinary use are based on toxoids resulting from a formaldehyde mediated inactivation of tetanus neurotoxin (TeNT). The genome comprised of a chromosome (2.8 Mb) and toxin encoding plasmid (75 Kb) which contain tetanus toxin genes (TeNT) and its direct transcription regulator (TetR). Genetic information available for C. tetani is mainly restricted to the nucleotide sequences of the gene encoding the tetanus toxin (TetX) and that encoding its direct transcriptional activator, TetR, both of which are on a 75-kb megaplasmid. The PCR method for TetX and the result obtained from ectrophoresis gel is used to investigate the molecular character and stability of tetanus vaccine strains.Quality control of vaccine strains is an important process in vaccine production and is directly related to the quality of the end product and is an essential element in ensuring the quality of a vaccine.

Keyword: tetanus vaccine, Genetic stability, Clostridium tetani

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Analysis of Lin28B expression in mouse model of ulcertive colitis

Behnush Ashubi, Zivar Salehi, Farhad Mashayekhi

Deprtment of Biology, Fculty of Scienc, University of Guilan, Rasht, Iran

Abstract:

Ulcerative colitis is a chronic, idiopathic inflammatory disease that affects the colon, most commonly afflicting adults aged 30–40 years and resulting in disability. It is characterised by relapsing and remitting mucosal inflammation, starting in the rectum and extending to proximal segments of the colon . As part of the presentation or through the disease course, patients can develop severe symptoms which can lead to several complications and the potential need for colectomy.some of the major symptoms include: rectal bleeding, diarrhea, tenesmus and lower abdominal crampy discomfort. It is associated with significant morbidity and has a mortality rate of approximately 1%. The incidence and prevalence of ulcerative colitis have been increasing over time worldwide[1]. It has been reported that the LIN28 protein interacts with mRNAs and regulates their translation or stability. LIN28 also binds to the precursors or primary transcripts of certain microRNAs (miRNAs), thereby blocking their maturation . Src activation triggers an inflammatory response mediated by NF-kB that directly activates Lin28 transcription. It seems that Lin28B is effective in triggering inflammation response[2]. Therefore the aim of this study is to analysis of Lin28B expression in mouse model of ulcerative colitis. In this study, micee samples consisted of 5cnotrol and 6 treated mice with dextran solfate sodium collected. RNASamples extracted from mice colon will be further studied.

Keywords: ulcerative colitis, LIN28B, mice models.

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Anatomical study of *A. stipitatum* complex (*Allium*: Amaryllidaceae)

Parvaneh Kazemi, Mansor Afshar Mohamadian and Mina Khorasani
Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Taxonomically, *Allium* forms a difficult group which is distributed over the northern hemisphere. According to Wendelbo (1971) who revised the genus in the area of Flora Iranica, as one of the major center of diversity of *Allium*, 139 species have been accounted 75 species out of recorded in Iran. The recent investigations have shown that this number should be increased considerably. Currently, more than 120 species (out of about 800-900 species worldwide) are known as growing in the Irano-Turanian phyto-geographical region with high level of specific endemism. These species are classified currently into 7 subgenera and 30 sections. According to the description given in monograph of Fritsch & Abbasi (2013) and Khorasani et al. (2018), the main features of *A. stipitatum* complex are as follows: a long scape with purple flowers that caused it to be easily separated from other species and complexes in *Allium* genus. In present study, populations of 12 *Allium* species representing several sections from *A. stipitatum* complex were collected from different areas of Iran and were determined according to available resources. For anatomical studies the plant samples were fixed in ethanol alcohol 70% and cross-sections were prepared, and then the sections were stained with Congo red and Methyl blue. The quantitative and qualitative characteristics were compared using a light microscope and photographs were also measured using Image.J software. According to the results, the anatomical characteristics, including epidermis situation, size of laticifer, number of vascular bundles and thickness of cuticle and presence of trichomes showed that there was a close relationship between the sections and the species as well as a congruent with their phylogenetic relationships. Therefore, the anatomical studies of *Allium* are effective in circumscribing of taxa and sections.

Keywords: Allium, Histology, Iran, Laticifer, Vascular bundle

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Using Deep Eutectic Natural Solvents for Green Extraction of PHB from *Spirulina* sp. Microalgae

Paria hashemnia, Akbar norastehnia

Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Polyhydroxy alkanates (PHAs) are bacterial polymers that are usually made as storing polyester by a wide range of microorganisms under nutritional imbalance conditions. In recent years, a new type of solvent, Natural Deep Eutectic Solvents (NADES), has been developed and has been replaced as a green solvent for conventional organic solvents. Since no method has been reported for the extraction of polyhydroxybutyrate from Spirulina microalgae by green solvents, the purpose of this experiment is to reach a protocol to extract polyhydroxybutyrate from spirulina algae using various NADES such as malic acid: choline chloride with a rate 1:2, sodium acetate: urea whit a rate 2:1 and triethanolamine solvent: Glucose with a ratio of 6: 1. The results of this study showed that sodium acetate: urea solvent cannot be suitable solvent for PHP extraction due to its solid properties at environment temperature and high viscosity at liquid time as well as malic acid solvent: choline chloride because of its high viscosity. The results also showed that the solvent triethanolamine: Glucose is a good solvent for extract of polyhydroxybutyrate due to its low polarity. We are currently identifying a protocol for extracting PHB by this solvent from spirulina algae.

Keywords: NADES, Spirulina, Green Solvent, PHB

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The study of *SPI1* immune gene polymorphism associated with Alzheimer's Disease

Pouya tofigh[1], *Farzam Ajamian*[2], *Alia saberi*[3]

[1] *MSc Student in Cell and Molecular Biology, Faculty of Science, University of Guilan, Rasht, Iran*

[2] *Assistant Professor, Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*

[3] *Professor, Department of neurology, Faculty of Medicine, Guilan University of Medical Sciences, Rasht, Iran*

E-mail: pouya.tofigh@gmail.com

Alzheimer's disease (AD) is the most common type of age-associated dementia that is accompanied by progressive cognitive decline and memory loss. Pathologically, AD is characterized by extracellular amyloid-β (Aβ) deposition in brain parenchyma as senile plaques and in vessels as cerebral amyloid angiopathy (CAA). AD is also characterized by a neuronal accumulation of phosphorylated tau–forming neurofibrillary tangles, which are typically accompanied by neuronal loss and glial activation. SPI1 is expressed by microglia, the resident immune cells of the brain. Microglias are of myeloid origin and perform a variety of functions in brain; cell–cell communication via secreting molecules, surveying synapses and clearing extracellular debris by phagocytosis. ETS domain and PU.1 are two transcription factors encoded by gene SPI1. The ETS domain transcription factor could activate gene expression during myeloid and B lymphocyte development. The PU.1 transcription factor is critical in the development of myeloid cells and a major regulator of microglial gene expression. Recent evidence from genome-wide association studies suggests that reductions in PU.1 contribute to a delayed onset of Alzheimer's disease (AD), possibly through limiting neuroinflammatory responses [1, 2]. In this case-control study, 75 patients with Alzheimer's disease and 75 healthy controls were evaluated. Blood samples were taken from the subjects and DNA was extracted. After Genotypes were determined by the ARMS-PCR technique, the results of both groups were analyzed and compared. The AA, GA, GG genotypes were between subjects in patients with AD and controls. This study suggests that (G/A) (rs1057233) *SPI1* gene polymorphism could be associated with AD. Therefore, evaluation of this polymorphism can provide appropriate information about the patient's condition.

Keywords: Alzheimer's Disease; Immune system; Neuroinflammation; *SPI1*

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Y chromosome Microdeletions and male infertility in Guilan province

M.Ghorbani, S. Talesh Sasani[2], M. Asgharnia[3]

1. MSc student University of Guilan

2. Assistant Professor University of Guilan

3- Assistant Professor Rasht Azad University Midwifery Faculty

Introduction

Y chromosome microdeletions are the second genetic cause of male infertility. The incidence of Y chromosome microdeletions is different due to several factors e.g. population composition, and diagnostic methods. They are correlated with spermatogenic defects and lead to azoospermia or oligozoospermia. The progression in assisted reproductive technology and intracytoplasmic sperm injection, and the possibility of genetic defect transmission to the next generation make it necessary to detection of various factors causing spermatogenic failure. The human Y chromosome harbors testis development related genes and also the genes responsible for initiation and maintenance of spermatogenesis in adulthood. The long arm of the Y chromosome (Yq) contains many ampliconic and palindromic sequences making it predisposed to self-recombination during spermatogenesis and susceptible to intra-chromosomal deletions. Such deletions lead to copy number variation in genes of the Y chromosome resulting in male infertility. Three common Yq deletions in infertile males are termed as AZF (Azoospermia Factor), microdeletions viz. AZFa, AZFb and AZFc. This study was designed to determine the frequency of microdeletions of Y chromosome in a population from Guilan Province.

Keywords: Microdeletions; Azoospermia; Infertility; Y chromosome

Methods: In this research the DNA was extracted from the semen samples of infertile men**..** Multiplex PCR were carried out using some of Y chromosome related microdeletions specific primers.The PCR products were run on agarose gel.

Resultns: Our study showed that some of microdeletions in long arm of Y-chromosome have relationship with male infertility in Guilan population . However, further study in a larger population is needed to confirm these results

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Properties investigation of albumin protein Nano carrier after improvement with Ascrobyl palmitate and paclitaxel to the targeting cells

Hamed Alizadehfar[1], Mostafa Shourian[2], Havva Rezaee*

1 Department of Biology, Faculty of Sciences, University of Guilan.

[2]Assistant Professor in Biophysics, Department of Biology, Faculty of Sciences,University of Guilan.

[3] Department of Chemistry, Faculty of Sciences, University of Guilan.

Abstract:

Cancer is the most important cause of death so we have to look for a new way of treatment. Therefore, various methods have been developed for drug delivery like using nanocarriers. Nano-drug delivery systems have been extensively investigated for anti-cancer drug delivery. Various nanocarriers have been developed for the co-delivery of anti-cancer drugs, Albumin is a plasma protein that carrier of many substances, including medicines. This protein is nano-scale, on the other hand paclitaxel (PTX) is an insoluble chemotherapy drug so we can put it in albumin**,** also Ascrobyl palmitate (AP) is an esterified form of vitamin C and it has antioxidant properties but at high concentration it is oxidant. As a result, it causes apoptosis. In this study, Ascrobyl palmitate-Albumin core-shell nanoparticles were developed for paclitaxel (PTX) delivery to improve the chemotherapy efficacy in breast cancer model. The PTX-loaded AP-Albumin core-shell nanoparticles (PTX-AP NPs) had small particle sizes (about 120 nm), high drug entrapment efficiency (85.7%) and loading capacity (15.5%), and showed sustained release profiles, in vitro. Docking studies indicated that the hydrophobic interaction and hydrogen bonds play a significant role in the formation of the PTX-AP-Albumin NPs. The PTX-AP NPs also exhibited stronger cytotoxicity, compared with PTX NPs with an increased accumulation of PTX in the MCF cells. Importantly, the PTX-AP NPs showed a higher anti-cancer efficacy in MCF-7 tumor model than the PTX NPs. Overall, the AP-Albumin core-shell nanoparticles could be a promising nanocarrier for PTX delivery to improve the chemotherapeutic efficacy of breast cancer.

Keywords: Albumin, Aascorbyl palmitate, Paclitaxel, Protein nano carrier.

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The importance of *SOCS1* deletion polymorphism at -1478 site in breast cancer

Habibullah Paeiz, *Zivar Salehi*

Abstract:

Breast cancer is the most common cancer among women. According to WHO statistics, one out of every 8 to 10 women has breast cancer. Breast cancer is the second most common cause of cancer death. One of the most important risk factors for breast cancer is family history of the disease, indicating that genetic factors are important determinants of breast cancer risk. A number of breast cancer susceptibility genes have been identified, the most important being *BRCA1* and *BRCA2*. However, it is estimated that all the currently known breast cancer susceptibility genes accounts for less than 25% of the familial aggregation of breast cancer. Although the genes responsible for most breast cancers have not yet been discovered, about half of all cancers occur through reproductive lineage mutations in tumor suppressor genes (TSGs), most of which play a role in maintaining the integrity of the genome. The SOCS (suppressors of cytokine signalling) family of proteins inhibits the cytokine-induced signalling cascade in part by promoting the ubiquitination of signalling intermediates that are then targeted for proteasomal degradation. The SOCS1 gene (Suppressor Of Cytokine Signaling 1) encodes a member of STAT coding inhibitors. Th SOCS protein family consists of eight classical members, including SOCS1–7 and cytokine-induced Src homology (SH2)- containing protein (CIS). Suppressor of cytokine signaling 1 expression is affected by various cytokines and hormones. SOCS1 is an essential physiologic regulator of the IFN-γ signaling that is crucial to lead appropriate immune responses. In this research, we evaluated the association of a -1478CAdel polymorphism in the promoter region of *SOCS1* with breast cancer susceptibility. A total of 70 patients with confirmed breast cancer and 100 subjects without breast cancer were selected. Genomic DNA was extracted from peripheral blood leukocytes. *SOCS1* genotyping was performed by tetra primers ARMS-PCR (amplification refractory mutation system-polymerase chain reaction). Statistical analysis was performed using MedCalc program (version 15.8). Significant difference in allele and genotype distribution was seen between patients and controls ($P<0.05$).

Keyword: breast cancer, *SOCS1*, polymorphism, deletion

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Fabrication of Zein nanofiber coated with nano hydroxyapatite for bone regeneration

Reza Sadeghi, Zivar Salehi, Mahvash Hadavi

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran.

Abstract:

The field of tissue engineering (TE) is making great strides in developing replacement tissue grafts for clinical use, marked by the rapid development of novel biomaterials, their improved integration with cells, better-directed growth and differentiation of cells, and improved 3D tissue mass culturing. TE combines living cells with synthetic or natural support, termed as scaffold. The scaffold is one of the critical elements, and acts as a temporary substrate or template, providing the necessary support for the cell growth and maintenance of their differentiated functions. The attention given to Zein based polymers is primarily attributed to their biocompatibility and biodegradability. Due to the relatively low mechanical properties of these polymers, numerous inorganic compounds such as hydroxyapatite (HAp) have been considered in combination with Zein. HAp has been widely used for bone regeneration because of its chemical similarity to natural bone and it can directly bind to bone tissue *in vivo*. HAp has high biocompatibility, osteoconductivity, osteoinductivity, abrasion resistance, corrosion resistance, and stable chemical properties. In this study, Zein scaffold was fabricated using electrospinning method. The properties of scaffold will be investigated by scanning electron microscope (SEM), Fourier-transform infrared spectroscopy (FTIR), as well as mechanical testing.

Keyword: tissue engineering, zein, nanohydroxyapatite, osteogenic differentiation

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The Study of ptk2B Expression in Peripheral Immune Cells with rs28834970 Polymorphism in Late-Onset Alzheimer Disease (LOAD)

Roxana Ehsani, *Farzam Ajamian*

Abstract:

Alzheimer's disease (AD), a neurodegenerative disease characterized by cognitive decline, has been associated with amyloid plaques, neurofibrillary tangles (NFTs), and massive neuronal loss. It afflicts as many as 45% of individuals who survive past the age of 85. Accumulating evidence has indicated that it is a complex disorder with a strong genetic background.

Emerging evidence indicates that protein tyrosine kinase 2β (PTK2B) is involved in the pathogenesis of Alzheimer's disease (AD). Recently, a large, two-stage meta-analysis of genome-wide association study (GWAS) confirmed that PTK2B was correlated with an increased risk of AD in Caucasian populations. The aim of this study is to investigate ptk2B Polymorphism in Late-Onset Alzheimer Disease (LOAD) and the association between PTK2B polymorphism rs28834970 and the risk of LOAD in Iranian population. A total of 104 sporadic LOAD patients and 86 healthy age-matched control subjects from the Iranian population were included in this study. Genomic DNA was extracted from peripheral blood leukocytes of AD patients and healthy individuals.

Genotyping of PTK2B polymorphism rs28834970 will accomplished with ARMS-PCR.our initial findings show a correlation between genetic PTK2B background with LOAD occurrence in our sample studied.

Keyword: Alzheimer's disease, PTK2B, rs28834970, Association study

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The effect of electrospun nanofiber conjugate with nano hydroxyapatite on the differentiation of mesenchymal stem cells

Roksana Raefi, Zivar Salehi, Mahvash Hadavi

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

Abstract

Tissue engineering is a helpful alternative field that focused on the principles of biological, chemical, and engineering sciences to the solution of serious medical troubles, as tissue loss and organ failure. The goal of this field is to mitigate the critical shortage of donor organs via in vitro fabrication of functional biological structures. The method is based on three major interplaying actors: a scaffold, cells of interest and an appropriate environment. For biomedical applications such as soft tissue engineering, plant proteins are becoming increasingly attractive. Zein is a natural protein and it has biodegradability and good biocompatibility which makes it a potential biomaterial used in tissue engineering scaffold. Nowadays, there is a significant need for synthetic bone replacement materials used in bone tissue engineering (BTE). hydroxyapatite (Ca10(PO4)6(OH)2; HAp) is one of the ideal materials for bone substitutions due to the nature of its biocompatibility and mechanical strength. The aim of this study is investigation of the effect of electrospun nanofiber matrix conjugate with nanohydroxyapatite on the differentiation of mesenchymal stem cells. Zein/HAp nanofibrous structures were fabricated by the electrospinning process. A polymer solution was prepared by dissolving zein in acetic acid. Zein scaffold coated with nanohydroxyapatite and analyzed with scanning electron microscopy (SEM). The chemical structure will be characterized by Fourier-transform infrared spectroscopy (FTIR) and scaffolds mechanical properties will be evaluated by compressive test measurement. The scaffold will be cut into small pieces and sterilized with UV and antibiotic before cell seeding.

Keywords: tissue engineering, cell differentiation, zein, stem cells, Hydroxyapatite

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Investigation of paracrine effects of stem cells on cancer cells by evaluation of cell proliferation-related genes' expression

Zahra Rahmani, Fatemeh Safari

Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Stem cells create the foundation for every organ and tissue in our bodies. Stem cells possess very unique property for unlimited or prolonged self-renewal and to differentiate into highly distinct cell lineages. Mesenchymal stem cells (MSCs) are present in different tissues like bone marrow, adipose tissue, placenta, umbilical cord, umbilical cord blood have differentiation capabilities. They can differentiate into specific cell types *in vitro* and *in vivo* and have a tendency to acquire tissue specific characteristics when co-cultured with specialized cell types like cancer cells. The term "cancer" describes a group of diseases that are characterized by uncontrolled cellular growth, cellular invasion into adjacent tissues, and the potential to metastasize if not treated at a sufficiently early stage. MSCs are able to modulate the growth, response treatments, angiogenesis, invasion and metastasis of tumors. It was shown that MSCs actually support the tumor growth and progression in different cancer types and secrete a variety of growth factors that are known to influence tumor proliferation, migration, and angiogenesis. On the other hand, it was found that MSCs effectively induce tumor cell apoptosis. They can inhibit the proliferation-related signaling pathways through paracrine actions. For instance, MSCs can inhibit the expression of Wnt downstream targets and/or effectors such as Bcl-2, cellular myelocytomatosis oncogene (c-Myc), β-catenin, Bax, and survivin in tumor cells. Also stem cells can function as *in situ* drug factories, secreting antitumor agents for an extended period of time, and overcoming various cancer therapy limitations, such as high systematic toxicity and short drug half-life. In this study the role of MSCs from umbilical cord blood on the growth of cancer cells will be investigated and the cell proliferation-related genes' expression will be evaluated.

Keywords: cancer, stem cell, proliferation-related genes' expression

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Acute toxicity of Malachite green to *Daphnia magna* adult and neonate

Zahra Rezaei [1], Akram sadat Naeemi [1], Naz Chaibakhsh [2]
Rasht, University of Guilan, Department of Biology [1]
Rasht, University of Guilan, Department of Chemistry [2]

Malachite green, a water-soluble dye, used in aquaculture, leather, food, dyeing wool, silk, wood and paper. This pollutant can be resistant to natural biological degradation and disturb the aquatic life. In this study acute toxicity of Malachite green to adult and neonate of *Daphnia magna* was investigated. Toxicity test was performed at different concentrations of Malachite green. For assessing acute toxicity, three replicates with seven daphnia per replicate at different concentrations of Malachite green (for adult= 0.1, 0.2, 0.4, 0.6, 0.8 $mg.l^{-1}$) and (for neonate=0.06, 0.08, 0.1, 0.12, 0.14 $mg.l^{-1}$) were used and the EC_{50} values were calculated by probit analysis at 24, 48, 72 and 96h. According to results median effect concentration of adult daphnia were 0.22 , 0.13, 0.07 and 0.07 $mg.l^{-1}$ for 24, 48, 72 and 96h, respectively and median effect concentration of neonate were 0.11, 0.07, 0.06 $mg.l^{-1}$ for 24, 48 and 72h, respectively. Also, the results showed that Malachite green was highly toxic to adult and neonate of *Daphnia magna* and the toxicity of malachite green increased with exposure time. It can be concluded that the Daphnia neonate was more sensitive than to adult Daphnia and lower concentrations of Malachite green in neonate caused more mortality.

Keywords: Malachite green, daphnia, median effect concentration

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Petiole anatomical study of *Drymocalis poteriifolia* (Rosaceae)

Zahra Faizi, Marzieh Beigom Faghir
Department of Biology, Faculty of science, University of Guilan, Rasht, Iran.

Abstract

This survey devoted to petiole anatomical study of *Drymocallis poteriifolia* distributed in Mazandaran, Fars and Kohgiluyeh and Boyer-Ahmad provinces. At the beginning plant materials were collected from Guilan and Tehran university herbaria. The cross sections were prepared by manually cutting the petioles and double staining (using methyl green and red kongo colors). Then the stained specimens were observed by light microscopy (LM) and photographed. Table containing petiole anatomical traits of three studied populations is presented. The petiole shape, distance between the two upper lobes. thickness of epidermis and cuticle, shape of crust cells, number and type of vascular bundles, phloem and xylem thickness, presence and absence of hairs and glandular trichrome are the most important anatomical evidences examined in this study. The result showed that, the shape of petiole cross section varies from triangular-sub circular, with upper depression and sometimes with two lateral lobes; epidermis covered with long and short trichrome and glandular hairs; hypodermis in two rows and ovate crust cells (ground tissue) ; 3 vascular bundle: 2 smaller on the upper part and one large at the center, with collateral arrangement and extra vascular fiber(sclerenchyma fibers) are found above phloem. Our findings support previous petiole anatomical studies of the family rosaceae especially regarding to vascular bundle shape (crescent shape), number and type pattern.

Keyword: *D. poteriifolia*, anatomical characters, Rosaceae, Iran

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Study of the bioremediation ability of C.I. Acid Blue 92 (AB 92) from contaminated water by *Ceratophyllum demersum*

Zahra Eftekhari[1], *Akbar Norastehnia*[1], *Zahra Masoudian*[1]

1 – Department of Biology, Faculty of Science, University of Guilan

Abstract

Physical and chemical remediation techniques have been subjected to effectively remove different dyes but these methods are different in efficiency, cost and environmental impacts. Since bio-friendly approaches are ecofriendly, require low costs, and produce fewer toxic metabolites compared to physicochemical processes, they have been the main focus for treatment of dye containing waste waters. In this study the ability of *Ceratophyllum demersum* for decolorization of Acid Blue 92 (AB 92) was evaluated. Effect of some operational parameter such as the reaction time (1, 3, 5, 7 day), initial dye concentration (5, 10, 15, 20 mg/l), initial plant biomass (0.5, 1, 2, 4 g) and pH (2.5, 5, 7.5, 9) on dye removal efficiency was studied and optimized using Taguchi method. Sixteen experiments were required to study the effect of parameters on biodegrading of dye. Each of experiments was repeated three times to calculate signal/noise (S/N). The most effective parameter in comparison to others was determined. In this study, we also optimized the experimental parameters and chose the best condition by determination effective factors. Also interactions between factors were investigated.

Keywords: Ceratophyllum demersum, Biodegradation, Azo dye

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Investigation of miR-205 expression in breast cancer

Z. Badihyan[1], S. Talesh Sasani[2], F. Fakor[3]

[1]MSc student University of Guilan

[2]Assistant Professor University of Guilan

[3]Associate Professor Guilan University of Medical Sciences

In Iran, breast cancer is the most common cancer among women, accounting for 2.8% of all cancers in women. Breast cancer is the uncontrolled and invasive growth of abnormal cells in the breast tissue, usually ducts and lobules. One of the genetic factors involved in cancer is microRNA. MicroRNAs are small noncoding RNAs that regulate various biological processes such as cellular differentiation, cellular metabolism and immune response. The molecules bind to the 3'UTR of target mRNAs and block translation or, in less cases, lead to the mRNA degradation. MiRNAs can have both tumor suppressor and oncogenic roles, which are called OncomiR and Ts-miR. MiRs expression levels vary significantly between normal and cancer cells suggests that miRNA might be associated with cancer development and potentially could be used for cancer diagnosis or even treatment. MiR-205 acts either as a tumor suppressor through inhibiting proliferation and invasion, or as an oncogene through facilitating tumor initiation and proliferation, depending on the specific tumor context and target genes. Loss of miR-205 is associated with enhanced metastatic potential in both model tumor systems and in human cancers, particularly of the breast. MiR-205 is downregulated in breast cancer tissues and breast cancer cell lines compared with normal breast tissues and a non-tumorigenic breast epithelial cell line. Several targets of miR-205, which may influence tumor behavior, have been identified, including *ErbB3*. *ErbB3* is a member of *ErbB* tyrosine kinase receptor family, which is frequently overexpressed in breast cancer.

The purpose of this study was to investigate of miR-205 expression in breast cancer.

Keywords: MicroRNA, miR-205, Breast Cancer, Real-Time PCR

Methods: In this case-control study the RNA was extracted from the breast tissue samples**.** Complementary DNA(cDNA) was synthesized, *miR-205* and housekeeping gene(*U6*) replication was conducted using specific primers through RT-PCR technique by an automated thermocycler.

Resultns: We showed that miR-205 expression has association with breast cancer. However, these results need to be assessed in future studies.

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ZM-093, a novel thiadiazole derivative, induces apoptosis in human breast cancer cells

Zeynab Mahmoudi[1], *Hossein Ghafouri*[1] *and Asadollah Mohammadi*[2]

[1] *Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*

[2] *Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran*

Apoptosis is a cell suicide mechanism invoked in disparate situations to remove redundant, damaged, or infected cells. Resistance of tumor cells to apoptosis enhances the spontaneous growth of tumors and renders them resistant to host defense mechanisms as well as to various forms of therapy Hsp70 is an anti-apoptotic protein abundantly and preferentially expressed in malignant human tumors Thus, the neutralization of the function of Hsp70 or inhibition of its expression may inhibit tumor growth and/or sensitize tumor cells to chemotherapeutic agents without affecting normal cells with low or absent Hsp70 expression. Apoptosis plays an integral role in the removal of unwanted cells and evasion of cell death is a hallmark of cancer. A promising approach for the treatment of breast cancer would be to take advantage of the susceptibility of these cells to drugs that induce apoptosis. It is then necessary to identify new and more specific compounds. Solid lipid nanoparticles (SLNs) are categorized as a new generation of lipid nanoparticles consisting of a complete solid lipid matrix. SLNs used for oral administration offer several benefits over conventional formulations, including increased solubility, enhanced stability, improved epithelium permeability and bioavailability, prolonged half-life, tissue targeting, and minimal side effects. Inhibiting HSP70 has been set up as a therapeutic strategy for control of cancer. Accordingly, the present study aimed at design, synthesis and evaluation of new thiadiazole derivatives as potential apoptosis inducers. To this aim, two bioactive thiadiazole -based compounds were synthesized using 2-Amino-5-mercapto-1,3,4-thiadiazole and some aldehydes such as 3-hydroxybenzaldehyde and 3-nitrobenzaldehyde by the condensation reaction under reflux conditions. The structure of synthesized compounds was characterized and confirmed by the FT-IR analysis. Potential measurement Particle size of the SLN was measured by laser light scattering technique using particle size analyzer. Polydispersity index (PI) and zeta potential (ZP) of the nanoparticle were measured by dynamic light scattering technique using Micro Trace NANOFlex and Micro Trace ZetaCheck. High drug encapsulation efficiency (98–99%) was achieved by the centrifugation method. The absorbance was measured at 317 nm in a UV spectrophotometer to calculate the entrapment efficiency.

Keywords: 2-Amino-5-mercapto-1,3,4-thiadiazole, Apoptosis, HSP70,Cancer and SLN

The Study of ptk2B Expression in Peripheral Immune Cells with rs28834970 Polymorphism in Late-Onset Alzheimer Disease (LOAD)

Saeed Sari Mohammadlee, Farzam Ajamian

Late-onset Alzheimer's disease (AD) is the most frequent form of dementia affecting 24 million persons worldwide. The annual incidence rate of AD increases from 1% among people aged 65 years to approximately 8% for people aged 85 years and older. Many basic discoveries spurred research into inflammation as a driving force in the pathogenesis of Alzheimer's disease (AD). Recent genetic association studies have revealed genes that regulate or encode inflammatory proteins associated with AD risk. The triggering receptor expressed on myeloid cell-1 (TREM1), a member of the immunoglobulin superfamily of receptors, is widely expressed in monocytes and microglia. On the other hand, TREM1 variant, rs6910730, is reported to associate with ad pathology; however, the exact mechanism is not yet clear. Jiang et al. found that TREM1 facilitates microglial AB phagocytosis while rs6910730 impairs this function and exacerbates AD pathogenesis. These findings suggest that TREM1 can be implemented investigated as a potential therapeutic target in AD.

Here, we examine the TREM1 Polymorphism in Late-Onset Alzheimer Disease (LOAD) and the association between TREM1 polymorphism rs6910730 and the risk of LOAD in Iranian population.

A total of 104 sporadic LOAD patients and 86 healthy age-matched control subjects from the Iranian population were included in this study. Genomic DNA was extracted from peripheral blood leukocytes of AD patients and healthy individuals.

Genotyping of TREM1 polymorphism rs6910730 will accomplished with ARMS-PCR. our primary analysis shows a correlation between genetic TREM1 background with LOAD occurrence in our sample studied.

Keyword: Alzheimer's disease, TREM1, rs6910730, Association study

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Evaluation of the antioxidant activity of various extracts of citrus peels

Sariri, S. Shirin Shahangian Reyhaneh Somaye Mohammadi, Moslem Afsharnezhad,*

Department of Biology, University of Guilan, Rasht, Iran

The growing interest in the replacement of synthetic antioxidants with natural ones has directed many research toward the plant-derived raw materials. The special attention is focused on inexpensive or residual sources from food agricultural industries. Fruit peels are valuable wastes obtained from domestic and industrial sources. The potential of fruit wastes as sources of natural antioxidants was explored in the present research. The aim of this study was to determine the antioxidant activity of citrus peels after their extraction using various solvents. The dried citrus peels were ground into fine powder and extracted using different solvents, including methanol, acetone and methanol-acetone. The antioxidant capacity of the different extracts was evaluated through their free radical scavenging activity on the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical. According to the results, various extracts of citrus peels showed strongly scavenging activity on DPPH radical. The IC_{50} value for methanol, acetone and acetone-methanol extracts were 29.35, 17.44 and 6.46 mg/ml, respectively. This study demonstrated that citrus peels could serve as potential sources of antioxidants in the food and pharmaceutical industries.

Keywords: Citrus peels; Natural antioxidant; DPPH scavenging activity; Solvent effects

The effect of Amygdalin on the gill cells extracted from sturgeon *Acipenser ruthenus*

Sevda Zarei, Hossein Ghafouri, Leila Vahdati, Behrouz Heydari

Department of Biology, Faculty of Science, University of Guilan

Abstract

The importance of the *in vitro* cultures of animal cells with their proper functioning has been well recognized. In this study, gill cells were isolated of gill tissues and cultured of the sturgeon *Acipenser ruthenus* using non-enzymatic protocol. minimum essential medium supplemented in culture medium (containing 80% L15, 20 % Fetal Bovine Serum (FBS), 100 U/ml of Streptomycin / Penicillin and 100 U/ml of Amphotericin B) were cultured in a T-25 flask and incubated at 22° C and 95% humidity, yielded confluent monolayer on 8th and 12th day in gill tissues. Number of cells from isolation and fraction of gills were 6.9 to 9.4 $*10^7$ cell/ml and cell viability was 85-95%. Then, cells were treated with the amygdalin with different concentrations (0, 1.25, 2.5, 5, 10, 20 and 30 mM). The MTT assay was used to evaluate cell proliferation. The MTT assay results showed that increasing the concentration of the amygdalin did not cause cell death. Actually with the increase of amygdalin dose, the growth of treated cells were increased compared to controls.

Keywords: Cell Culture, gill, Sturgeon, amygdalin, MTT

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Application of solid lipid nanoparticles to improve the biological properties of Naringin

Shamim Nejati and Hossein Ghafouri

Department of Biology, University of Guilan, Rasht, Iran

Naringin is a natural flavanone glycoside that is formed from the flavanone naringenin and the disaccharide neohesperidose, it is one of the most important ingredients in herbal medicine. Studies have demonstrated that naringin possesses numerous biological and pharmacological properties in human. Flavonoids are an important group of secondary metabolites and a source of bioactive compounds in plants. An extensive literature survey has revealed that naringin possesses antioxidant, anti-inflammatory, anti-cancer, anti-ulcer, anti-osteoporotic and anti-carcinogenic properties. However, there have been few reports, until recently, which describe naringin processing. Solubility, is one of the important parameters to achieve desired concentration of naringin in systemic circulation. Low aqueous solubility is the major problem encountered with formulation development of naringin. Various techniques are used for the enhancement of the solubility of poorly soluble compound which include physical and chemical modifications of compound. Solid Lipid Nanoparticles (SLNs) can improve drug delivery to target cells by different mechanisms. SLNs are colloidal particles of submicron size, with a diameter between 50 and 1000 nm. They are made of a lipid matrix solid and surfactants. Naringin -loaded SLN formulations were prepared by hot homogenization according to published methods. Compritol 888 with 100 µl Tween 20 as a surfactant was heated at 80 ◦C and surfactant Poloxamer 407 was dissolved in ultra-pure water and heated to the same temperature of the oil phase. The naringin was dissolved in 2 ml of aqueous phase and added into the oil phase under homogenization at 20,000 rpm. The stability of NPs loaded with naringin was assessed in regular time intervals. Particle size, zeta potential and PDI were determined using nano Zetasizer device. Results showed solid lipid nanoparticle's diameter is from 50 to 100 nm and it was 54.1nm in 50 percent of synthesized nanoparticles and this result shows that the nanoparticle synthesize was correct.

Keyword: herbal medicine.flavonoids.naringin.SLN

Study of association between *HOTAIR* gene and breast cancer

Arefeh Tajik [1], *Soheila Talesh Sasani* [2], *Fereshteh fakor* [3]

[1] *M.Sc student university of Guilan*

[2] *Assistant Professor University of Guilan*

[3] *Associate Professor Guilan University of Medical Science*

Breast cancer is the second leading cause of cancer death among women worldwide. The mean age-standardized rate (ASR) for breast cancer was 20.4 cases per 100 000 women. Breast cancer is the third leading cause of cancer death, and mortality rate due to the cancer is 9.9 per person-years in Iran. .LncRNAs, as a part of ncRNAs , play critical roles in cell proliferation, migration, and invasion in breast cancer . HOX antisense intergenic RNA (HOTAIR) is a recently discovered lncRNA and plays an important role in various areas of cancer. HOTAIR, is transcribed from the antisense strand of the HOXC gene cluster, which is specifically located between *HoxC11* and *HoxC12* on chromosome 12q13.13 . An early study showed that HOTAIR was highly expressed in primary and metastatic breast cancer tissues and its level in primary tumors was an risk factor for metastasis and survival. In cell-based experiments, HOTAIR promoted breast cancer cell invasion by recruiting PRC2 to specific targets genes, leading to H3K27 trimethylation and silencing of tumor suppressor genes. Another study showed that HOTAIR upregulation leads to enhanced resistance to radiotherapy in breast cancer through homeobox D10 (HOXD10) downregulation. *HOXD10* encods a repressor protein that inhibits cell migration and invasion-associated genes transcription. Howevere, breast cancer is one of the most common cancers in Iran and in this study relationship between HOTAIR gene and the disease is evaluated.

Keywords: Breast Cancer, LncRNAs, HOTAIR, gene expression

Methods: Two groups consisting breast cancer patients and healthy subjects were studied. The RNA extraction was carried out from breast tissues followed by cDNA synthesis. Specific primers were designed for *HOTAIR* gene and *GAPDH* gene, as internal control gene, RT-PCR was conducted.

Results: The RT-PCR results showed expression level of *HOTAIR* gene is associated with breast cancer. In order to confirmation of the results, qRT-PCR will be done in future.

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Pollen and seed morphological study of *Polygala anatolica* and *P. platyptera* (Polygalaceae) in north of Iran

Ali Sarvi[1]*, *Marzieh Beygom Faghir*[1], *Robabeh Shahi Shavvon*[2]
1 Department of Biology, Faculty of science, University of Guilan, Rasht, Iran
2 Department of Biology, Faculty of science, Yasouj University, Yasouj. Iran

Polygalaceae (Fabales) has a worldwide distribution, subdivided into three tribes: Carpolobieae, Moutabeae and Polygaleae, 27 genera and ca. 1200 species in the world [1]. Polygalaceae comprises only one genus and 7 species in the Flora of Iran [2]. Pollen and seed morphological character of Polygalaceae has been reported as taxonomically informative, and used as diagnostic traits at different taxonomic ranks [3]. In the current study, the pollen grains and seeds of two hyrcanian species of *Polygala*: *P. anatolica* and *P. platyptera*, were examined using light (LM), scanning electron microscopy (SEM) and stereo microscope. Results show that the pollen grains are monad; medium in size; Isopolar, polycolpate. The outline of pollen grains is ovate-cylindrical from equatorial and round- from polar views. Number of colpi varies from 10 to 12 colpies in *P. platyptera* and 12 to 14 colpies in *P. anatolica*. The shape of pollen is prolate-spheroidal in both species. The sculpturing pattern changes from psilate-granulate in equatorial and reticulate in polar (apocolpial area) walls. Differences in lumina dimension, muri thickness; gibbous or indent operculums from equatorial view are diagnostic characters between the two studied species. Based on the present seed morphological study aril appendages and its numbers; seed length and texture; its fine, straight short hairs, with variable length are important criteria for separating the two species. Our finding revealed that both palynological and seed morphological evidences are good tools for species identification.

Keywords: Hyrcanian forests, Palynology, Polygalaceae, *Polygala anatolica, Polygala platyptera,* Seed morphology

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Designing and characterization of a novel KDR-binding peptide

Ali Hamrahi[1], Hossein Ghafoori[1], Kamran Mansoori[2], S. Mohsen Asghari[1]*
[1] Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran
[2] Medical Biology Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

Angiogenesis is essential for tumor growth, invasion and metastasis. Tumors develop their own blood vessels to provide sufficient amount of nutrition and oxygen. The new vascular supply also provides the opportunity for tumor cells to penetrate into the circulation resulting in distant metastasis. The Vascular Endothelial Growth Factor (VEGF) family play an important role in angiogenesis, lymphangiogenesis, and vasculogenesis. In human, VEGF family consist of VEGF (or VEGF-A), VEGF-B, VEGF-C, VEGF-D, and placental growth factor (PlGF). VEGF-A (VEGF) is the major regulator of endothelial cell (EC) function, by mediating processes related to survival, proliferation, adhesion and migration, all of which germane to functional and responsive vasculature, and all occurring downstream of receptor activation: VEGF receptor 1 (VEGFR1) is mostly involved with precursor recruitment and intercellular communication, namely with macrophages and monocytes, whereas VEGFR2 activity underlies endothelial-specific functions. Based on binding domain of VEGF-A to VEGFR2, we designed a novel peptide antagonizing VEGF-A to attenuate breast tumor growth.

The breast tumors subcutaneously implanted into the flank of Balb/c mice. The animals (n=6) received 0.5, 2 and 10 mg/kg dosages of the peptide intraperitoneally every day, and the control group received PBS at the same condition, for twenty days. The tumor volume was measured every five days by a digital vernier caliper, using the following formula: $v= a^2 \times b \times 0.52$.

The average tumor volume in the treated groups (2 and 10 mg/kg) were significantly lower compared with the PBS-treated controls ($P<0.0001$).

According to the results, the peptide was able to control the rate. Dosages 2 and 10 mg/kg exhibited no significant differences in tumor volume regression but showed significantly reduced tumor size compared to the control group.

Keywords: Peptide design, KDR, Angiogenesis, Tumor Growth

Cell Surface Display of Green Fluorescent Protein as a Widely-used Biological Reporter

Alireza Esmaeili, Ali Foroutan Kalourazi, S. Shirin Shahangian, Reza H. Sajedi*

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

Cell surface display systems are applied to express a protein or peptide on the cellular surface of prokaryotes and eukaryotes which have been used for many different biotechnological and biomedical applications. As one of the most widely-used reporter proteins, Green fluorescent protein (GFP) has attracted much attention in a wide range of analytical applications in diverse research areas. This protein contains 238 amino acid residues, three of them (65-67) form a structure that emits visible green fluorescent light. Owing to its intrinsic fluorescence, GFP is a powerful tool for cell-based assays, allowing real-time analysis of molecular events. GFP possesses main advantages over conventional fluorescent probes, including non toxicity and successful expression in bacterial cells. In this research, by using recombinant DNA technology, the GFP gene has been inserted in pET21a vector containing gene encoding InaK, followed by transformation into *E. coli* BL21 (DE3). *E. coli* cells were induced with IPTG and cultured at 15°C for 24h. InaK/GFP fusion protein was efficiently expressed on the cell surface of bacteria, and showed a considerable fluorescent emission in the green portion of the visible spectrum at 509nm. Here we showed that the surface-anchored GFP retains its fluorescence capability. This efficient reporter system could be very useful in many biotechnological applications and used as a whole-cell based biosensor.

Key words: Cell surface display; GFP; Fusion protein; Biosensor

The expression of DNA repair genes under the influence of UV rays in *Deinococcus radiodurans*

F. zeinali[1], *M .Mehdipour Moghadam* [2]

[1]MSc student University of Guilan

[2] Assistant Professor University of Guilan

The use of resistant bacteria to radiation for bioremediation of the environmental and radioactive waste is very important due to their survivability and catalytic efficiency under high stress conditions. *Deinococcus radiodurans* is one of the most radioresistant microorganisms and able to survive in radioactive environments where other organisms are unable to grow .The ability of this radioresistant bacterium to survive high levels of UV radiation has been related to their strong DNA repair systems. For example *PprI* is one of the newer known genes in *Deinococcus radiodurans* that plays a major role in the DNA repair and resistance of this bacterium to UV radiation . The aim of this study was to investigate the expression of DNA repair genes affected by UV radiation.

Methods: *Deinococcus radiodurans* IBRCM1086 was prepared from Iranian Biological Resources Center, then was activated and cultured in TGY medium and exposed to UV (250nm) with intensity of 10 J/cm^2 at different times (0 -30 -60 -120- 240 sec). From each sample the RNA was extracted using Trizol and cDNA synthesized. RT-PCR was performed and the PCR products was electrophoresed on 2% gel agarose.

Results: The results of this study showed that expression level of DNA repair genes was changed. Although future studies are needed.

Key words: bioremediation, UV radiation, UV-resistant bacteria, *Deinococcus radiodurans*

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Comparison of antioxidant activity of aqueous and hydroalcoholic extracts of three species of green-blue algae, green algae and red algae of northern Iran water reservoirs

Fatemeh Moradi [1], *Mahmood Reza Aghamaali* [2], *Mahvash Hadavi* [3]
1- Ph.D. in Biochemistry, Faculty of Basic Sciences, University of Guilan
2- Associate Professor, Department of Biology, Faculty of Basic Sciences, University of Guilan
3- Ph.D. in Tissue Engineering, Faculty of Basic Sciences, University of Guilan

Abstract

Identification of new sources of healthy and inexpensive antioxidants of natural origin is of great importance. Today, algae are an excellent source of bioactive compounds with antioxidant properties. Antioxidants with scavenging properties of free radicals play an important role in the prevention or treatment of oxidative diseases. In this study, the antioxidant activity of aqueous, methanolic and methanolic (80%) extracts of three algae species *Spirulina* sp. (green-blue microalgae), *Spirogyra* sp. (Green algae) and *Gracilaria gracilis* (Red algae) collected from water resources of northern Iran. DPPH radical scavenging was used to measure antioxidant activity. The results showed that the studied samples had different degrees of antioxidant potential, with the highest antioxidant activity of 80% methanol extract (86.80 ± 0.63%) belonged to *Spirogyra* sp. green alga. As a result, it can be a good source of high antioxidant properties for use in various medical, pharmaceutical and cosmetic industries.

Keywords: Antioxidant, Free radicals, Algae

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Vetiver essential oil and its bioapplications

Fatemeh Vahedi, Afshar Mohammadian

Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

Chrysopogon zizanioides L. Roberty (*Vetiveria zizanioides* L. Nash), commonly known as khuss, is a perennial grass which belongs to Poaceae family. *C. zizanioides* has long linear leaf, straight stem and fast grown fibrous root. Root essential oil is one of the reasons that universalized vetiver. It has several chemical compositions which increase the importance of vetiver with different applications. The aim of this study was investigating the quality and quantity of the chemical compounds of vetiver. For this purpose, several articles have been used from various scientific data bases related to the essential oil of vetiver. The results showed that there were 3 main groups of chemical compounds in vetiver including sesquterpenes (3-4 %), sesquterpenols (18-25%) and sesquterpenones (7-8 %). Among these, the most important compounds were khusimol, α- vetivone, β-vetivone, β-vetivenene and khusimone which the 3 first compounds consisted of about 35% of the essential oil of vetiver. The extract of vetiver root had considerable antioxidant activity due to the high amount of α- vetivone, β-vetivone and β-vetivenene. Additionally, vetiver extract can be used as almost a safe herbicide and pesticide material in the ecosystem with lower side effects compared with synthetic materials.

Key words: *Chrysopogon zizanioides* L.,Vetiver, Chemical composition, Essential oil, Antioxidant

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Investigation of CD33 rs3865444(C) gene polymorphism associated with Alzheimer's Disorder (AD)

Fatemeh Heidari[1], Farzam Ajamian[2], George Ansstas[3]

1. *M.Sc. Student of Molecular Genetics, Department of Biology, Faculty of Basic Sciences, University of Guilan, Rasht, Iran*
2. *Assistant Professor, Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*
3. *Assistant Professor, Division of Oncology, Department of Medicine, Washington University school of Medicine, St. Louis, Mo, USA*

Corresponding author E-mail: fatemeh.heidary74@yahoo.com

Alzheimer's disease (AD) is the most common neurodegenerative disorder and the leading cause of dementia among elderly. AD affects nearly 50 million people worldwide. In 2011, two genome-wide association studies (GWAS) identified a single-nucleotide polymorphism (SNP) located at 373_{bp} upstream of CD33, rs3865444, as associated with Late Onset Alzheimer's Disease (LOAD) risk. CD33 is a type I trans-membrane protein belonging to the Sialic acid binding immunoglobulin-like lectins (Siglecs) family, which is thought to mediate the cell–cell interaction and to inhibit normal functions of immune cells. In the brain, CD33 is mainly expressed on microglial cells, and compelling evidence implicating that CD33 facilitates Aβ-related pathology in AD by impairing microglia-mediated Aβ clearance. Polymorphisms of CD33 have been implicated in modulating AD susceptibility and the pathology of LOAD. rs3865444C is a common allele (> 70%) and has been found to be associated with an increased risk of AD in European, Chinese, and North American populations in four large-scale GWAS. This allele has also been tied to more severe cognitive decline in AD and lower Mini–mental state examination (MMSE) scores. The studies showed that the C allele of SNP rs3865444, which caused the elevation in CD33 levels, was associated with a greater burden of fibrillar amyloid in older asymptomatic individuals and with neuritic amyloid plaques in the brains of older individuals at autopsy. The aim of this study is to investigate the association of CD33 rs3865444(C) gene polymorphism with Alzheimer's Disorder (AD) occurrence in an Iranian population. Genomic DNA was extracted and the allele and genotype frequencies in both groups were determined using Amplification refractory mutation system-polymerase chain reaction (ARMS-PCR) method. Final results will be analyzed after gathering all investigated data.

Keywords: AD; CD33; Polymorphism

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Ecological effects of breakwater in Bandar Anzali on diversity and abundance of macro-invertebrates

Fariborz Sayyadoghly[1], Nader Shabanipour[1], Sakineh Alijanpour[2], Rahman Patimar[2], Alireza Mirzajani[3]

1- Department of Biology, Faculty of Science, University of Guilan.
2- Department of Biology, Gonabad University.
3- National Inland Water Aquaculture Institute

Abstract

This study was carried out in order to investigate the impact of Bandar Anzali's breakwater on the diversity and abundance of Macro-invertebrates. Twelve stations were selected in both sides of the breakwater wall and sea bottom. The sampling was carried out from November 2017 until August 2018, seasonally. From sea bed stations in the sea side, the bivalve species *Cerastoderma glaucum* and Amphipods like *Stenogammarus compersus* were observed in all stations with an average 344.1 ± 11.6 and 7.77±55.9 $n.m^{-2}$, respectively. The worm species *Streblospio gynobranchiata* with abundance of 33.3 ± 42.5 $n.m^{-2}$ was found only in the estuary section. Among the Macro- invertebrates on the breakwater wall, *Mytilaster lineatu*s and *Mytilopsis leucophoeata* were found on the sea side and in the estuary side, respectively. Their abundance had not significantly vary in different seasons. The Amphipod *Melita mirzajanii* and *Hediste diversicolor* were also frequent on the wall of breakwater with 4106±1878 and 495±110 $n.m^{-2}$, respectively. The crustacean and worms had more abundant in summer 2018 than other seasons. According to ecological indices, species diversity was more in the sea side rather than the estuary side for both habitats; the sea substrate and the wall. Furthermore, the species diversity was more in the wall of breakwater rather than sea substrate. The artificial constructs such as breakwater have an important role to increase of the species diversity.

Keywords: Bandar Anzali, Breakwater, Macro-invertebrate, Diversity, Abundance.

Morphological study of the selected species of the genus *Ribes* (Grossulariaceae) and their taxonomic applications

Kosar Rezaee chamani, Marzieh Beigom Faghir
Department of Biology, Faculty of science, University of Guilan, Rasht, Iran.

The genus *Ribes* comprises**,** approximately ca.150 species of shrubby plants with strikingly diverse floral and fruit features, distributed in the temperate regions of the Northern hemisphere and South America. It consists of ca. 10 species in the area covered by Flora Iranica, 4 representatives and 2 endemics in the Flora of Iran. These species occur in N, NW, NE, C and SE of the country.

This study deals with morphological survey of the two species of the genus *Ribes* including: *Ribes biebersteinii* and ***R. uva.-crispa*** in Iran. The first species is distributed in N (Guilan and Mazandaran provinces) and NW(Azerbaijan provinces) and the second representative is found in N (Mazandaran provinces) of the country. We used both freshly collected and dried herbarium samples. The studied specimens were identified and their detailed study was carried using light and digital microscopy. This includes the photographs of flower and other parts of the specimens. In the next stage, the morphological traits were carefully examined. These characters were presented in morphological table. The result showed that presence and absence of spine in stem; leaf blade length, position of hairs of the leaf; petiole length; shape and length of petal; ratio of stamen length / calyx length; shape of style are the most important diagnostic characters of the two species. Our findings support previous taxonomical treatment of the genus. The diagnostic characters mentioned above are taxonomically informative and can clearly separate the two species.

Keywords: Grossulariaceae, Morphological, Iran, *Ribes* , Taxonomiy

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Cytotoxicity of Layered Double Hydroxide nanostructures as a drug delivery system

Koorosh Jahanban[1], S. Shirin Shahangian[1], Reza H. Sajedi[2]*

1. *Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*
2. *Department of Biochemistry, Faculty of Biological Sciences, Tarbiat Modares University, Tehran, Iran*

Two-dimensional inorganic nanolayers, also known as clay minerals or inorganic clay or layered double hydroxy salts are mainly synthesized through co-precipitation and ion exchange methods. These nanostructures have attracted great interest in numerous biomedical applications, including drug delivery. Accordingly, their toxicity levels would be important to be measured. In this study toxicity level of 3 different types of layered double hydroxide was measured on mouse fibroblast cell line (L929) using MTT assay. Cells were cultured at 37°C in 5% CO_2 in the flasks containing 5 mL of Dulbecco's modified Eagle medium supplemented with 5% fetal bovine serum and 2% Penicillin/streptomycin. Cells were trypsinized and plated at a density of approximate 6×10^3 cells per well in a 96-well plate. The number of viable cells was determined by MTT assay with 3-(4,5-dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide. After incubation at 37°C in a 5% CO_2 for 24 hours, cells were treated with various concentrations of ZnAl LDH, AgZn LDH and NiCr LDH (2mg/mL, 1mg/mL, 0.5mg/mL, 0.25mg/mL and 0.125mg/mL) and incubation continued for more 24 hours and then each well was incubated with 10 µL (5 mg/mL) of MTT dye solution for 4 hours at 37°C. After removal of MTT solution, cells were treated with 100 µL of dimethyl sulfoxide, and the optical density absorbance at 490 nm was quantified using a microplate reader. Results showed that most LDHs have no toxicity, even if they have it is in lower concentrations needed for drug delivery.

Keywords: Layered Double Hydroxide; drug delivery; toxicity; MTT assay

A new species of *Phoreiobothrium* Linton, 1889 (Cestoda: Onchoproteocephalidea) off southern Iran.

La'ya Javadi and Mohammad Haseli

[1] Department of Biology, Faculty of Sciences, University of Guilan P.O.Box: 4193833697, Rasht, Iran

** Corresponding author: haseli@guilan.ac.ir*

Abstract

The cestode order Onchoproteocephalidea includes many genera some of which possess the armed bothridia. Of the hook-bearing taxa, the genus Phoreiobothrium is known to have four bothridia each of which possesses a pair of tripronged hooks, an anterior region in form of a sucker, and a post-hook region with the anterior and posterior loculi. In the Persian Gulf, only one species of *Phoreiobothrium* has been recently described and from this point of view information on the diversity of this genus is so limited. In the present study, a new species of *Phoreiobothrium* is described from the spiral intestines of 35 mature individuals of the shark species *Carcharhinus dussumieri* (total length: 48-95 cm) collected from the Persian Gulf in 2007. The new species most closely resembles *P. golchini* and *P. rozatii* described respectively from *Rhizoprionodon acutus* and *Carcharhinus macloti* both off southern Iran. Nonetheless, the new species is distinguished from *P. golchini* by the length and width of the bothridia and that it differs from *P. rozatii* in the length and width of the cirrus sac and having a thicker vagina. Considering this new species, the number of valid species of *Phoreiobothrium* is 17 of which two species are distributed in the Persian Gulf.

Keywords: *Carcharhinus dussumieri*, *Phoreiobothrium*, new species, Iran

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Synthesis 5-Amino-1,3,4-thiadiazole-2-thiol -based compounds to induce apoptosis by reducing the expression of anti-apoptotic HSP70 protein in human breast cancer cells

Mohaddeseh Baravordeh[1], *Hossein Ghafouri*[1] *and Asadollah Mohammadi*[2]

[1] *Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran*

[2] *Department of Chemistry, Faculty of Sciences, University of Guilan, Rasht, Iran*

Apoptosis is the major form of programmed cell death and contributes to the development and the proper functioning of multicellular organisms through the removal of unwanted or harmful cells. The process of apoptosis is used to kill harmful cells such as virus-infected cells and cancer cells by cytotoxic T and natural killer lymphocytes. Breast cancer is the second most lethal cancer to women worldwide. Apoptosis plays an integral role in the removal of unwanted cells and evasion of cell death is a hallmark of cancer. A promising approach for the treatment of breast cancer would be to take advantage of the susceptibility of these cells to drugs that induce apoptosis. It is then necessary to identify new and more specific compounds. New drugs designed to induce cell death may represent a more effective therapeutic options for the treatment of breast cancer. The HSP70 family of heat shock proteins consists of molecular chaperones of approximately 70 kDa in size that serve critical roles in protein homeostasis. Hsp70 is an anti-apoptotic protein abundantly and preferentially expressed in malignant human tumors. Solid lipid nanoparticles (SLNs) are novel drug carrier system with submicron size particles. SLNs are considered as substitute carriers to traditional colloidal systems, for controlled and targeted delivery. Inhibiting HSP70 has been set up as a therapeutic strategy for control of cancer. Accordingly, the present study aimed at design, synthesis and evaluation of new thiadiazole derivatives as potential apoptosis inducers. To this aim, two bioactive thiadiazole -based compounds were synthesized using 5-Amino-1,3,4-thiadiazole-2-thiol and some aldehydes such as 4-nitrobenzaldehyde and 4-chlorobenzaldehyde by the condensation reaction under reflux conditions. The structure of synthesized compounds was characterized and confirmed by the FT-IR analysis. Potential measurement Particle size of the SLN was measured by laser light scattering technique using particle size analyzer. Polydispersity index (PI) and zeta potential (ZP) of the nanoparticle were measured by dynamic light scattering technique using Micro Trace NANOFlex and Micro Trace ZetaCheck. High drug encapsulation efficiency (98–99%) was achieved by the centrifugation method. The absorbance was measured at 264 nm in a UV spectrophotometer to calculate the entrapment efficiency.

Keywords*:* 5-Amino-1,3,4-thiadiazole-2-thiol, Apoptosis, HSP70, Cancer and SLN

Evolution of the effect of Curcumin on the expression of hcp and vgrG genes in *Aeromonas hydrophila*

Mohadeseh Salehzadeh, Hojjatolah Zamani

Department of Biology, Faculty of Science, University of Guilan, Iran

Aeromonas hydrophila is an oxidase-positive, Gram-negative rod which is found in fresh and brackish water, sewage, soil, and foodstuffs. Type 6 secretion system (T6SS) of *Aeromonas hydrophila* plays an important role in bacterial virulence, and immunization of animals with the T6SS effector hemolysin co-regulated protein (Hcp) protects them against lethal infections with wild-type bacteria. T66S functions analogously to a phage tail, allowing injection of virulence factors into host cells via valine glycine repeat G (VgrG) proteins and hemolysin-coregulated protein (Hcp), which functions as a pore-forming protein when secreted.

Curcumin, a polyphenolic compound derived from dietary spice turmeric, possesses diverse pharmacologic effects including anti-inflammatory, antioxidant, anti-proliferative and antimicrobial activities. Reduction of bacterial virulence using curcumin has been reported, previously. In this work, the possible effect of curcumin on the expression of *Hcp* and *VgrG* genes in *A. hydrophila* will be investigated using quantitative reverse transcription-polymerase chain reaction. We expect that treating *A. hydrophila* with curcumin at sub-inhibitory concentration could decrease the expression of *hcp* and *vgrG* genes and thus, reducing the pathogenesis of A. *hydrophila*.

Keywords: *Aeromonas hydrophila*, Curcumin, *hcp*, *vgrG*.

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A study of *Rhizoprionodon Oligolinx* Infection with *Anthobothrium* Van Beneden, 1850 in the Persian Gulf

Mohammad Sadeghi Komachali and Mohammad Haseli

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

The order Tetraphyllidea has a wide diversity the species of which are distributed in different marine localities. The members of this order use sharks and batoids as final hosts. This order has many genera one of which namely *Anthobothrium* possesses four unarmed bothridia with craspedote proglottids. At the level of the Persian Gulf, there is no information on this genus. In this study, the specimens of two new species of *Anthobothrium* were isolated from the intestines of 22 sharks belonging to *Rhizoprionodon Oligolinx* and the prevalence, mean abundance and intensity of each cestode species were calculated. Furthermore, *R. oligolinx* is presented as a new host record for the species of *Anthobothrium*. From one of the species which has a larger size, 5 specimens were isolated from one shark, thus, the prevalence and intensity were 20% and 5 respectively. The prevalence, mean abundance, and intensity of the second species of *Anthobothrium* the members of which had a smaller size were 100%, 9.2±7.4, and 4-22 respectively.

Keywords: Cestode, *Anthobothrium*, Persian Gulf, Shark, infection, *Rhizoprionodon*

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The impact of folic acid on eukaryotic translation initiation factor 4E (eIF4E) expression in the developing cerebral cortex

Mohammad Hafi Balagafsheh, Farhad Mashayekhi*
Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran;

The vitamin folic acid has been recognized as a crucial environmental factor for nervous system development. From the early fetal stages of the formation of the presumptive spinal cord and brain to the maturation and maintenance of the nervous system during infancy and childhood, folate levels and its supplementation have been considered influential in the clinical outcome of infants and children affected by neurological diseases. Central nervous system is one of the first organs in vertebrates developmental process. In this process, neural tube formation is the most important stage which is called neurolation. Studies have shown that taking folic acid supplement in pregnancy will protect embryos from NTDs during neurolation stage. Many genes have been shown to be involved in NTDs, such as MTR, MTHFR and eIF4e. eIF4e is located at chromosome 4q23 and plays a key role in translation and it seems to be necessary for other transcriptional factor to be upregulated in their protein synthesis. In this study mRNA levels of eIF4e expression in the brain of mice embryo in response to folic acid in embryonic days 13 and 17 have been evaluated. Total RNA was selectively isolated away from proteins and DNA using the Trizol reagent. Contaminating DNA is then removed from the RNA by using DNase-1. The RNA was reverse transcribed into cDNA using specific and oligo dT primers. Quantitative PCR using SYBR green was performed to quantify mRNA levels. Data will be analyzed using SPSS and GraphPad Prism.

Keywords: eIF4e, NTD, folic acid, developing cortex; mice

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Development of primordial germ cells in embryo and larva of *Huso.huso* (a sturgeon fish)

Mohammad Reza Sohrabi, Tooba Mirzapour, Shirin Jamshidi

Department of Biology, Faculty of Science, University of Guilan

Sturgeon are one of the oldest species of Actinopterygii and are known as living fossils (Grande and Bemis, 1991). Beluga from genus of huso and family of Acipenceridae is the biggest freshwater species in the world. There are reports of this fish with length of 6m. Naturally it takes 13 years for male and 15 years for female beluga to reach full sexual maturity (Artyukhin et al., 1979). They live in Caspian sea, Azov sea and Black sea. They return to the rivers of their birthplace in order to reproduction (Berg., 1948, Hensel & Holcik., 1997). Primordial Germ Cells (PGCs) are embryonic precursors of gametes that originate from vegetal pole of the egg. They migrate toward genital ridges during developmental stages. Germ plasm has maternal origin and contains some information that is essential for formation and differentiation of PGCs. These informations are as form of RNAs and proteins from which products and transcripts of Vasa, Nanos and Dead end (DND) genes can be listed. In these fishes, the PGCs migrate to the genital ridges after 22-cell stage on the yolk mass, passing along the gonadal ridge and through the somatic cells. They are transformed into spermatogonial stem cells in male and oogonial stem cells in female.

In this study in order to track PGCs from 1-4cell stage to formation of larvae and their migration to developing genital ridges, we inject fluorescein isothiocyanate-Dextran (mw500) to the vegetal pole of 1-4cell stage beluga fertilized eggs(Saito and Psenicka, 2015). We determine the locations where PGCs are most intensely present by the means of fluorescent microscopy; therefore we can extract PGCs from these locations and culture them for two weeks in L-15 or DMEM-FCS medium. For confirmation of PGCs, mRNA of cultured cells will be extracted and the expression level of Vasa and Nano genes determined utilizing Real-time PCR technique after 3 weeks. Given the long reproductive cycle and the long time it takes for this species to reach sexual maturity, this method can be used to transplant cultured PGCs into the gonad of species with a short reproductive cycle. The obtained information is useful for preserving endangered species and increasing the yield of economically justified species in fish farms.

Keywords: primordial germ cells, Sturgeon, differentiation

The floristic study of the ecotourism region of Saqalaksar (Guilan province)

Moammadreza Ajamian[1*], *Marzieh Beygom Faghir*[1]

[1]*Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran.*

The Hyrcanian (Caspian) province on the northern slopes of Alborz Mountains, N Iran, unlike the arid and semiarid landscapes throughout most of Central and Southern Iran [1], is one of the remnants of natural closed-canopy deciduous forests in the world. The south Caspian forests, which form a long and narrow vegetation belt on the northward slopes of the Alborz Mountains, are characterized by a Euro-Siberian flora unique to Iran [2]. Saqalaksar located to the far south east of Rasht and north east of Shaft. The area study is 280 hectars containing both aquatic and terrestrial landscapes. This region, like many other mountains of Guilan province has a European - Siberian (Hyrcanian) climate. Residing in Guilan, puts this place in a wet Caspian climate with high precipitation and a good flora and good place. This place is in lowlands with maximum altitude of 150 meters. Most important species of the temperate broad-leaved deciduous trees, of which some are thermophilous Tertiary relicts of Hyrcanian forest, include *Ruscus hyrcanus*, *Parrotia persica*, *Quercus castaneifolia* and some other Asian subtropical trees such as *Gleditsia caspica* also present in this area. Most important families are Poaceae, Asteraceae, Rosaceae, Lamiaceae. We predict that the richest families were Poaceae with 16%, Asteraceae with 10.3%, Lamiaceae with 6.3% and Rosaceae with 5.8%, respectively. Considering life form spectrum, the most proportion of life forms belonged to, phanerophytes (50%), hemicryptophytes (22%), cryptophytes (15%), epiphytes (8%) and therophytes (5%), respectively. Likewise, the highest proportion of chorotypes belonged to pluriregional elements, followed by Euro-Siberian and Irano-Turanian elements. Since the studied forests in the current investigation are considered as remnants of lowland Caspian forests which had been dominated by *P. persica* and conservation policies are quite necessary to protect these very important vulnerable and sensitive ecosystems and to eliminate all dangers and pollutions threatening them.

Key words: Flora, Guilan, Life form, Lowland forest, Saqalaksar

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Leaf surface and root longitude changes of *Vetivera zizzanioedes* and *Canna indica* plants in response to irrigation with industrial wastewater

Morteza Mohammadi, Sahebeh Hajipour, Mohaddeseh Momenzadeh, Mansur Afshar Mohammadian

Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

Abstract

Vetiver with scientific name of "*Vetivera zizaniodes*" is a weed and perennial plant species which has high environmental compatibility. This plant has the ability to absorb various environmental pollution including heavy metals, and it can grow under different environmental stresses. *Canna indica* is a tropical and semitropical plant species which has the ability of growing in soil polluted with heavy metals. The purpose of this study was the evaluation of leaf surface variations and leaf and root longitudinal growth in *V. zizaniodes* and *C. Indica* in response to irrigation by industrial wastewater. To reduce stresses arising from picking and transferring, plants were irrigated first with water for one month and then with industrial wastewater. Soil analysis done using ICP-OES method and measurements of leaf surfaces (three regions of leaf including tip, middle and the end of the leaf) and longitude of leaf in 7 steps and the longitude of roots have been measured for control and treatment plants. The results showed that significant increasing in plant's leaf longitude as well as the leaf area and root longitude occurred in treated plants with wastewater compared with the control plants. In following, we will evaluate the relationships between variations of leaf longitude and leaf area and the root longitude in relation to heavy metals in *V. zizaniodes* and *C. indica*.

Key words: *Vetivera zizaniodes*, *Canna indica*, monocot, industrial wastewater

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Extraction of polyhydroxybutyrate (PHB) from Spirulina microalgae by green solvent

Marzieh Pourbaba, *Akbar Norastehnia*

Department of Biology, Faculty of Science, University of Guilan, Rasht, Iran

Abstract

The term biodegradable means substances that are simply decomposed by the activity of organisms into their constituent units and therefore do not remain in the environment. Many biodegradable polymers such as PHB is produced and stored by many microorganisms. NADES as a green solvent can be use for extract of PHB from Spirulina microalgae. NADES consists of two or more common natural products that form a liquid by mixing in a specific molar ratio. The purpose of this experiment was to extract polyhydroxybutyrate from the Spirulina microalgae by green solvent. NADES, such as lactic acid: glucose: water in the ratio of 6: 1: 6 and choline chloride: propionic acid in the ratio of 2: 1, were used in this experiment. The results of this study showed that lactic acid: Glucose: water is a good solvent for extraction of PHB from spirulina algae. Choline chloride: Propionic acid is also not a good solvent for extraction due to its low solubility and Also because it is not economical when used in large volume.

Keywords: NADES, Spirulina, Green Solvent, PHB

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Taxonomic position of *Sedum rubens* complex using palynological and anatomical traits

Maryam Mohammadi Shahrestani[1]*, Marzieh Beygom Faghir[1], Mostafa Assadi[2]
[1]Department of Biology, Faculty of Science, University of Guilan, P.O. Box: 41335-1914, Rasht, Iran;
[2]Research Institute of Forests and Rangelands, P.O. Box: 13185-116, Tehran, Iran.

In the current investigation, a detailed observation in pollen morphology and anatomy of *Sedum rubens* complex (including *S. rubens*, *S. hispanicum* and *S. pallidum*) are presented using light (LM) and Scanning electron microscopy (SEM). The large cosmopolitan genus, *Sedum* L. belongs to the family Crassulaceae and subfamily Sedoideae. It comprises ca. 420 species, constituting one third of the family diversity. The circumscription of the genus has been a matter of controversy resulted in to existence some species complex. Within this genus, the systematic position of *S. rubens* group is controversial in different literatures and it's species delimitation is still not clearly understood. Our results support the segregation of the closely related taxa of this complex and show that palynological and anatomical features provide helpful information for distinguishing these species particularly with regard to contradictory data and a few morphological characters available for their discrimination. The following characters can serve to help delimit the studied taxa: the exine ornamentation patterns, polar axis length, pollen heteromorphism, stem and peduncle cross section, presence or absence of cortical bundles and starch storage cells in the stem, presence or absence of hypodermis and midrib region in the leaf cross sections.

Keywords: Anatomy, Palynology, *Sedum*, *S. rubens*, Systematic

Antioxidant activity of various extracts of *Taxus baccata*

Sariri, S. Shirin Shahangian Maryam Malbusi, Moslem Afsharnezhad, Reyhaneh*

Department of Biology, University of Guilan, Rasht, Iran

Oxidative stress is resulted from an imbalance between pro-oxidant and antioxidant defense systems, leading to the formation of toxic forms of oxygen and other free radicals. Different types of oxidative stress can cause the development of various chronic disorders, including atherosclerosis, cancer, aging, neurodegenerative disorders (Alzheimer and Parkinson's disease) and type 2 diabetes. Natural antioxidants in medicinal plants are potential candidates to prevent oxidative stress and reduce its harmful effects. This study was devoted to the determination of antioxidant activity of *Taxus baccata* using various extraction solvents. The air-dried and grounded leaves *Taxus baccata* were extracted by using three solvents: methanol, acetone and acetone-methanol. The antioxidant activity of the extracts was measured by investigating their DPPH radical scavenging potential. The results showed that various extracts of *Taxus baccata* have significant potential in DPPH free radical scavenging. The IC_{50} value for methanol, acetone and acetone-methanol extracts were 26.22, 9.98 and 2.28 mg/ml, respectively. These results suggest that the *Taxus baccata* can be considered a promising source of natural antioxidant agents for the management of oxidative damage, and for pharmaceutical and food purposes.

Keywords: *Taxus Baccata*; Reactive oxygen species; Antioxidant activity

A novel milk-clotting protease from *Onopordum leptolepis*

Mozhdeh Doosti, Moslem Afsharnezhad, S. Shirin Shahangian, Reyhaneh Sariri*
Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

The coagulation of milk by enzymatic methods is a basic step in the manufacture of most cheeses. Calf rennet, which contains chymosin as the main enzyme component, has been widely used for centuries as an aid in the cheese making process. However, the increasing cheese production and consumption, the high price and reduced supply of rennets have led to the search for alternative rennet substitutes from other sources. This work reports the detection and purification of a new milk-clotting protease from *Onopordum leptolepis*. The enzyme extract was prepared from the flowers of *O. leptolepis* using trituration in liquid nitrogen, homogenized at a ratio of 1 g per 3 ml of 100 mM sodium citrate buffer (pH 3.0). Milk-clotting activity (MCA) was analyzed by bovine milk at 40 ºC. The enzyme was purified via cation exchange chromatography. The homogeneity of the enzyme in all the fractions was assessed by SDS-PAGE. It was found that the crude extract displayed a good milk clotting activity (62.85 ± 3 U/ml). The enzyme was partially purified and showed an obvious milk clotting activity (36.66 ± 2.1 U/ml). The simple purification procedure together with the availability of the plant materials is cost effective in biotechnology. This approach could possibly be used for large-scale production of the enzyme, allowing a broad study of its various probable applications. Moreover, high milk-clotting ability of the protease, could therefore pave the way for its uses in the cheese industry as well as other food and biotechnological industries.

Keywords: *Onopordum leptolepis*; Milk-clotting activity; Purification

The effect of Alpha-Ketoglutarate on Differentiation of Mouse Spermatogonial Stem Cells In Vitro Culture

Mehdi Jahanbakhsh , Tooba Mirzapour, Morteza koruji, Fatemeh Ghasemian

Department of Biology, Faculty of Science, University of Guilan

Today, with the progressing of technology and industrialization of societies, various diseases have also emerged that threaten human life and healthy. Some diseases, such as cancers, can be controlled and improved by chemotherapy or radiotherapy. Cancer diagnosis patients usually will be infertile based on arrest in spermatogenesis process due to damaging effects of chemicals or radiation therapy. So, extracting spermatogonia stem cells (SSCs) from their testes, in vitro culturing of them and providing Optimizing conditions for their proliferation and differentiation is a new way to treat infertility. In this technique, spermatogonial stem cells that have been arrested in cell division are extracted from testis in different ways, and cultured under different conditions with addition of different factors. After proliferation and differentiation processes, the cells will be returned to the testis by transplantation technique. This technique is a new approach to treatment of male infertility in laboratory and is being studied on various animals. Today, designing a microenvironment that provides differentiation conditions for cells is very important. Alpha-ketoglutarate is an intrinsically mediated metabolite in the Krebs cycle. It acts as an energy donor, leading the biosynthesis of amino acids, a signaling molecule as well as a regulator of epigenetic processes and cellular signaling by binding to proteins.

In the present study, the effect of different doses of Alpha-ketoglutarate will be investigated on differentiation of spermatogonial stem cells from testis biopsies of mice. After extraction of SSCs by enzymatic digestion, these cells were cultured on Sertoli cells for three weeks. The medium is changed every three days and repeat at least three times for each group. The number and diameter of colonies are calculated at the end of each week. Expression of differentiated genes in pre-meiotic stage (with STRA8 gene), in meiotic stage (with Th2b gene) and in later meiosis stage and spermatid production (with Tp1 and Tp2 genes) are evaluated using Real-Time PCR at the end of each week (total of three weeks). Immunocytochemical technique is used to confirm presence of germ cells as well as Sertoli cells in culture system. Electron microscope images will be taken from the cultured cells. Differentiation of spermatogonial stem cells toward specific differentiated cells will be evaluated by Quantitative analysis of gene expression (Real-Time PCR).

Keywords: Alpha-ketoglutarate, Differentiation, Spermatogonial Stem Cells, Mouse

Biodegradation of dye solution containing C.I. Acid Blue 92 (AB92): Optimization of effective parameters using Taguchi method

Mahdi ghasempoor[1], *Akbar Norastehnia*[1], *Zahra Masoudian*[1]

1 - Department of Biology, Faculty of Science, University of Guilan

Removal of hazardous industrial effluents is one of the growing needs of the present time. Dyes are synthetic aromatic water-soluble dispersible organic colorants, having potential application in various industries. Dyes may significantly affect photosynthetic activity in aquatic life because of reduced light penetration and may also be toxic organisms due to the presence of aromatics and metals, chlorides, etc. In the present study, *Salvinia natans* showed to be able to remove C.I. Acid Blue 92 (AB92) from contaminated water. The effect of main variables such as the reaction time (1, 3, 5, 7 day), initial dye concentration (5, 10, 15, 20 mg/l), initial plant biomass (0.5, 1, 2, 4 g) and pH (2.5, 5, 7.5, 9) on dye removal efficiency was studied and optimized using Taguchi method. In this study the ability of sixteen experiments were required to study the effect of parameters on biodegrading of dye. Each of experiments was repeated three times to calculate signal/noise (S/N). The most effective parameter in comparison with others was determined. Interactions between factors were investigated. In this study, we also optimized the experimental parameters and chose the best condition by determination effective factors.

Keywords: *Salvinia natans*, Biodegradation, Azo dye

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LncRNA GAS5 5bp ins/del (rs145204276) genetic polymorphism in type 2 diabetic patients

Mahdis Kohsarian, Zivar Salehi, Behrang Motamed

Abstract

Diabetes mellitus (DM) comprises of a group of metabolic diseases characterized by impaired fasting glucose levels. Type 2 DM is more prevalent with 90% of adult cases being T2DM. genetic and environmental factors interact to contribute towards this epidemic Long noncoding (lnc) RNAs have varied functions including signaling, molecular decoys, scaffolding and guiding ribonucleoprotein complexes. lncRNAs are 200 nt in length and have distinct structural and spatial features which allow it to bind to DNA, RNA or protein partners. The lncRNA growth-arrest specific transcript 5 (GAS5) is a 5′-terminal oligopyrimidine class of genes which regulates cell growth, proliferation and survival. However, due to the presence of STOP codon, none of the transcripts are transcribed into protein and degrade via the non sense mediated decay (NMD) pathway when translation is initiated. GAS5 is encoded at 1q25, a locus displaying abnormalities in a number of cancers such as melanoma, prostate cancer and SLE. However, the role of GAS5 lncRNA in diabetes is not known. The rs145204276 is located at the transcriptional start site of GAS5, and because different genotypes of rs145204276 were shown to affect the expression level of GAS5. Assessment of polymorphism in GAS5 rs145204276 in 50 patient and 50 healthy individual will attempt by ARMS-PCR.

Keywords: diabetes type 2, GAS5, polymorphism, LncRNA

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Evaluation of the effect of curcumin on the expression of *AHA_3857* and *AHA_098* genes in *Aeromonas hydrophila*

Mahdieh Sobh Zahedi, Hojjatolah Zamani

Department of Biology, Faculty of Science, University of Guilan, Iran

Although considerable information is available on the nature and properties of toxins produced by Gram-positive bacteria, much less is known of the extracellular products of Gram-negative bacteria. *Aeromonas hydrophila* is a Gram-negative bacterium that can infect a variety of aquatic and terrestrial animals, including humans, with different disease outcomes. The organism is resistant to water chlorination and several antibiotics, specifically when it aggregates in biofilm, posing a potential public health threat. In fish, it affects several species, where it causes fatal hemorrhagic septicemia, a major freshwater disease affecting aquaculture worldwide. *A. hydrophila* produces a verity of virulence factors, which function together to cause disease in the host. The involvement of *AHA_3857* and *AHA_098* genes, the genes responsible for bacterial serine protease and metalloprotease, respectively, on the pathogenesis of *Aeromonas ssp*. has been demonstrated. Metalloprotease and serine protease activities are under quorum sensing (QS) control. QS is a mechanism of cell-to-cell signaling via the production of compounds known as autoinducers that allow a bacterium to ‘‘sense’’ its own population as well as the population of other bacteria in a given environment. Anti QS potential of curcumin has been reported, previously. In this study, we aim to investigate the effect of curcumin on the expression of metalloprotease and serine protease in *A. hydrophila* using qRT-PCR. In our opinion, curcumin could be regarded as a potent anti-QS agent and would inhabit proper expression of the protease genes and thus, decreasing bacterial virulence.

Keyword: *Aeromonas hydrophila*, Quorum sensing, Metalloprotease, Serine protease, Curcumin

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Study on the ability of *Salvinia natans* to remove C.I. Basic Red 46 (BR46) from contaminated water

Nahid Sharifi[1], *Akbar Norastehnia*[1] *and Zahra Masoudian*[1]

1 - Department of Biology, Faculty of Science, University of Guilan

Synthetic dyes have been widely used in many industries such as textile, paper, tannery, food and pharmaceutical. The effluent discharge from these industries has destructive effects on the environment and human health; reducing sunlight penetration and gas solubility in aqueous ecosystems and mutagenic and carcinogenic effects in living organisms. Phytoremediation is an environmental friendly and sustainable means of pollutant remediation through the using of plants. In this study, the ability of *Salvinia natans* for decolorization of Basic Red 46 (BR46) was evaluated. Effect of some operational parameter such as the reaction time (1, 3, 5, 7 day), initial dye concentration (5, 10, 15, 20 mg/l), initial plant biomass (0.5, 1, 2, 4 g) and pH (2.5, 5, 7.5, 9) on dye removal efficiency was studied and optimized using Taguchi method. Sixteen experiments were required to study the effect of parameters on biodegration of dye. Each of experiments was repeated three times to calculate signal/noise (S/N). In this study, we also optimized the experimental parameters and chose the best condition by determination effective factors. Based on the S/N ratio, the optimized conditions for dye removal were time 7 day, initial plant biomass 4 g and initial pH 7.5.

Keywords: *Salvinia natans*, Biodegradation, Azo dye

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The Enzyme-like Activity of a Functionalized/Reduced Graphene Oxide Nanostructure

Niloofar Jahandar Shamami[1], Ali Foroutan Kalourazi[1], S. Shirin Shahangian[1], Hojjatolah Zamani*

1. Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

Design and construction of artificial enzymes have received much attention in recent years and significant progress has been achieved. Since the properties of nanomaterials can be intentionally modulated by size, shape, compositions, as well as surface chemistry, these artificial enzymes exhibit versatile application potentials in the fields of sensing/bio-sensing, disinfection, therapeutics, etc. There is no doubt that 21st century is the era of graphene, one of the most studied nanomaterials, and the scope of its utility has grown remarkably over the past decade. The contemporary applications of graphene intersect a variety of disciplines including biomimetics and heterogeneous catalysis. The fabrication of graphene or its subtypes such as graphene oxide (GO) and reduced graphene oxide (rGO) with a range of nanoscale structures have opened new opportunities in developing highly efficient functional nanomaterials with catalytic performances similar to or even better than that of natural enzymes, in particular, peroxidases. In this study, Graphene oxide@ p-Phenylenediamine (GO-PPD) nanostructure has been introduced as a novel nanozyme with peroxidase mimic activity. The peroxidase-like activity of the GO-PPD nanostructure can be attributed to the acceleration of their electron-transfer process and the consequent facilitation of OH radical generation. Its kinetic parameters were measured using TMB (3,3′,5,5′-Tetramethylbenzidine) and H_2O_2 as substrate by monitoring the absorbance changes at 652 nm and kinetic analysis demonstrates that the catalytic behavior is in accordance with typical Michaelis–Menten kinetics. The K_m and V_{max} values of the enzyme-mimic GO-PPD for H_2O_2 substrate were obtained 9.34 mM and 6.8×10^{-3} $mM.min^{-1}$, respectively.

Keywords: Nanozyme, GO-PPD, Peroxidase-mimicking, Graphene-based nanostructure

Isolation, Proliferation and identification of derived -germ cells from gonad of mature Huso huso

Hediye Fadakar, Tooba Mirzapour, Shirin Jamshidi

Department of Biology, Faculty of Science, University of Guilan

The beluga (Huso huso) is a species of anadromous fish in the sturgeon family (Acipenseridae). The natural habitat of these species is mainly in the Caspian Sea, Black Sea, Azov Sea, and also in the Adriatic Sea (Holcik, 1989). They will return to the rivers from the sea, for reproduction (Berg.,1948, Hensel & Holcik, 1997). The sturgeons have a late sexual maturity, so that the male beluga will be mature in 12-14 years old and the female is fully matured in 16-18 years old (Holcik 1989). The revival of endangered species of sturgeon is not possible by the conventional techniques, due to the long cycle of reproduction. Primordial germ cells (PGC) are the progenitor cells that give rise to the gametes. This cell specification occurs via inheritance of maternally-provided gene products, known as germ plasm. The PGCs cells are larger than somatic cells and have a larger nucleus (Saito and Fujimoto 2006). The migratory route of sturgeon PGCs from their formation site to the gonadal ridge differs from that of anurans, but they were specified in a similar manner to those. Sturgeon PGCs migrate after Stage 22 on the yolk ball and extend toward the gonadal ridge via the mesenchyme. Such a migration pattern resembles that observed in many species of the Teleostei, in which PGCs migrate on the yolk ball around the border of the lateral plate mesoderm (Saito et all 2014).

In this study, testis biopsies, is extracted from adult Huso huso and digested enzymatically with trypsin and collagenase enzymes. Spermatogonial stem cells were isolated and cultured for three weeks in L-15 or DMEM-FCS medium. The presence of these cells in culture system is examined by immunocytochemistry after 3 weeks of culture. The mRNA of cultured cells will be extracted and the expression level of Vasa and Nano genes determined utilizing Real-time PCR technique. Optimal conditions for proliferation of these cells in culture system are evaluated by adding different growth factors. The best method for cryopreservation of these cells will be designed. In case of successful proliferation, germ cells can be transferred into the gonad of recipient fish with short sexual maturation. As a result of shortening sturgeons' maturity period, a reliable context will be provided for production of edible goods (i.e. caviar), formation of gene banks, and reducing the dependencies on restricted natural resources, etc.