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Abstracts

Nanobiosensors

Abstract#1 **Key Lecture**

New DNA Nano-Biosensors for Determination of Drugs and Detection of the Mechanism of Their Action

S. Zahra Bathaie

Department of Clinical Biochemistry, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran. Email: bathai_z@modares.ac.ir

DNA immobilization was considered as a fundamental methodology for the construction of DNA biosensors in the last decades. Firstly, DNA biosensors have been used for detection of some genetic diseases; hybridization was the basis for these investigations and determination of deletion, insertion or mismatch in specific genes has been reported in a lot of studies. However, application of these biosensors for the determination of drugs and DNA-drug interactions was used by us. Recently, we tried to determine the mechanism of drug action using these biosensors.

In addition to the various types of DNA (high molecular weight DNA or specific oligonucleotides), for the first time specific DNA secondary structures such as G-quadruplex (GDNA) were applied in our studies. All of our biosensors were based on the electrochemical techniques such as cyclic voltammetry and impedance spectroscopy, using conductive polymers and nano materials for making the biochemical electrodes.

The specific determination of some biochemicals (such as spermine) and drugs (such as taxol) and so on was done in our previous studies. Recently, we reported the interaction of G-quadruplex with various compounds; and in continue of this research, we classified the different groups of compounds according to their binding constant as intercalators or groove binding ligands. In the present lecture we will review some of the obtained data and published papers in this regard.

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Abstract# 2 **Key Lecture**

Application of Nanomaterials in Glucose Biosensors

Jafar Ezzati Nazhad Dolatabadi*

Research Center for Pharmaceutical Nanotechnology, Tabriz University of Medical Sciences, Tabriz, Iran.

Abstract

The application of nanomaterials in biosensors due to their versatility, stability, and selectivity areto the attention of many researchers.Among various biosensors, glucose biosensors have been considered as significant detection tools in clinics. The constant interest in glucose biosensors is due tothe significance of the continuous monitoring of blood glucose levels in diabetes mellitus. Application of nanomaterials, similar to other sensing platforms offered an option for use in glucose biosensors.Nanomaterials have a number of common inherent features as well as high surface to volume ratio, good electrocatalytic activity and high chemical reactivity. In addition, Nanomaterials facilitate the immobilization of glucose oxidase (GOx) on the surface of enzyme-based glucose biosensors. In this paper,recent advances in the manufacture of enzymatic and non-enzymaticglucose biosensors will be overviewed.

Key words: Biosensors; Glucose; Glucose oxidase;Nanomaterials.

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*The corresponding author, E-mail: ezzatij@tbzmed.ac.ir & ezzati_j@yahoo.com, Tel: +98 411 3367914, Fax: +98 411 3367929.

Abstract# 3 **Key Lecture**

New analytical applications of gold and magnetic/gold nanoparticle composites as labels for signal amplification in immunosensors

Kobra Omidfar

Biosensor Research Center,
Endocrinology and Metabolism Cellular and Molecular Sciences Institute,
Tehran University of Medical Sciences, Tehran, Iran
P.O. Box 14397/1179, Tehran,I.R. Iran
Tel: +98 21 88220037-38; Fax: +98 21 88220052
E-mail: omidfar@tums.ac.ir

Accurate and sensitive detection of the biomarkers is very important both for preclinical research fields and clinical diagnostics. Biosensors and nano-biosensor are among promising instruments which have been the subject of great interest and progress in recent years. In fact, micro and nanoscale biosensors have been designed with the aim of striving an effective mean of rapid, convenient and precise analysis of clinical samples for early diagnosis of disease. Nanoparticles (NPs) with different characteristics are among particular nanomaterials extensively deployed in various kinds of analytical techniques. Unique structural, electronic, magnetic, optical, catalytic and biocompatible properties can be attributed to their nanoscale dimension roughly in the range of 1–100 nm. Such splendid properties have specifically made them very attractive material, which can be used as a label or an appropriate platform for detecting analytes through colorimetric or diverse electrochemical techniques.For successful development of user-friendly tests with sufficient sensitivity, the type of label is very important. Fortunately, nanomaterial-based signal-amplification strategies hold great promise in realizing ultrasensitive detection due to their versatile properties. A large number of nanomaterials, including metal nanoparticles and carbon-based nanostructures can be utilized as labels in order to obtain the amplified electrochemical detection signal. Among the nanomaterials, gold nanoparticles and magnetic gold nanoparticles have been recently used as label in signal amplification thanks to their huge surface-area-to-weight ratio, remarkable conductivity and electronic properties. Given the

outstanding characteristics of AuNPs and magnetic gold nanoparticles and their potential applications in a wide variety of disciplines, synthesis of these particles has found a considerable interest in developing various kinds of detection methods, including optical, electro- chemical and rapid PoC tests.

Abstract# 4 **Lecture**

Fabrication, characterization and nanosensor properties of SnO_2, ZnO and CuO nanoparticles in the presence of Aspergillus niger Fungi

E.Azhir[1], R.Etefagh [1],*, N.Shahtahmasebi[1]

[1]Nano Research Center, Ferdowsi University of Mashhad, Iran

*r.etefagh@gmail.com

Abstract: In this paper, SnO_2, ZnO and CuO nanoparticles were prepared by sol-gel technique. The structural properties have been investigated by (XRD), (SEM), and (TEM) analyses. Then Aspergillus niger fungi were cultured in an appropriate medium and were exposed to these nanoparticles. The nano-system electric resistance was measured in the presence of produced gases and the effect of time and temperature factors on nano sensor were also studied.

Keywords: SnO_2, SnS_2, Aspergillus niger fungi, spray pyrolysis technique, biosensor.

Introducthion: The safety of Aspergillus Niger as production organism for food-high grade product has long been recognized. Due to severe lung problem which inhalation of A. Niger causes and the risk of its availability in food industry to human health, eliminating this micro organism would enhance the society health. The aim of this work was therefore designing a senor based on nano structured layers of metal oxides.

Synthesis of nanoparticles:1-nanoparticles of SnO_2 were preparedby sol-gel method. For this purpose, a precursor solution was prepared by using ethanol (C_2H_5OH, Merck, >99.9%)and deionized (DI) Water as solvent (1:1) followed byaddition of $SnCl_4.5H_2O$. Then citric acid and ethyleneglycol were used as polymerization and complexionagents, respectively.

2- ZnO nanoparticles were synthesized by refluxing solution of $Zn(NO_3)_2.6H_2O$, ethanol and double distilled water(1:1)were used as solvent and ethylene glycol and acetic acid were used as polymerization and complexion agents, respectively.

3- CuO nanoparticles were synthesized by sol–gel method. A precursor solution was prepared by use of ethanol (C_2H_5OH, Merck, >99.9%) and deionized (DI) water as solvent (1:1). Then, copper nitrate [$Cu(NO_3)_2.3H_2O$] was added. Citric acid and ethylene glycol used as polymerization and complexing agents, respectively.

Result: The films of SnO_2, CuO and ZnO were characterized by X-ray diffraction (XRD), Scanning electron microscopy (SEM). Then A. Niger fungi were grown in an appropriate medium and exposed to the synthesized samples in a closed glass vessel.

The biosensing properties of the nano-system were investigated by measuring their electric resistance at regular time intervals.

Conclusion: The considerable changes observed in the electrical resistance of the prepared samples, in the presence of A. Niger, support our proposed system as biosensor.The SnO2, CuO and ZnO nanobiosensor in the presence A. Niger fungi responds quickly as electrical resistance changes.

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Abstract # 5 **Lecture**

Detection of biomolecules using Au-Ag nanoparticles on the carbon nanostructures based on LSPR technique

Ghodselahi T, Hoornam S, Neishaboorynejad T, Arsalani S, Aghababaie N

School of Physics, Institute for research in fundamental sciences, PO Box 19395-5531, Tehran

Iranian Nano Mabna Inc.PO Box 41676600,Tehran

ghodselahi@ipm.ir&info@nanomabna.com Tel-Fax: 77894561

A nanoplasmonic molecular ruler is employed to measure nuclease activity and DNA foot printing has been introduced by Localized Surface Plasmon Resonance (LSPR) of gold and silver nanoparticles. In recent years, the LSPR spectroscopy advancements have provided a sensitive, flexible tool to probe biological interactions. A comparison between biosensor response of gold, silver and gold-silver nanoparticles on the amorphous carbon and carbon nanotube substrates is the aim of this research. Synthesis of gold and silver nanoparticles was carried out by RF-sputtering and RF-PECVD from acetylene gas and gold and silver target. The prepared nanocomposites were utilized as sensor chip to detect interaction between two types of osmolytes, i.e. sorbitol and trehalose, with Pesudomonace Cepacia Lipase (PCL) and DNA primer decamer (ten-deoxycytosine) at fM concentrations. The gold-silver nanocomposites are more sensitive to detection of DNA with respect to alone silver and gold nanoparticles. The shift of the LSPR peak for the silver and gold nanoparticles on the carbon nanotube substrate is stronger than nanoparticles on the amorphous carbon substrate. The response time of biosensor chips reduces with immobilization of gold and silver nanoparticles on the carbon nanotube. The LSPR of noble metal nanoparticles depends not only on the metal, the size and shape of the nanoparticle, but also on the surrounding local dielectric of nanoparticles and inter-nanoparticle coupling interactions. By utilizing these properties we detect biomolecules and their interactions. The detection of such weakly interaction between bio-molecules and low concentration bio-molecules cannot be achieved by other analysis.

Keywords: LSPR Biosensor, Au-Ag nanoparticles, carbon nanotube DNA ,Pesudomonace Cepacia Lipase

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Abstract # 6 **Lecture**

Synthesis and investigation of biosensor properties of gold nanoparticles based on surface plasmon resonance

S.Hoornam[1,2,3],T.Ghodselahi[1,2]

[1.] School of physics, Institute for research in fundamental science IPM,Tehran, Iran

[2]. Nano Mabna Iranian Inc, PO BOX:41676600, Tehran,Iran

3.Islamic Azad university, central Tehran branch, Tehran,Iran

Email: info@nanomabna.com; Telefax:(021)77894561

Gold nanoparticles (Au NPs) were prepared by co-deposition of RF-sputtering and RF-PECVD from acetylene gas and Au target. The hydrogenated amorphous carbon (a-C:H) thin film was used as intermediate material to immobilize Au NPs on the glass substrate. Deposition conditions were optimized to reach a two dimensional (2D) array of Au NPs with particle size less than 4 nm. These characteristics and surface morphology were investigated using Atomic Force Microscopy (AFM) data. The prepared array of Au NPs was utilized as a sensor chip to detect interaction between two types of osmolytes, i.e. sorbitol and trehalose, with Pesudomonace Cepacia Lipase (PCL). The detection mechanism is based on Localized Surface Plasmon Resonance (LSPR) in which the wavelength of absorption peak is sensitive to the refractive index of the environment of the Au NPs. This mechanism eliminates the use of a probe or immobilization of PCL on the Au NPs of LSPR sensor chip. The interaction between PCL and osmolytes can weakly change refractive index of the mixture or solution. We found that unlike to trehalose, sorbitol interacts with the PCL. This interaction increases refractive index of the PCL and sorbitol mixture. Refractive index of PCL in presence of different concentration of sorbitol is

obtained By Mie theory modeling of LSPR peak. Moreover, the detection of such weakly interaction between bio-molecules cannot be achieved by other analysis.

Keywords: gold nanoparticles, RF-PECV, biosensor, UV-Visible, SPR, enzyme, osmolyte.

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Abstract # 7 **Lecture**

Synthesis of Silver/Carbon Nanocomposite by RF Deposition and their biosensor properties based on LSPR

T. NeishabooryNejad[1,2,3], T. Ghodselahi[1,2], S. Arsalani[1,4,5]

[1.] School of physics, Institute for research in fundamental science IPM,Tehran, Iran

[2]. Nano Mabna Iranian Inc, PO BOX:41676600, Tehran,Iran

[3].Islamic Azad university, central Tehran branch, Tehran,Iran

[4].Islamic Azad university, Fars science and research branch, shiraz, iran

[5]School of Medicin,Bam University of Medical science, Bam,Iran

Email: info@nanomabna.com; Telefax:(021)77894561

Localized Surface Plasmon Resonance (LSPR) sensor chip of Ag NPs on the hydrogenated amorphous carbon (a-C:H) were prepared by co-deposition of RF-Sputtering and RF-PECVD using acetylene gas and Ag target. Deposition was carried out at constant RF power of 160 W and constant initial gas pressure of 0.04 mbar with different time deposition from 1 min up to 45 min. The AFM image and topography show change in morphology of sensor chip when Ag NPs content increases. AFM analysis and XRD profile indicates that Ag NPs have fcc crystal structure and mostly have spherical shape. Moreover the analysis shows that particle size is the same for different samples. Therefore LSPR wavelength of Ag NPs sensor chip depends to morphology of Ag NPs film and coupling of Ag NPs. We applied the prepared sensor chips to detect of a DNA primer at fM concentration based on breaking of inter-particles coupling of Ag NPs. A large sensitivity and a small response time was obtained for different sensor chips which were attributed to morphology feature and coupling of Ag NPs on sensor chip.

Key words: Silver nanoparticles, biosensor, surface plasmon resonance

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Abstract # 8 **Lecture**

The synthesis and characterization of magnetic nano gold and their application for antibody immobilization

Ahmadi[1] A., Shirazi[1] H., Pourbagher[1]N.,OmidfarK.[1*]

[1] Biosensor Research Center, Endocrinology and Metabolism Research Center, Cellular - Molecular Research Center, Tehran University of Medical Sciences, Tehran, I. R. Iran

[*]Corresponding author at: Endocrinology and Metabolism Research Center, Tehran University of Medical Sciences, P.O. Box 14395/1179, Tehran, Islamic Republic of Iran. Tel.: +98 21 88220037 38; fax: +98 21 88220052. E-mail address: omidfar@tums.ac.ir(K. Omidfar).

Background & Purpose: Gold (Au) Fe oxide core-shell nanostructure is a major class of nanoscale material that has attracted a considerable attention due to the biotechnological and biomedical applications and specific properties.

Materials & Methods: Here we synthesized the magnetite nanoparticles (MNPs) with an average size of 10-12 nm in diameter using the chemical co-precipitation of Fe^{2+} and Fe^{3+} in strong alkaline material(1).Then, an Au coated Fe oxide core-shell nanocomposite with an average diameter of 18-20 nm was produced in the presence of sodium citrate as the reducing agent(2-3).The structures of Au shell and magnetic core (Au–Fe oxide) were studied by transmission electron microscopy (TEM), X-ray diffraction (XRD) and fourier transformed infrared spectroscopy (FTIR).

Results: Results showed that the NPs were agglomerate-free and shaped regularly, with a narrow sized distribution. The Au-coated Fe oxide NPs exhibited a surface plasmon resonance peak in the range of 500-650 nm with a remarkable peak at 550 nm.

Conclusions: Immobilization studies with antibody (Ab) demonstrated that the Au Fe oxide core-shell nanostructure can be used to immobilize Ab, making them valuable for treatment and diagnosis applications such as biosensors(4).

Key Word: Au Fe oxide NPs, core-shell nanocomposite, antibody, immobilization

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Abstract # 9 Lecture

Selective determination of Dopamine in human serum by using molecularly imprinted polymer nanoparticles

Abouzarzadeh A, Jahanshahi M

Nanotechnology Research Institute, School of Chemical Engineering, Babol University of Technology, Babol, Iran

E-mail: mjahan@nit.ac.ir / mmohse@yahoo.com

In this worka rapid and selective method for the extraction and determination of Dopamine from human serum samples has been successfully developed using molecularly imprinted polymer (MIP) nanoparticles. Dopamine is neurotransmitter in the central and peripheral nervous systems. Clinical measurement of Dopamine in biological samples is useful for clinical diagnosis of pheochromocytoma and neuroblastoma of Parkinson's disease and in the investigation of stress systems. Since Dopamine in biological fluids only occurs in small quantities, the analytical methods developed for their determination should be both selective and sensitive. MIPs are porous polymeric materials that possess built-in molecular recognition capabilities. MIP nanoparticles have a small dimension with extremely high surface-to-volume ratio, so that most of the imprinted sites are situated at the surface or in the proximity of surface therefore MIP nanoparticles are very selective and sensitive.MIP nanoparticles were prepared using methacrylic acid (MAA) as functional monomer, trimethylolpropane trimethacrylate (TRIM) as crosslinking agent and Dopamine as a drug template by precipitation polymerization method. The produced polymers were characterized by Fourier transform infrared spectroscopy and scanning electron microscopy.The extraction was carried out by stirring serum samples with MIP nanoparticles. When the extraction was completed, the MIP nanoparticles were separated from the sample matrix. The analyte desorbed from the MIP nanoparticles was determined by HPLC.

Different parameters affecting the extraction efficiency were evaluated in order to achieve the optimal conditions. Results indicated that very uniform nanospheres with mean diameter of 94 nm were obtained.Under the optimal conditions, the dopamine limits of detection were at the 0.025-0.04 μM range. It was shown that the MIP nanoparticles had high affinity and selectivity toward dopamine in human serum.

Keywords: Molecularly imprinted polymer, Nanoparticles, Extraction, Human serum, Dopamine

Abstract # 10 **Lecture**

Recognition The Growth Phases Of Staphylococcus Aureus Using A Resistive Gas Sensor

Hosseini-Golgoo S. M.[1*], Shafiepour S.[2], Mahboobi A.[3], Saberkari A.[1]

[1.] Assistant professor in electrical engineering, University of Guilan, Rasht, Iran

[2.] MSc student in electrical engineering, University of Guilan, Rasht, Iran

[3.] Assistant professor in pharmocology, Shahid beheshti University, Tehran, Iran

* (Corresponding Author) Tel: 0131-3235651, 0912-2775095 Fax: 0131-3227022
Emails:smhosseini@guilan.ac.ir and smhosseini1@yahoo.com

A resistive gas sensor, TGS #813-Figaro co., has been used to identify four growth phases of *Staphylococcus Aureus* bacteria (*S.Aureus*)which is responsible for ear, nose and throat (ENT) infections when present in standard agar solution in the hospital. Swab samples were collected from the infected areas of the patients' ear, nose and throat regions. Gathered data were cultured in microbial control laboratory in Shahid Beheshti University. An innovative idea was investigated for detection of growth phases of *S.* Aureus containing lag-, log-, stationary–, and death phase. In some industries, like food and drug, exactly detection of a microbe culture is demanded. In traditional methods, the expert should count cultured microbe quantities in several times and then draw the obtained graph points, manually. Accordingly, these methods are complicated and waste time and laboratory instruments. In this work,we introduce a new method for this clinical complication which is based on produced gas concentration from each culture under incubator conditions. It is based on this principle that the produced gas concentration levelwhich is variedin each growth phase can be detected with a utilized commercial resistive gas sensor. The experimental data were recorded with a Lab view controlled Advantech device (USB/4711A). Analyzed data showed 95% compatibility in comparison to old methods. Using new method doesn't need an expert to recognize phase growth and is not time consumption more.

Keywords: Microbe detection, S. Aureus, ENT, Resistive gas sensor

Abstract # 11 **Poster**

Development of Aptamer based Biosensors

Varmira K.

Department of Radiopharmacy, Pharmaceutical Research center, Mazandaran University of Medical Sciences, Sari, Iran

Tel.& Fax: +98-151-3261244; E-mail:varmira@gmail.com

Biosensors using aptamers as biorecognition elements are referred to as aptasensors. Aptamers are single-stranded oligonucleotides that fold into distinct three-dimensional conformations capable of binding strongly and selectively to a target molecule. As molecular recognition probes, aptamers have been selected that have dissociation constants (Kd) in the nanomolar or picomolar range. In addition, aptamer technology offers several benefits, such as in vitro synthesis, spread range of targets, suitable stability under most environmental conditions, possibility of immobilization at high density and having a longer shelf life [1].An aptasensor requires at least to a signal transduction as well as aptamer. Metallic NPs, magnetic NPs, QDs, and CNTs are the signal transduction elements in these studies. Aptamer-based bioassays are classified as electrochemical, optical and mass-sensitive, according to their signal-harvesting method [2]. Among the developed aptamer-based nanosensors, metallic NPs such as gold nanoparticles (Au NPs) and silver nanoparticles (Ag NPs) are the most common [3]. To date, several aptasensor platform to detect of various target were designed. Among the different targets, thrombin, ATP, HIV-1 Tat protein, IgE, bacteria, viruses, neurotoxin, allergen trigger, VEGF are most important examples of biological target that have been detected with aptasensor [4-5].

Key words: Biosensing Techniques, Aptasensor, Oligonucleotide Arrays, Gene Chips

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Abstract # 12 **Poster**

Dobiobased Nanocomposites could help Processors detect multiple pathogens faster ?

Zahra Bankehsaz* and Seyed Housein Montazer

Mazandran University of Medical science–Sari - Iran

Tel: 0151- 2261702

Depatment of Biotechnology- Ecological Academic of Caspian Sea Faculty of Mazandran University of Medical science; Email:mbankzaz@yahoo.com

Background & purpose: Nanotechnology will become one of the most powerful forces for innovation in the food packaging industry & detect pathogens. One such innovation is biobased nanocomposite technology, which holds the key to future advances in flexible packaging. Biobased nanocomposites are produced from incorporation of nanoclay into biopolymers (or Edible films).

Advantages of biobased nanocomposites are numerous and possibilities for application in the packaging industry & detect pathogens are endless.

Materials &Methods: This provides a general review of previous works. Many of the works reported in the literature are focused on the production and the mechanical properties of the biobased nanocomposites

Result: A comprehensive review of biobased nanocomposite applications in food packaging industry should be necessary because nanotechnology is changing rapidly and the food packaging industry is facing new challenges. Little attention has been paid to gas permeability of biobased nanocomposites. Advantages of biobased nanocomposites are numerous and possibilities for application in the packaging industry are endless.

Conclusion: In regard to extensive research on Edible film, this article suggests investigating the replacement of biobased nanocomposites instead of Edible films in different areas of food packaging industry & detect pathogens.

Kaywords: Pathogen- Biobased nanocomposites -Edible film- Packing

Abstract # 13 **Poster**

Electrical contacting of enzyme redox center to the electrodes using DNA nanotubes

Sayyed Mohammad Musavi-Khattat[1] and Pooria Gill [2,*]

1. Department of Medical Biotechnology, Faculty of Advanced Medical Technologies; Golestan University of Medical Sciences, Gorgan, Iran

2. Department of Medical Nanotechnology, Faculty of Advanced Medical Technologies; Golestan University of Medical Sciences, Gorgan, Iran

Corresponding Author: Pooria Gill (PhD of Nanobiotechnology); pooriagill@yahoo.com

Background and Purpose: The electrical contacting of redox enzymes with electrodes has been the subject of extensive research in recent years, with important implications on developing biosensing enzyme electrodes, biofuel cells and bioelectronic systems[1–3]. Simultaneously various nanobiosensors have been designed based on DNA sequences, their mechanical and chemical properties, and structures of DNA such as DNA scaffolds[4], DNA tweezers[5,6], DNAzymes[7] and DNA nanotubes[8]. Here, we propose a new innovative method for the diagnosis of redox enzyme misfoldings at catalytic sites where a true folding, as a result of mutation or hereditary disease, has not been obtained.

Materials and Methods: DNA nanotubes have been used for connecting electrodes to the enezyme redox centre. The resulting electron current is evidence of enzyme activity in a constant concentration of substrate.

Electrons are transferred along DNA nanotube as a result of the conductivity property of DNA. This property can be optimized through alterations in temperature and improvements to the stability of nanotubes.[9]

Conclusion: Pervious methods of using single-walled carbon nanotubes have faced barriers resulting in an inability to achieve a true electron current from redox centres to the embedded elecrrodes. One such example is, defections in side walls of carbon nanotubes during modification process. This is an unnecessary step for DNA nanotubes because of their native building block structure.

Finally, using this shape of DNA hold great promise to make long-rage connections by ability to achieve a large current of electron referred to high aspect ratio of DNA nanotubes.

Keywords: *biosensor,nanotube, Electrode*

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Abstract # 14 **Poster**

High sensitive biosensor for ultra-determination of Atenolol, a gold nanoparticle-CNT modified glassy carbon electrode

[a]MahdiEmami, [b*]MojtabaShamsipur, [c]Reza Saber

[a]Department of chemistry, Tehran university, Tehran, Iran

[b]Department of chemistry, Razi university, Kermanshah, Iran

[c]Research center of medical science, Imam Khomeini hospital, Tehran, Iran

Address correspondence to mojtabashamsipur E-mail: mshamsipur@yahoo.com

Atenolol (ATN) is a cardioselective β-adrenergic receptor blocking agent. Detection of ATN is of a great importance in pharmaceutical research so several methods have been reported for detection of ATN including HPLC(1), GC (2), spectrophotometry(3) and voltammetry(4). Voltammetric methods are the most favorable methods for their simplicity, rapid response, low cost and high sensitivity. In this work we used combination of GNPs and CNTs to modify the surface of glassy carbon electrode and its response toward determination of ATN investigated by cyclic voltammetry, differential pulse voltammetry and Chronoamperometry methods.

It was observed that the synergetic effects of GNPs and CNTs highly improved the electrochemical response and the sensitivity of the sensor. The effect of experimental parameters including CNT amount, GNPs electro-deposition time, pH values and scan rate on the response was evaluated. In optimum conditions the linear range response, detection limit and sensitivity of the sensor was obtained 1 - 65 μM, 0.1 μM and 348nA/μM for DPV method, 0.1 - 1μM, 63nM and 4.74 μA/μM for Chronoamperometry method. The proposed sensor was successfully used for determination of Atenolol in pharmaceutical samples, human urine and blood serum as real samples. Satisfactory recoveries of the analyte from the real samples made this sensor applicable in clinical analysis, quality control and routine determination of drugs in pharmaceutical formulations.

Keywords: Atenolol (ATN), gold nanoparticles, Chronoamperometry

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Abstract # 15 **Poster**

Electrochemical determination of pramipexole on the surface of carbon paste electrode modified by nickel nanoparticles

Ojani R*, Raoof Jb, zamani S,Gholitabar Sh

Electroanalytical Chemistry Research Laboratory, Faculty of Chemistry, University ofMazandaran, Babolsar, Iran

*Corresponding author.Tel.: +98 112 5342392; fax: +98 112 5342350.

*E-mail Address:*fer-o@umz.ac.ir (R. Ojani)

Pramipexole (PX) is a dopamine agonist of the non-ergoline class indicated for treating early-stage Parkinson's disease and restless legs syndrome and it is also being investigated for the treatment of clinical depression and fibromyalgia [1]. Various analytical methods have been reported for the determination of PX based on spectroscopy [2], liquid chromatographymethods. Electrochemical techniques have been shown to be excellent procedures for the sensitive determination of drugs in real sample.

In this work, nickel nano particles were synthesis by Polyol method and also AFM imagesindicated that the nickel nanoparticles formed well. Then this nanoparticales were used as modifier for preparation of a new modified carbon paste electrode. For the first time, this modified electrode was used for electro oxidation of PX.The catalytic oxidation peak current of PX was linearly dependent on its concentration and a linear calibration curve was obtained in the range of 10 to 200 μM with a correlation coefficient of 0.9994. The limit of detection (3s) was determined as 2 μM. This electrocatalytic oxidation was used as simple, selective and precise voltammetric method for determination of PX in pharmaceutical preparations.

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Abstract # 16 **Poster**

An Electrochemical Senor for Determination of Amlodipine and Application in biological and pharmaceutical samples

Elham Arkan[1], Ziba Karimi[2], Mojtaba shamsipur[2], Reza Saber[1, 3] *

1. Department of Medical Nanotechnology, School of Advanced Medical Technologies, Tehran University of Medical Sciences (TUMS), Tehran, Iran.

2. Faculty of Chemistry, Razi University, Kermanshah, Iran

3. Research Center for Science and Technology in Medicine, Imam Khomeini Hospital, Tehran University of Medical Sciences (TUMS),Tehran, Iran

* E-mail address: rsaber@tums.ac.ir (Reza Saber) * Corresponding author. Tel.: +98-21-66908031; Fax: +98-21-66908030

Calcium ions are required to generate electrical activity for the contraction of cardiac and smoothmuscle and conduction of nerve cell. Calcium antagonist is a drug that inhibits the entry of excess calcium into cells. This causes lowering of blood pressure thereby reducing oxygen demand in the heart and relieving angina pain. Amlodipine besylate (ADB) is a third-generation dihydropyridine calcium antagonist which is used alone or in combination with other medications for treating high blood pressure (1-4).

ADB is an electroactive compound, which can be easily subject to oxidation on different working electrodes, it can be investigated by electrochemical methods (5). In recent years, graphene nanosheets have attracted in the preparation of sensors and biosensors due to their large

surface area, extraordinary electronictransport property, high electrocatalytic activity, good mechanical strength, high thermal conductivity and high mobility of charge carriers. (6, 7)

In this paper, a simple and fast method for the determination of ADBat graphene–chitosan composite film modified glassy carbon electrode (GR-CS/GCE) was presented by using cyclic differential pulse voltammetry. In 0.1 M pH 7.3 phosphate buffer solutions, the redox peak currents of ADB increased significantly at graphene–chitosan composite film modified GCE compared with bare electrode. Under the optimal experimental conditions, the oxidation peak current was proportional to ADB concentration in the range from to 1-70 μM with the correlation coefficient of 0.9930. The detection limit was 0.6 μM (S/N=3). Using the proposed method, ADB was successfully determined in serum sample, tablets and urine, suggesting that this method can be applied to determine ADB in pharmaceuticals.

Keywords: Glassy carbon electrode; Graphene; Chitosan; Amlodipine besylate; Differential pulse voltammetry

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Abstract # 17 **Poster**

GNPs-modified electrode as an efficient electrochemical sensor for determination of Ibuprofen in human blood plasma

Saeedeh Sepehrikiya[a], Zahra Sepehri, Donya Arefi[a*]

a. Department of pharmacutical Chemistry, Faculty of pharmacy,Zabol University of Medical Sciences, Zabol, Iran
b. Zabol University of Medical Sciences, Zabol, Iran
Donya_Arefi@yahoo.com(+985422253527)

Ibuprofen (IB) from iso-butyl-propanoic-phenolic acid, is a nonsteroidal anti-inflammatory drug (NSAID) used for pain relief, fever reduction, and against swelling. In the present study, a new chemically modified electrode was fabricated for determination of IB in human blood plasma using gold nanoparticles (GNPs) and carbon paste electrode (CPE). Gold nanoparticles-modified carbon paste electrode (GNPs/CPE) was characterized by transmission electron microscopy and scanning electron microscopy. The experimental parameters such as pH, scan rate (ν) and amount of modifier were studied by cyclic voltammetry and the optimized values were chosen [2,1]. The electrochemical parameters such as diffusion coefficient of IB (D_{IB}), electrode surface area (A) and electron transfer coefficient (α) were calculated. Square wave voltammetry as an accurate technique was used to quantitative calculations. As can be seen in the following figure, there was no redox peak at bare CPE (a), while in the presence of GNPs in the composition of paste, a significant oxidation peak can be observed (b). These observations established the effective influence of GNPs for determination of IB.A good linear relation was observed between anodic peak current (i_{pa}) and IB concentration (C_{IB}) in the range between $6 \times 10^{-8}$to 8×10^{-5}mol L^{-1}, and the detection limit was achieved 2.7×10^{-8}mol L^{-1}, that it`s comparable with those reported elsewhere [3]. This paper demonstrated a novel, simple, selective and rapid method for determination of IB in the biological fluid.

Keywords: Ibuprofen, Gold nanoparticles, modified electrode, transmission electron microscopy and scanning electron microscopy

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Abstract # 18 **Poster**

Design of a modified electrode with amine functionalized-TiO2/Multi-walled carbon nanotubes nanocomposite for electrochemical sensing of fluoxetine

Donya Arefi[a] ,Saeedeh Sepehrikiya[a*], Sara Arefi[b]

a. Department of pharmacutical Chemistry, Faculty of pharmacy,Zabol University of Medical Sciences, Zabol, Iran
b. Zabol University of Medical Sciences, Zabol, Iran
sepehrikiya@yahoo.com(+985422253527)

Fluoxetine is an antidepressant of the selective serotonin reuptake inhibitor (SSRI) class. Multi-walled carbon nanotubes (MWCNTs) have remarkable electronic and mechanical properties [2,1]. Due to its low-cost, nontoxic, strong oxidizing power, long-term stability against photocorrosion and strong metal-support interaction, TiO2 has become an attractive electrode material [3]. In this work, nanocomposite NH2-TiO2-MWCNT was used as modifier for glassy carbon electrode(GCE) modification.
The nano composite has been characterized by FT-IR, SEM and TEM techniques. The NH2-TiO2-MWCNT modified glassy carbon electrode (NH2-TiO2-MWCNT/GCE) provided high surface area and more sensitive performance. The NH2-TiO2-MWCNT/GCE was used for fluoxetine determination .The electrochemical behavior of fluoxetine at the modified electrode was investigated and results indicated that the electrode reaction is controlled by adsorption. The cyclic voltammetric results indicated that the NH2-TiO2-MWCNT/GCE can remarkably enhance electrocatalytic activity of GCE toward electro-oxidation of fluoxetine in pH=5.0. The peak current of fluoxetine reached its maximum at accumulation potential and time of -0.6 V and 150 s, respectively.

Keywords: Fluoxetine , Multi-walled carbon nanotubes , glassy carbon electrode

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Abstract # 19 **Poster**

An enzymatic nano biosensor based on HRP/AgNPs/ poly aniline/ Au electrode for detection of H_2O_2 for biological and clinical application

NarimaniS[1], Jahanshahi M[*1], Shokuhi RadA[2]

1- Nanotechnology Research Institute, School of Chemical Engineering, Babol University of Technology, Babol, Iran

2- Chemical Engineering Group, faculty of Engineering, Qaemshahr Branch, Islamic Azad University, Qaemshahr, Iran

Biosensors are presently the focus of extensive research for the development of wide variety of applications in clinical diagnosis, food technology, biomedical and environmental monitoring (1). Hydrogen peroxide (H_2O_2) is an essential mediator in food,pharmaceutical, clinical and industrial analyses (2,3). In this work, an enzymatic biosensor based on immobilization of horseradish peroxidase (HRP) on AgNPs and poly anilin layer was successfully fabricated.At first, Poly aniline were electrodepositedonto Au electrode by applying certain polymerization cycles. The resulting AgNPs/polyaniline/Au modified electrode was prepared by electrodeposition of AgNPs onto the polyaniline/Au modified electrode.Ag nano particles can act as tiny conduction centers on electrode that adsorb redox enzymes, facilitating the transfer of electrons with no requiring any loss of biological activity (4). HRP was selected as biomaterial bound with AgNPs. Then, HRP was immobilized covalently onto electrochemically deposited AgNPs/poly anilin (PANI) layer on the surface of gold electrode. The electrochemical characteristics of the biosensor were studied by amperometric metod. Under optimum conditions, the biosensor responded linearly to H_2O_2 in the concentration range of 80 to 1000μM. The resulting Biosensor offered an excellent detection for hydrogen peroxide with expanded linear response range, and excellent stability.

Keywords: Clinical diagnosis- Enzyme immobilization- AgNPs- Poly anilin- Amperometric.

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Abstract # 20 **Poster**

(Fe_3O_4)-graphene oxide as a novel magnetic nanomaterial for non-enzymatic determination of phenylalanine

Nasrin Shadjou[a], Mohammad Hasanzadeh [b], Eskandar Omidinia [a]

[a] Enzyme Technology Lab., Biochemistry Department, Genetic and Metabolism Group, Pasteur Institute of Iran, P.O. Box 13164, Tehran, Iran.

[b] Drug Applied Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

E-mail nasrin.shadjou@gmail.com

Phenylketonuria is an inborn defect in protein metabolism that results from an impaired ability to metabolize the essential amino acid l-phenylalanine. Diagnosis time is of importance in helping children affected by Phenylketonuria since rapid diagnosis of Phenylketonuria in affected infants can help us to prevent the progress of mental and developmental disorders associated with the disease.A simple, sensitive graphene-based biosensor for the detection of l-phenylalanine is developed using the electrochemical transduction method. For that, an Au, Ag/AgCl and a platinum wire were used as working, reference and counter electrodes, respectively. Electrochemical measurements were carried out in a conventional three-electrode cell (from Metrohm) powered by an electrochemical system comprising of AUTOLAB system with PGSTAT302N (Eco Chemie, Utrecht, The Netherlands).Fe_3O_4-graphene oxide modified glassy carbon electrode was used as a new magnetic nanosensor for determination of phenylalanine. It was found that Fe_3O_4-GO has been stably absorbed on glassy carbon electrode modified by simple technique. The cyclic voltammograms of the modified electrode in an aqueous solution displayed a pair of well-defined, stable and irreversible reductive/oxidation redox systems. The apparent electron transfer rate constant (K_s) and transfer coefficient (α) were determined by cyclic voltammetry and were approximately $9.3s^{-1}$ and 0.67, respectively. The modified electrode

showed excellent catalytic activity towards the oxidation of phenylalanine at an unusually positive potential in buffer solution. This nanosensor also displayed fast response time, high sensitivity, low detection limit and had a remarkably positive potential oxidation of phenylalanine that decreased the effect of interferences in analysis.

Keywords: magnetic graphene oxide,Electrochemical nanosensor, Phenylalanine, Physiological pH.

Abstract # 21 **Poster**

Assay Possibility Nanoclay for Packing Fish fillet for Detection Pathogen Bacteries

Seyed hosein Montazer and Zahra Bankehsaz

Faculty Science of Department Emergency medicine ,Mazandran University of Medical Science

Department of Biotechnology.Ecological Academic of Caspian Sea

Adress : Iran, Sari, P.O.Box.961 ; **Email** :hmontazer66@yahoo.com
Tell:3462499

Background &purpose: Nanotechnology is power production Material s, tools ,new systems by control in Surface of moleculs ,atomic & usage their aspect nature .

In fact usage Nano technology is offspring of usage elements.Every of them use special in different conspectus Farmacological treatment ,Early &harmless Carcinoma cells ,resolution environment pesticides and deletation pathogen bacteries .

Materials & Methods:In this research first produced Nanoclay in Nano technology laboratory Indutrial university of Babol & assay Capasite thermal & for stored fillet of fish to changes temperature ,decreasing outflow oxygen in meat & decreased moisture without reduction quality produce for increasing rate of shelflife.

Results :Nano technology produced for storing fish fillet machinated by changes temprature ,decreasing outflow oxygen in meat & decreased moisture without reduction quality produce for increasing rate of shelflife and have not leftover for environments harm.

Conclution: One of main difficulties in food packing even marine(Fish fillet) is usage Vaccum & polyethylene covers,so naturally every phenomenon have loss therefore leftover of this covers have harm for environment.

Keywords:Nanoclay- pathogen bacteries- disease- Fish fillet- packing

Abstract # 22 **Poster**

Encapsulation of phenylalanine dehydrogenase on nPyr-NH_2-MCM-41: A novel nanobiosensor for determination of phenylalanine

Mohammad Hasanzadeh[b] ,Nasrin Shadjou [a], Eskandar Omidinia [a]

[a] Enzyme Technology Lab., Biochemistry Dept., Genetic and Metabolism Group, Pasteur Institute of Iran, P.O. Box 13164, Tehran, Iran.

[b] Drug Applied Research Center, Tabriz University of Medical Sciences, Tabriz 51664, Iran

E-mail address: mhmmd_hasanzadeh@yahoo.com

Imbalance of amino acids concentration causes diseases such as phenylketonuria (PKU). To date some of optical methods such as fluorescence, luminance and spectroscopy was applied for detection of phenylalanine concentration. But all of these methods required derivation which has a serious problem for determination of some amino acids in biological samples. Therefore, in the present work, we constructed a new nanobiosensor for determinatio of phenylalanine.

For that, an Ag/AgCl-Sat'd KCl (from Metrohm) and a platinum wire were used as reference and counter electrodes, respectively. The working electrode was an Au and Enzyme-MCM-41-NH_2-Au electrode. Electrochemical measurements were carried out in a conventional three-electrode cell (from Metrohm) powered by an electrochemical system comprising of AUTOLAB system with PGSTAT302N (Eco Chemie, Utrecht, The Netherlands).

The immobilization and electrocatalytical activity of phenylalanine-dehydrogenase onto the n-propylamine functionalized mobile crystalline material 41 (MCM-41-NH_2) was studied using cyclic voltametry (CV), differential pulse voltammetry (DPV), linear sweep voltametry (LSV) and square wave voltammetry (SQWV). At the first time, the electrode was evaluated as an electrochemical nanobiosensor for determination of phenylalanine in buffer solution. CV study

indicated that the oxidation process is irreversible and diffusion controlled. The results revealed that MCM-41-NH_2 promotes the rate of oxidation by increasing the peak current. Proposed nanobiosensor based on nanotechnology and silica based mesoporous materials are significant factors and have not required derivation and directly can be used for detection of phenylalanine.

Keywords: phenylalanine dehydrogenase, mesoporous, immobilization, Enzyme nanobiosensor.

Nanoimaging

Abstract # 23 **Key Lecture**

Multifunctional Polymeric Nanoparticles for Nanodiagnostics and Anticancer Drugs

Pedram Ebrahimnejad

[1]Department of Pharmaceutics, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran

[2]Pharmaceutical Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran

Cancer is one of the most dreaded diseases of the 20th century and spreading further with continuance and increasing incidence in 21st century. The use of nanoparticles (NPs) as drug delivery vehicles for anticancer therapeutics has great potential to revolutionise the future of cancer therapy. As tumour architecture causes nanoparticles to preferentially accumulate at the tumour site, their use as drug delivery vectors brings about the localisation of a greater amount of the drug load at the tumour site; thus improving cancer therapy and reducing the harmful nonspecific side effects of chemotherapeutics.

In addition, formulation of these nanoparticles with targeting moieties provides a very efficient system for drug targeting. Various targeting moieties or ligands against tumor-cell–specific receptors have been immobilized on the surface of nanoparticulate carriers to deliver them within cells via receptor-mediated endocytosis. Among them, folate (FOL) has been widely employed as a targeting moiety for various anticancer drugs.FOL as a targeting ligand offers many potential advantages over macromolecules such as monoclonal antibodies.

Recent reports demonstrate that the rapid reticuloendothelial system (RES) uptake of PLGANPs could be significantly reduced by modifying their surface with PEG.The PEG-modified PLGA NPs, prepared mostly by using a di-block copolymer of PLGA-b-PEG as an additive, prolonged their half-life considerably in the circulation due to the presence of highly mobile and flexible PEG chains on the surface.PEG-modified PLGA NPs, however, cannot be delivered to specific cells in a target-specific manner. Given the comprehensive possibilities available to polymeric nanoparticle chemistry, research has quickly been directed at multi-functional nanoparticles, providing a useful multi-modal approach in the battle against cancer. This study will discuss the properties of nanoparticles that allow for such multiple functionality such as folate, iron oxide and poly(ethylene glycol)-conjugated (PEGylated) polymeric nanoparticles, as well as recent scientific advances in the area of multi-functional nanoparticles for cancer therapeutics.

Keywords: drug delivery, anti-cancer, multi-functional, polymeric nanoparticles

Abstract # 24 **Lecture**

Grafting of newly synthesized ‹$AuCl_3Py$ Complex

on NanoPorous MCM-41 Silica and Investigation of its Application in

Diagnosis and therapy of Cancer

Fazaeli Y*[1]

[1]Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran, P.O.Box: 31485-498

youseffazaeli@gmail.com, Fax:+98-26-34464053

Background & Purpose: Complex trichloro (2, 4, 6-trimethylpyridine) Au (III) as an anticancer agent was synthesized and the toxicity of this complex was compared with $AuCl_3$@PF-MCM-41 in Saccharomyces cerevisiae.

Materials & Methods: The gold (III) complex was prepared using fresh solution of $HAuCl_4$ in acetonitrile and 2, 4, 6-trimethylpyridine followed by grafting on pyridine-functionalized MCM-41 silica in a direct manner in toluene.

Results: The gold (III) complex showed a mid cytotoxic effect on yeast viability. Using the drug delivery system, nanoporous MCM-41, the grafted gold (III) complex became a strong inhibitor for growth of yeast cells at a very low concentration and showed high cytotoxic effect due to grafting. Furthermore, the animal tests revealed a high uptake of $AuCl_3$@PF-MCM-41 in breast tumor cells.

Conclusion: as shown in our previous works, the results confirm the role of nanoporous MCM-41 in affecting photoluminescence properties and delivery of the gold (III) complex to their target(s) in cells. Toxicity and photoluminescence properties of the compounds show the potential of this nano compound in diagnosis and therapy of Cancer [1].

Key words: nanoporous MCM-41, gold (III), Tumor

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Abstract # 25 Lecture

Polyglycerol-grafted iron oxide nanoparticles as high efficient MRI contrast agent for liver and kidney imaging

Fattahi H.[1,2]*, **Mosaei Oskoei Y.**[1], **Eghbali P.**[3], **Arsalani N.**[2], **Laurent S.**[4], **Muller R.N.**[4]

[1]Nonth-West Research Institute of Defense Science and Technology, Malek Ashtar University of Technology, Urmia, Iran.
[2]Polymer Research Laboratory, Department of Organic and Biochemistry, Faculty of Chemistry, University of Tabriz, Tabriz, Iran.
[3]Department of Applied Chemistry, Faculty of Chemistry, University of Mahaghegh Ardabili, Ardabil, Iran
[4]Department of General, Organic and Biomedical Chemistry, NMR and Molecular Imaging Laboratory, University of Mons, Avenue Maistriau, 19, B-7000 Mons, Belgium
*Corresponding author:hassan.fattahi@gmail.com, Tel: 0441-2258392, Fax: 0441-2258105

Background & Purpose: Contrast agents are useful in magnetic resonance imaging (MRI), improving its sensitivity and specificity. Superparamagnetic iron oxide nanoparticles (SPIONs) are suitable as MRI contrast agents, since these SPIONs are more efficient in modifying the proton relaxation in the tissue microenvironment, and thus provide better MR imaging than conventional Gd-chelate compounds (1, 2).However, the direct use of SPIONs as in vivo MRI contrast agent results in biofouling of the particles in blood plasma and formation of aggregates that are quickly sequestered by cells of the reticular endothelial system (RES) such as macrophages (3).Therefore the nanoparticles are usually coated with a layer of hydrophilic and biocompatible polymer.Hyperbranched polyglycerol is water-soluble and taking the biocompatibility of polyether structures such as PEG into account, its polyether backbone makes it an attractive polymer for biomedical and pharmaceutical applications. In the present study, polyglycerol was chemically grafted onto superparamagnetic iron oxide nanoparticles to prepare a novel negative MRI contrast agent.

Materials & Methods: In order to prepare polyglycerol-grafted iron oxide nanoparticles, magnetite nanoparticles were prepared by coprecipitation method in aqueous media, then the surface of nanoparticles were modified with 3-aminopropyltriethoxysilane to introduce the reactive amine groups on the surface of nanoparticles. After that, polyglycerol was grafted on the surface of nanoparticles by ring-opening anionic polymerization of glycidol using n-bulyllithium as initiator.

اولین همایش ملی
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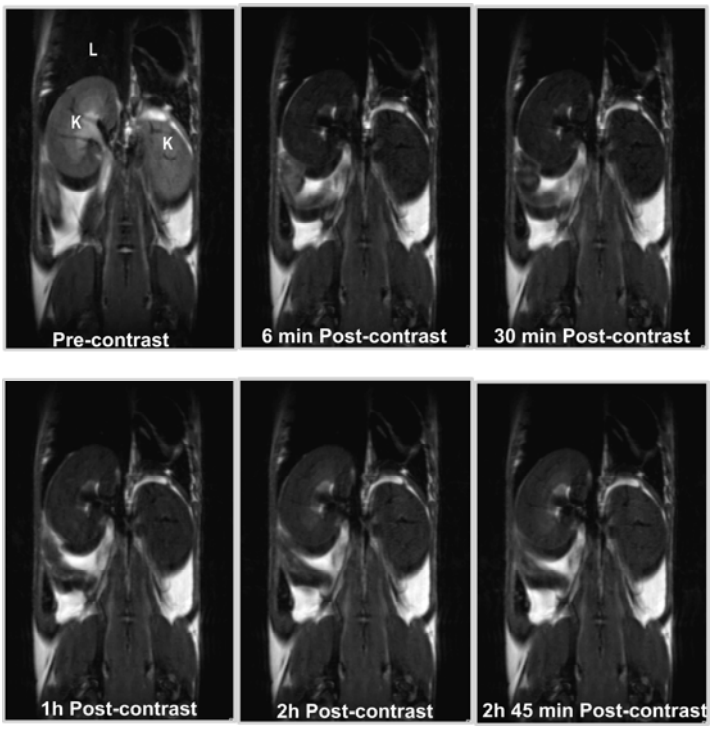
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Pre-contrast
6 min Post-contrast
30 min Post-contrast
1h Post-contrast
2h Post-contrast
2h 45 min Post-contrast

Conclusion: Since polyglycerol is a water-soluble and biocompatiblepolymer with lots of hydroxyl groups on the periphery, itcan be considered as a highly potential platform for furthervectorization to target different organs and diseases in molecularimaging. The obtained results show their greater potentialas negative MRI contrast agents in comparison with commerciallyavailable compounds.

Keywords: Superparamagnetic iron oxide nanoparticles (SPIONs), Polyglycerol, MRI, contrast agent

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Abstract # 26 **Lecture**

Shikonin Loaded Solid Lipid Nanoparticle: A Self-Fluorescent Nanobiomaterial for Bio-distribution Studies

Eskandani M[1], and Nazemiyeh H[2]*

[1] Research Center for Pharmaceutical Nanotechnology,Student Research Committee, Tabriz University of Medical Science, Tabriz, Iran

[2]Research Center for Pharmaceutical Nanotechnology, Tabriz University of Medical Science, Tabriz, Iran, Tel: +98 (411) 336 7914, Fax: +98 (411) 336 7929, email: Nazemiyehh@yahoo.com

Background & Purpose: Drug bio-distribution is one of the important challenges related to the drug discovery and delivery [1]. Here, we have formulated Shikonin, a Self-Fluorescent naphthoquinone red natural product [2], in Solid Lipid Nanoparticles (SLN) and assessed its potential as an imaging tool in tracking of pharmaceutical vehicles.

Materials & Methods: Shikonin (SHK) was extracted from roots of *Echium italicum* L and encapsulated in SLN by hot homogenization methods. Consequently, their size was characterized using laser diffraction particle sizer and particles stability and their drug encapsulation efficiency information were gathered. The fluorescent capacity of SHK@ SLN was examined by fluorescent microscopy against A549 human alveolar epithelial cancer cells lines and further analyses was done using FACS flow cytometery technique. Finnaly, chicken thighs injected with SHK@ SLNand analysed usingIn-Vivo Imaging System F Pro for tracking of synthesized nanoparticles.

Results: Our results showed that the size of SHK@ SLN after formulation was 90±4 and after 60 days, the size did not change significantly (92±6). Drug encapsulation efficiency was 88±8 %. Fluorescent microscopy analysis showed that SHK@ SLN well uptaeked by A549 cells and FACS analysis (Ex: 537, Em: 617 nm) of SHK@ SLN treated A549 approved well fluorescent properties of SHK@ SLN. Whole animal imaging analysis gave us similar results.

Conclusion: The result of this investigation for the first time showed that Shikonin loaded SLN has very good emission at ~ 600 nm through tissues and can be used in bio-distribution studies in drug delivery and discovery investigations.

Key words: Shikonin, Solid lipid nanoparticle, Fluorescent, Drug delivery, Drug discovery

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Abstract # 27 **Poster**

Superparamagnetic iron oxide nanoparticles as a targeting contrast agent in MRI of breast cancer

A. Jafari[1], S. Farjami Shayesteh[1], M. Saluti[2], Z. Heidari[3], K. Boustani[1]

[1]Nanostructure Lab, Department of Physics, University of Guilan, Rasht, Iran

[2]Biology Research Center, Zanjan Branch, Islamic Azad University, Zanjan, Iran

[3]Biology Research Center, University of Guilan, Rasht, Iran

Background & Purpose: Cancer is on the increase in developing countries as well as in industrial countries. A wide variety of imaging techniques such as ultrasound, computed tomography and magnetic resonance imaging are commonly employed for cancer diagnosis. With the development of nanotechnology, a variety of nanoparticles has been provided to improvecancer diagnosis.Superparamagnetic iron oxide nanoparticles (SPION) have attracted more attention in various fields such asdrug delivery, hyperthermia, MRI contrast agents.Dextran isa biocompatible shell, thus dextran coatedSPION(DSPIONs) is suitable as a contrast agent [1]. When a peptide with breast cancer cell targeting ability was covalently linked to the DSPIONs, we will have breast cancer cell targeting contrast agents. The purpose of this study is preparation of peptide conjugated DSPIONsand in-vitro investigation to the targeting contrast agents in MRI of breast cancer.

Materials & Methods: The DSPIONs were synthesized by co-precipitation method as following: $FeCl_2.4H_2O$, $FeCl_3.6H_2O$ (with 1:2 molar ratio) and 0.5g dextran were dissolved in 50mL of DI water. The resulting solution was added into the 200ml of NaOH solution. The generated precipitation waspurified with DI water and dialysis over night [2]. Then the DSPIONs were conjugated with a peptide.

Results & Conclusion: The FT-IR spectroscopy was performed to confirming the conjugation of peptide to DSPIONs. Stability results proved that the peptide-DSPONs were more stable in human blood for 4 h. The low cytotoxic activity of the peptide-DSPONs was confirmed by MTT. The peptide-DSPONs showed good targeting ability to breast cancer cells while not to the bladder cancer cells.

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Keywords: Iron Oxide, Contrast agent, Peptide, Breast cancer, Targeting**.**

Abstract # 28 **Poster**

Hybrid Nanoparticles as a Single Multi-Functional Nanosystem

Afifeh jafari[1], Hossein A. Tehrani[1]

[1]Department Of Medical Biotechnology, Faculty Of Medical Sciences, Tarbiat Modares University,Tehran,Iran.

Currently many efforts have been done to integrate two nanocomponents into a multifunctional hybridnanosystem for the more effective cancer treatment. These systems which is called “theranostic” devices have both diagnostic and therapeutic functions and they can be administered in a single dose.Stickingspecificly to tumors is an important character of these nanosystems. A more specific method to target a tumor is to attach molecules to the surface of the nanoparticle that have an affinity for tumor tissues. These molecules can be sugars, folic acid, antibodies, or small peptides.These nanosystems can carry small payloads of anti-cancer drugs and deliver them directly to target sites*in vivo*, minimizing side effects and toxicity of the drug payloads. They are also biocompatible. Other therapeutic functions can be performed by nanoparticles engineered with the ability to transduce optical or radio frequency energy into thermal energy.Diagnostic nanocomponents such as gold nanostructures (for optical imaging) and magnetic nanocrystals (for improving MRIcontrastor hyperthermia) can be hybrid with the therapeutic part of the nanosystem.Viruses are another nanocomponent which were used in this hybrid nanosystems. Theyare excellent delivery vehicles due to their facile cellular transfection and gene expression efficacies within their target cells.Advantage of hybrid nanoparticles combining imaging with therapeutic functions is that the biodistribution of the materials can be monitored *in vivo*, reducing the potential for unintended side effects of drug toxicity or hyperthermia-induced damage in healthy tissues.

Keywords: Hybrid Nanoparticles,theranostic,MRI, hyperthermia

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Abstract # 29 **Poster**

Synthesis and surface modification of iron oxide magnetic nanoparticles for drug delivery

Sajadi,M, Fathi,F

Department of Chemistry, Science and Research Branch, Islamic Azad University, Tehran, Iran

Background and Purpose: Magnetic iron oxide nanoparticles with proper surface coatings are increasingly being evaluated for clinical applications such as hyperthermia, drug delivery, magnetic resonance imaging, transfection and cell/protein separations.

In order to implement the practical application, the particles must have combined properties of high magnetic saturation, stability, biocompatibility, and interactive functions at the surface. For biological and biomedical applications, magnetic iron oxide nanoparticles are the primary choice because of their biocompatibility and chemical stability. Iron also has lower magnetocrystalline anisotropy, which means that much larger iron nanoparticles can still be superparamagnetic at a given temperature compared cobalt and nickel. Additionally, iron oxides is relatively non toxic compared to the magnetic particles of cobalt and nickel, therefore making it attractive to be tailored in to nano-sized particles for biomedical(in vivo) applications.

Moreover, the surface of iron oxide NPs could be modified by organic materials or inorganic materials, such as polymers, biomolecules, silica, metals, etc.

The co-precipitation method is the most effective technique for preparing aqueous dispersions of iron oxide nanoparticles because the synthesis is conducted in water. For this report, we studied several biological materials as surface coatings to achieve biocompatibility such as poly ethylene pyrrolidone(PVP), SiO_2 and gold (Au). These materials were used to control the particle size, to prevent the nanoparticles from aggregation, and to achieve biocompatibility.

Materials and methods: All chemicals were of analytical grade and used withoutfurther purification. Iron oxide nanoparticles were synthesized by a modified co-precipitation method. The precipitation method is the simplest chemical pathway to obtain SPIONS .Ferric chloride ($FeCl_3.6H_2O$-1.09 g) and ferrous chloride ($FeCl_2.4H_2O$, 0.394 g) at a ratio of 2 to 1 were dissolved in 100 mL deionizedwater, which was then stirred at room temprature. The solution was bubbled with N_2gas to prevent unwanted oxidation. Subsequently, 0.64 gr NaOH solution was injected and the reaction continued at that room temperature for 30 minutes before the flask was removed from stirring.

$$Fe^{2+} + 2Fe^{3+} + 8OH^- \rightarrow Fe_3O_4 + 4H_2O$$

iron oxides are not very stable, and are not soluble in water. Stabilization of SPIONS is essential to prevent against aggregation and oxidization. After synthesis, the black precipitates werecollected, washed with DI water, three times, and acetone, tow times.

To coating of IO nanoparticles with PVP, the 10% of PVP solution(50 ml) in distilled water was sonicated 20 min to remove oxygen. Then the black precipitation was added to PVP solution slowly, washed with water and dried with oven at 35^0C. to coted of surface with SiO_2 , 0.08 gr of IO nanoparticles was dispersed in 20 ml iso-butanol and 0.5 ml NH_3, 1ml TEOS, 4 ml of H_2O was added the solution and stirred 8 h. then the precipitation washed with ethanol tow times and dried with oven at 35^0C. to coated surface with Au, 0.02 gr of synthesis nanoparticles at previous step was dispersed in water and 100 ml of 0.01×10^{-4} M of $HAuCl_4$ and 0.01 M $NaBH_4$ as reducing agent was added to the solution. Then stirred 8 h and washed with water and dried with oven.

Results:

The functional groups of the surface modified iron oxide nanoparticles were confirmed by FT-IR spectra. The FT-IR spectrum of iron oxide exhibits strong bands in the low-frequency region (1000-500cm-1) due to the iron oxide skeleton. This pattern is consistent with the magnetite

(Fe_3O_4) spectrum (band between 570-580cm^{-1}) .The characteristic band of Fe-O at 572 cm^{-1} shows that the particles consist mainly of Fe_3O_4.

The shift of the vibrational band of the carbonyl group from 1659 cm^{-1} to 1634 cm^{-1} in the nanocrystal samples, suggests that PVP is modified on the surface of the Fe_3O_4 nanocrystals via coordination interaction through its carbonyl group. But no change has been observed for the peak of N-OH (at 1291cm^{-1}) which was weakened greatly. These changes of intensity can be attributed to the coordination between N -OH and iron oxide nanoparticles. The broad intense absorption peak at around 564 cm^{-1} can be attributed tolattice absorption of the Fe_3O_4 particles.

The FT-IR spectra of Fe_3O_4-PVP-$SiO_2$and coated with Au showed the peaks of Si-O-Si(447,1097cm^{-1}) , Si-OH(802,945cm^{-1})are for IO-PVP-SiO_2.

the crystal structure was verified using x-ray diffraction (XRD); peaks observed in XRD pattern were consistent with those of standard XRD pattern of Fe_3O4 (reference JCPDS No. 82-1533) and confirm crystallinity of Fe_3O_4 nanoparticles. The crystalline size of Fe_3O_4 at the characteristic peak was calculated by Scherrer formula as follows:$D = K\lambda/\beta\ 1/2\ \cos\theta$

where D is the average crystal size, K is a constant (here chosen as 1); λ is the wavelength of X-ray radiation(1.54056 A), β 1/2 is the half width of the diffraction peak and θ (°) is Bragg angle. The results of D values, using 311 plane for the sample were 8 nm. While the absence of (210) and (300) peaks in this recorded XRD pattern show that separate maghemite (γ-Fe2O3) is not present in the samples.

The size and morphology of nanoparticles were studied by transmission electron microscopy (TEM); TEM of IO-PVP ,IO-PVP-SiO_2-Au showed that nanoparticles are spherical and the size of them are about 10-12 nm. This value is in accordance with the particles size calculated usingSherrer formula for Fe_3O_4 core. The surface images and surface morphology were studied by scanning electron microscopy(SEM).

Conclusions: Following the investigation of the nano-sized magnetite particles, we assume that the resulted magnetic fluidbased on multiple-layer coated nanoparticles obtained by co-precipitation method, could be used for biologicalapplications. Manufacturing such type of nanomaterials, could be also useful in drug delivery.

Key words: iron oxide nanoparticles, silica,gold, drug delivery

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Abstract # 30 **Poster**

Design, synthesis, and evaluation of nanoemulsion as carrier forSuperpara Magnetic Iron Oxide

Ahmadi Lakalayeh Gh.[1], Faridi-Majidi R[1] , Saber R.[1,2] , Partoazar A[1,3] Ejtemaei Mehr Sh.[3] and Amani A.[1,4,5]

[1] Department of Medical Nanotechnology, School of Advanced MedicalTechnologies, Tehran University of Medical Sciences, Tehran,Iran

[2] Nanotechnology Group, Research Center for Science and Technologyin Medicine (RCSTIM), Tehran University of Medical Science, Tehran,Iran

[3] Department of Pharmacology, School of Medicine, Tehran Universityof Medical Sciences, Tehran,Iran

[4]Biotechnology Research Center, Tehran University of Medical Sciences, Tehran, Iran.

[5] To whom correspondence should be addressed. (e-mail: amani76@gmail.com)

Background and purpose: Considering insolubility of many drugs in aqueous media, many approaches have been investigated to overcome this defect. Among them, Nanoemulsions have gained a remarkable notice[1] , showing high potential ability to formulate drug for physiological environment.

Materials and methods: In this study Superparamagnetic Iron Oxide Nanoparticles (SPIONs) ,which have shown great importance and capability in drug delivery and imaging[2]dissolved in Almond oil, comprise the inner phase of nanoemulsion, which is surrounded by a mixture of non-ionic surfactant (Tween80, Span80) and ethanol as co-surfactant, synthesized by ultrasonication method. Transparencies of 48 samples were measured after 30 minutes and seven days, and the ratio between them was considered as a sign of increasing size, which can be interpreted for stability status. In this study to evaluate dominant factors affecting the stability, a competence software called Artificial neural Network (ANN) was implemented. Four factors including the concentration of surfactant, alcohol, almond oil, and nanoparticle were considered as variables and the transparency ratio as a result.

Results: The acquired model shows that the concentration of surfactant and alcohol beyond an optimum amount can destabilize the formulation while in optimum concentration they enhanced the stability. Adding the concentration of nanoparticle and oil are also in favors of reducing the stability. However it should be considered that the stability is due to collective effects of four factor and all of them have reverse effect on stability beyond an optimum amount.

Keywords: nanoemulsion, artificial neural network, surfactants, superparamagnetic iron oxide

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Abstract # 31 **Poster**

Ultrasound a new method to trigger release of biologically active material from nanocarrier

Amini Seyed Mohammad.[1], Ahmadi Lakalayeh Gholamreza [1] , Sedmoradi Lila.[1,2] , Ghanbari Hossin[1,3]

[1] Department of Medical Nanotechnology, School of Advanced MedicalTechnologies, Tehran University of Medical Sciences (TUMS), Tehran,Iran

[5] To whom correspondence should be addressed. (e-mail: hghanbari@tums.ac.ir)

Stepping nanotechnology in medicine for drug delivery purpose, draw the attention to ways of external tools like ultrasonic waves to stimulate drug release from nanocarriers, thus improving drug efficiency.

Three mechanisms are to be effective in drug and gen release from the carriers. The first though to be thermal effects, which ablate the carrier as consequence of ultrasound pressure intensity and the content would be available for treatment [1]. The second and major cause of release is related to a phenomenon called cavitation, which is divided into two subgroup with different outcome, inertial cavitation and non-inertial cavitation. In the first one the intensity of ultrasound wave cause eddy fluid around the bubbles leading to drug output of the bubbles and in the latter, the intensity of the wave has the adequate power to collapse the bubble and drug release would occur [2].

Application of ultrasound wave as a method to enhance drug absorption to cure tissue inflammation was first introduced by Schmin and Fellinger for polyarthritis [3]. In this method to improve therapeutic effects and better release, carriers like liposomes, micelles,and microbubbles were implemented. Each carrier with different properties and chemical structure show different interaction ,which leads to variety of release, distribution, clearance and toxicity [4]. Hence, synergic effect of diverse drug carrier with ultrasound wave appears as a new trend for drug delivery applications.

Keywords: ultrasound, trigger release, drug delivery

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Abstract # 32 **Poster**

Liposome: classification, preparation, and Applications In Nanomedicine

ElhamAnari[1], Abolfazl Akbarzadeh[2]*, Nosratollah Zarghami[3]*, and Kazem Nejati-Koshki[4]

[1,2,3,4]School of Advanced Medical Sciences, Tabriz University of Medical Science

*** Corresponding authors:**Abolfazl Akbarzadeh(akbarzadehab@tbzmed.ac.ir), Nosratollah Zarghami(zarghami@tbzmed.ac.ir)

Background: Liposomes, sphere-shaped vesicles consisting of one or more phospholipid bilayers, were first described in the mid-60s. Today, they are a very useful reproduction, reagent, and tool in various scientific disciplines, including mathematics and theoretical physics, biophysics, chemistry, colloid science, biochemistry, and biology. Since then,liposomes have made their way to the market. Among several talented new drug delivery systems, liposomes characterize an advanced technology to deliver active molecules to the site of action, and at present, several formulations are in clinical use. Research on liposome technology has progressed from conventional vesicles to 'second-generation liposomes', in which long-circulating liposomes are obtained by modulating the lipid composition, size, and charge of the vesicle. Liposomes with modified surfaces have also been developed using several molecules, such as glycolipids or sialic acid.

Conclusion: This paper summarizes exclusively scalable techniques and focuses on strengths, respectively, limitations in respect to industrial applicability and regulatory requirements concerning liposomal drug formulations based on FDA and EMEA documents.

Keywords:Liposomes, Glycolipids, Drug formulations, Drug delivery systems

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Abstract # 33 **Poster**

Preparationand characterization of targeted nanoparticles of deferasirox by PLGA-PEG-FOL and Vit E TPGS

Ebrahimnejad P.[1], Mir M.[2]

1. Pharmaceutics department, Faculty of pharmacy, Mazandaran university of medical sciences, Sari, Iran,
2. Faculty of pharmacy, Mazandaran university of medical sciences, Sari, Iran, 09112722755, mina.mir254@gmail.com

Background & Purpose: It has been reported that iron depletion by a chelator inhibits proliferation of some cancer cells. Anticancer effects of deferasirox have been reported (1). The purpose of this study was to prepare Deferasirox-loaded PLGA-PEG-FOL NPs and evaluating variables such as the amount of vitamin E TPGS as emulsifier and the drug:polymer ratio on nanoparticle characteristics.

Materials & Methods: For folate-receptor-targeted anticancer therapy, deferasirox nanoparticles were produced using poly-lactide-co-glycolide-polyethylene glycol_folate (PLGA_PEG_FOL) conjugate by emulsification/solvent evaporation method. The particle size, size distribution and zeta potential of the nanoparticles were measured by laser light scattering. Scanning electron microscopy was used to determine the shape and surface morphology of the produced nanoparticles.The drug entrapped in the nanoparticles was determined by HPLC analysis. The release rate of deferasirox from the nanoparticles was measured in phosphate-buffered solution (pH 7.4) at 37ºC by a UV-VIS spectrophotometer.

Results: The size of the particles was in the range 140 to 210 nm. The value of the zeta potential for nanoparticles was in the range -11.3 to -26.1 mV. The highest encapsulation efficiency was 62.8% with 0.03% vit E TPGS and 6 mg drug and 12 mg polymer in 10 mL organic phase. The in vitro release profile of deferasirox from nanoparticles showed an initial burst release followed by a constant slow release.

Conclusion: Considering size, zeta potential, encapsulation efficiency, shape and in vitro release profile, prepared nanoparticles had desired characteristics.

Keywords: nanotechnology, deferasirox, PLGA-PEG-FOL, vit E TPGS

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Abstract # 34 **Poster**

Synthesis of magnetic nanoparticles in order to preparation ferrofluid as a targeted drug delivery system

Zahra Rastegar M.G [*1], Mohammad Behdani [1], Mahmood Rezaei R[1], Masoud Mirzaei Sh[2]

1Department of Physics, Faculty of sciences, Ferdowsi University of Mashhad, Mashhad, Iran

2Department of chemistry, Faculty of sciences, Ferdowsi University of Mashhad, Mashhad, Iran

Tel/fax : +98 511 8796983; * E-mile address : za_ra115@stu-mail.um.ac.ir

In this research, magnetic nanoparticles were prepared from salt aqueous solutions with respective stoichiometry in an alkaline medium by co-precipitation method. The precipitated particles were used for the preparation of ferrofluid. Targeted drug delivery is an application of ferrofluid based on magnetic nanoparticles. Ferrofluid is biocompatible and therefore it is one of the most extensively used biomaterials for different application in medicine.

Ferrofluid was discovered by Elmor in 1938. It is a colloidal mixture of magnetic particles that have 10-100 nm diameters in a liquid carrier. This liquid carrier contains a surfactant, which prevent the sticking of particles. Ferrofluid can be suspended in water or in an organic solvent. A typical ferrofluid contain 5% magnetic solids, 10% surfactant, and 85% carrier.

Various nonmagnetic microcarries are successfully utilized for drug targeting but they show poor site specificity and are rapidly cleared off by RES (reticuloendothelial system) under normal circumstances. Ferrofluid carriers were developed to overcome two major problems encountered in drug targeting namely RES clearance and target site specificity.

In this research, after preparation magnetic nanoparticles, samples were characterized by XRD and Fourier transform infrared spectroscopy (FTIR). Mean size of nanoparticles were about 8 nm and showed single-phase and cubic spinel structure.

Keywords: magnetic nanoparticle, co-precipitation method, ferrofluid, targeted drug delivery

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Abstract # 35 **Poster**

Recovery and Purification of Nanoparticulate Bioproducts Using a Novel Nanoporous Affinity Adsorbent in Expanded Bedfor Therapeutic and Diagnostic Applications

A. Rezvani, *M. Jahanshahi, G. Najafpoor

Nanotechnology research institute, school of chemical engineering, babol university of technology, babol, iran

*Mjahan@nit.ac.ir

Nanoparticulate bioproducts play a basic role in different applications of bio-medicine not only in drug delivery and gene therapy but also in molecular medicine to diagnosis and healing of disease, sophisticated organs grafting, nanoscale surgery, DNA detectors and sequence testers, nano-indicators that are able to diagnosis cancers in initial stages, biosensors, and pharmaceutical therapeutics in target tissues and rapid diagnostic methods[1]. In the recent decades, biodegradable nanoparticles such as natural polymers like proteins specially albumins,because of their specific advantages such as nontoxicity, stability for long duration, avalability and biodegradability were used widely specially in diagnosis and healing of cancers, controled drugdelivery systems and intracellular targetabletransmission vehicles. Among these, Bovin serum albumin(BSA) is a promising material and was used in a multitude of studies for particle preparation[2]. Chromatography in expanded mode is a rapid and efficient scalable purification protocol with highest resolution, therefor being essential for producing of NBPs suited for therapeutic and diagnostic application which specially is able to direct purification of target molecule from complex unclurified feedstocks[3]. The object of peresent study is to investigate the purification of NBPs using RG19-Agarose-Nickel nanoporous

adsorbents[4] customized for expanded bed affinity adsorption. However, expanded bed adsorption(EBA) of NBPs was carried out and the dynamic binding capacity was calculated. The overall process yield of recovery of the NBPs was more than 85%, which is a superior result in expanded bed chromatography. The generic application of RG19-Ag-Ni expanded bed adsorbents for adsorption and recovery of nanoparticulate bioproducts is indicated.

Keywords: nanoparticulate bioproducts, pharmaceutical and diagnostic products, bovine serum albumin, RG19-Ag-Ni adsorbent, expanded bed adsorption

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Abstract # 36 **Poster**

Cancer imaging and personalized therapy using liposomal radiopharmaceuticals

Fatemeh Gheybi

Nanomedicine Ph.D student -Tehran University Of Medical Science

Although liposomes have been used or proposed for use in a variety of applications in medicine, especially as carriers of diagnostic or therapeutic compounds, no liposomal radiotracer formulation for diagnosing cancer or visualizing tumors has been approved and marketed. Novel cancer imaging agents target cancer tissue by being sensitive to tumor specific micro-environmental conditions or phenotypical characteristics.Identification of tumor characteristics and targets, including gene-expression profiles, mutational status and phenotypical characteristics, is often based on multiple tumor biopsies. This approach was recently identified as being insufficient in many cases to fully describe the whole tumor due to large intra-tumor heterogeneities in the parameters being evaluated.The unique possibility to predict the biodistribution of liposomal drug delivery systems by radiolabeled liposomes may serve as a method to individualize and optimize cancer diagnosis and therapy during the treatment period (1-4).

Key words: Liposome - Diagnosis – Imaging- cancer- tumor

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Nanomolecular Diagnosis

Abstract # 37 **Lecture**

Rapid Nanomolecular Detection of Human Influenza Virus using Gold Nanorods

Hassan Nikbakht[1], Pooria Gill[2,*], Alijan Tabarraei[3], Alireza Niazi[1]

1- Department of Medical Biotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

2- Department of Medical Nanotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

3- Department of Virology, Faculty of Medicine, Golestan University of Medical Sciences, Gorgan, Iran

***Corresponding Author:** Pooria Gill; PhD of nanobiotechnology (pooriagill@yahoo.com)

Introduction: Influenza viruses are clinically important viral pathogens causing significant mortality, morbidity, and financial burden throughout the world(1). Because of the highly contagious nature of influenza viruses, the disease could be spread rapidly(2). Rapid identification of the viruses is therefore critical for the control of influenza and several molecular techniques have been developed as rapid tests for clinical diagnosis of the viruses (4, 3). Here, we introduced an isothermal-nanodiagnostic technology that the detection process has been minimized significantly for rapid molecular detection of this virus.

Materials and methods: Viral RNA from esophageal soap of 125 patient was converted to cDNA using reverse transcription via one-step kit. Bst DNA polymerase, betain, and targeting bumper and internal-loop primers for M-gene sequence were employed in the reaction of LAMP. Gold nanorods were added to LAMP product for identifying cauliflower-like amplicons from the virus cDNA.

Results: 49 samples of 125 were colorimetrically identified as positive and the minimum concentration of 10^{-4} of main product was detected via rod-shaped gold nanoparticles.Also 100% sensitivity and 95% specificity were obtained using this developed measurement in comparison to those via PCR.

Conclusion: nanodiagnostcis method using gold nanorods adapted with loop-mediated isothermal amplification method decreased the time needed for nanomolecular detection of the human influenza virus cDNA nearly 4-time faster than that in the conventional method. It seems utilizing this assay can be applied for rapid nanodiagnostics of the other microorganisms.

Keywords: Gold nanorod; Loop-mediated amplification; Human influenza virus

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Abstract # 38 **Lecture**

NanomolecularDiagnosis of Leishmania major using Rod-shaped Gold Nanoparticles

Alireza Niazi[1], Oghol-Niaz Jorjani[2,*], Hassan Nikbakht[1],Fatemeh Ghaffarifar[3],

Fatemeh Mesgarian[4], and Pooria Gill[5]

1. M.Sc. Student of Medical Biotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

2.Assistant Professor of Medical Parasitology, Faculty of Para-Medicine, Golestan University of Medical Sciences, Gorgan, Iran

3.Associated Profesor of Medical Parasitology,Faculty of Medical Sciences, Tarbiat Modares University,Tehran,Iran

4. M.Sc. of Medical Parasitology, Gonbad-e-Qabus Health Center

5. Assistant Professor of Nanobiotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

***Corresponding Author:** Oghel-Niaz Jorjani; PhD of Parasitology (niaz_jorjani@yahoo.com)

Background &purpose: Leishmania major is a flagellate protozoan parasite with diversity more than 20 species and it has a global expansion(1). This parasite is caused cutaneous leishmaniasis in the human (2). Employing molecular diagnostic techniques have more sensitivity and specificity than the microscopic methods for identification of this microorganism (3).Isothermal amplifications of nucleic acids such as NASBA technology has a high specificity for diagnosis of Leishmania pathogenic agent due to the viability determination in parallel (4).The purpose of this study was design and development of a nanomolecular method for detection of Leishmania major using nucleic acid sequence-based amplification(NASBA) and rod-shaped gold nanoparticles.

Materials &Methods: AfterRNA extraction from 51 skin biopsies,the 18S rRNA region amplified via NASBA isothermal amplification. The final result of reactionswas colorimetrically detected through interactions between NASBA amplicons and rod-shaped gold nanoparticles.

Results: The 19 of 51 samples were colorimetrically identified as positives and 100% sensitivity and 78.3% specificity were obtained using the nanodiagnostic assayin comparison to those resultsvia RT-PCR. The minimum concentration of 10^{-4} of main NASBA amplicons was detectedwithrod-shaped gold nanoparticles.

Conclusion: The nanomolecular method for detection of Leishmania major leads to performa specific, sensitive, and rapiddetection method, which is promisingthe fast diagnosis of this disease.

Keywords: Leishmania major; rod-shaped gold nanoparticles; NASBA.

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Abstract # 39 **Lecture**

Shiglella flexneri Laboratory diagnosis optimization through colorimetry base on the Gold Nano-particle

Salimi.S[1], Salouti.M[2], Mirza Ahmadi.S[3]

Undergraduate in Zanjan Islamic Azad University[1],Associate professor , medical physics physician, education department of Zanjan Islamic Azad University[2] Assistant professor, genetics proffesion, Zanjan Islamic Azad University[3]

Background and Purpose: Shiglella is an intestinal Gram-negative bacilliwhose infections has created many serious problems in developed and developing countries. IpaH is one of those gens that can be used as reagent to diagnose. The purpose of this study is to use colorimetry method as aquickdiagnosis of Shigella with high sensitivity and dedication.

Materials and method: In the study, a pair of particular primer was used to duplicate IpaH gen through PCR to identify Shigella type and a Uni-strandprobe was used in order to connect various regions of duplicated product of IpaH in which changed as Uni-branch one. In order to clarify particular connection probe, PRC product, phosphate buffer, Gold Nano-particle with OD1 then some 0.2salt was added to get optimized aggregation of Nano-particle. In this study, Negative control cases were used to analyze sensitivity and allocation (1,2)

Results: In this method, probe hybridization with DNA bacteria causes “Gold Nano-particles” aggregation then changed the red mixture to violet one and this change indicates the purpose molecule in the sample and it is observable by un-equipped eyes while no change was observed in negative control.

Conclusion: Due to IpaH gen existence in Shigella type, the method can be used as high sensitive and dedication with less time consuming and as practical one to identify Shigella flexneri and other types in food samples and disease.

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Keywords: Shigella flexneri , PCR, Probe, Gold Nano-paarticle, colorimetry

Abstract # 40 Lecture

Design and Development of Colorimetric method for detection of polymerase chain reaction using rod-shape gold nanoparticles

Reza Goudarzi[1] and Pooria Gill P[2,*]

1. Department of Biotechnology, Damghan Branch of Islamic Azad University, Damghan, Iran

2. Department of Nanotechnology, Faculty of Advanced Medical Technologies, Gorgan, Iran

*Corresponding Author: Pooria Gill; PhD of Nanobiotechnology (pooriagill@yahoo.com)

Background & Purpose: Nucleicacidamplificationisone of theimportant methodsinmoleculardiagnostics and polymerasechain reaction(PCR)has long beenone of themost populartoolsfor theamplificationofspecificDNA.(1,2,3,4) Usually, the procedure for identifying the product of this method is gelelectrophoresis methodandstaining withfluorescentdyes(5,6).Althoughthismethodiscommonlyused, but one of themost important thing in diagnostic techniquesis designprocessto rapid identify andreduction steps oftheprocess anduse ofadiagnostic procedurein whichtheidentityof theamplified productsby straight adding to reaction mix.

Material and methods:

Extraction ofDNA:DNAextractionwasperformedbyextraction kits.

SapphireAmp PCR Reaction:thereactionvolume25includes 0.2µMspecific primers, 12.5µl ofSapphireAmp Fast PCR Mater Mix (now Takara Bioscience Ltd.), 50NgofDNAextractionandwaterwere prepared.Programwhenthereactionof1minuteº C 94, 5seconds, 10 seconds98 º C,51º C ,72 º Cper second(30 times)done.

ThedetectionreactionSapphireAmp PCR:A barof goldnanoparticlestodetectthereactionvolumewas added to thepolymerase chain reaction.

Results:After addinggoldnanoparticlesasa positive responseto the reaction was cluttered and will changeover timeand doesnot alterthe responseis negative.

Conclusion It seems the straight adding of nanoparticles to thereactionsolutionwhich issuitable forrapid detection of DNA without UV staining for thedirectresultof thepresence or absenceofDNA.However,electrophoresisandstainingstepsremoved andinless than30minutes couldreachthedesired results.

Keywords:PCR,Detection, fluorescentdyes

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Abstract # 41 **Poster**

Quantum Dots: application in medical diagnosis

Abbasifar J.

Department of analytical, Faculty of chemistry, university of mazandaran, Babolsar, Iran

Tel:+985612500493. j.abbasifar@yahoo.com

Background & Purpose: Quantum dots (QDs) are nanocrystals that have attracted widespread interest in biology and medicine due to their unique optical and electronic properties. These inorganic semiconductor nanocrystals have typical diameter between 2-12 nm that possess unique luminescent properties. They can be used as an attractive alternative to organic molecules in applications such as optoelectronic devices, biological labeling and fluorescence probes in biologically active substances detection.

Conclusion: QDs have got unique properties which make them ideal for medical diagnosis. These include intense and stable fluorescence for a longer time; resistance to photobleaching, large molar extinction coefficients, and highly sensitive detection due to their ability to absorb and emit light very efficiently. Due to their large surface area-to-volume ratio, a single QD can be conjugated to various molecules, thus making QDs appealing for employment in designing more complex multifunctional nanostructures.

Keywords: quantum dots, medical diagnosis, luminescence

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Abstract # 42 **Poster**

Mesoporous silica nanoparticles: application in diagnosis

Jomeh Farsangi Z.[1], Beitollahi A.[2], Rezayat M.[1], Ghasemi SH.[2]
[1]School of advanced medical technologies, Tehran university of medical sciences
[2]School of metallurgy and materials engineering, Iran university of science and technology. zfarsangi@razi.tums.ac.ir, +989123125771

Clinical diagnosis has cometo depend heavily on detection and monitoring ofindividual chemical interactions of smaller and lessabundant targets, such as individual cells, mRNA,DNA, proteins, and peptides.

The variety of chemical and physical modifications possible with silica and its biocompatibility increases its versatility. The silica NP probe is highly hydrophilic and easy to centrifuge for separation, surface modification, and labeling procedures. The silica NPs exhibit enhanced and controllable mechanical and chemical stability and their porosity can also be easily tailored in terms of pore size and organization. Highly luminescent silica NPs have been developed for the selective tagging of a wide range of biomedically important targets, such as cancer cells, bacteria, and individual biomolecules.

It is also possible to make multifunctional silica NPs with the aim of developing nanoscale composites with innovative optical, chemical, and magnetic properties, all combined in one single nanostructure. For instance, magnetic fluorescent silica NPs based on iron oxide NPs combined with fluorophores can be simultaneously manipulated with an external magnetic field and characterized in situ with fluorescence microscopy or confocal scanning microscopy.

In this review, we describe the synthesis, bioconjugation, and applications of silica nanoparticles in different bioanalysis , such as:

1. Cancer cell imaging
2. Ultrasensitive single bacterium detection
3. DNA and microarray detection
4. Barcoding tags
5. Separation and purification of biological molecules and cells

Keywords: mesoporous silica nanoparticles, detection, imaging, cancer cell, bioanalysis

Abstract # 43 **Poster**

Quantum dots: synthesis, bioapplications,and toxicity

Marzieh Armat, Tayebeh Bakhshaiesh Oghabi, Alireza Valizadeh, Nosratalah Zarghami, Abolfazl Akbarzadeh*, Soodabeh Davaran**

School of Advanced Medical Sciences,Tabriz University of Medical Sciences

* Corresponding authors: Abolfazl Akbarzadeh: akbarzadehab@tbzmed.ac.ir and Soodabeh Davaran: davaran@tbzmed.ac.ir

Background: The development of a wide spectrum of nanoscale technologies is beginning to change the foundations of disease diagnosis, treatment, and prevention.These technological innovations, referred to as nanomedicines by the National Institutes of Health (Bethesda, MD, USA). The physical and chemical properties of materials can significantly improve or radically change as their size is scaled down to small clusters of atoms.Colloidal gold, ironoxide crystals, and quantum dots (QDs) semiconductor nanocrystals are examples of nanoparticles, whose size is generally in the region of 1–20 nm, and have diagnostic applications in biology and medicine. Several routes have been used to synthesize QDs,but, generally, techniques for QD synthesis used top-down processing methods and bottom-up approach. In this review, we evaluate few experiments that show the high potential of QDs in biological application, including tracking different macromolecules in the cell, tracking various cells in the tissue, labelling organelles and cells, clinical applications, and other applications.The three key elements of the toxicity screening strategy are: Physicochemical Characteristics, *In vitro* Assays (cellular and non-cellular), and *In vivo* Assays.

Conclusion: In this review, we summarize few experiments that illustrate the high potential of QDs used for/as: labelling biomolecules and cells; tracer to follow the intracellular/extracellular dynamic of a single biomolecule/cell; localization of biomolecules in vitro/in vivo; imaging of biomolecules or cells in vitro/in vivo; assessing cell growth in damaged tissue; pH probes for the study of enzyme reaction kinetics; biomarker detection in various cancers; imaging and sensing of infectious diseases; andprotein micro- and nanoarrays to the detection of cancer biomarkers.

Keywords: QD delivery systems, Toxicity, Emission spectra, Luminescence characteristics**.**

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Abstract # 44 **Poster**

Gold Nanoparticles: Preparation, Bio Applications, and Physical Properties

TayebehOghabiBakhshaiesh, [1]MarziehArmat,[2]Nosratalah Zarghami,[3]AbolfazlAkbarzadeh[*4]

[1,2,3,4]School of Advanced Medical Sciences,Tabriz University of Medical Sciences

[*] Corresponding authors: AbolfazlAkbarzadeh: akbarzadehab@tbzmed.ac.ir

Background: Metal nanoparticles have various unusual chemical and physical properties compared with those of metal atoms or bulk metal due to the quantum size effect ,their large superficial area and having surface plasmon resonance in the visible portion of the spectrum,which make them attractive for applications such as optics, electronics, catalysis, and biology. Among various metal nanoparticles, gold nanoparticles have tremendously high molar absorptivity in the visible region, and when gold nanoparticles approach each other and aggregate, the color of the nanoparticles changes from red to blue, because of the shift of the surface plasmon band to longer wavelength and in nanomolar concentration it can be clearly observed by naked eyes.This phenomenon can be applied to various sensing system. Also Gold nanoparticles (AuNPs) can be used to achieve drug delivery and photodynamic therapy.Au nanoparticles have been prepared using various methods such as chemical reduction, photochemical using UV irradiation , sonochemical , sonoelectrochemical.

Conclusion: In this review, we focus on some experiments that indicate broad bio application of AuNPs like DNA detection, non-viral-based gene delivery system, diagnostics, biosensing, therapeutic, drug and agent delivery at site of the tumor and cells ,cancer detection and therapy. Detection and quantification of metal ions in many fields such as environmental bioinorganic chemistry, developmental biology, and clinical toxicology can be done with gold nanoparticles.

Keywords: Gold Nanoparticles, Bio Applications, Surface Plasmon Resonance

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Abstract # 45 **Poster**

Study of adjuvant capability of the gold nanoparticles on immunity of botulinum neurotoxin serotype E in mouse

Rabiee Amir, Ebrahimi Firouz, Arefpoor Mohammad Ali

Botulism is a dangerous neuroparalytic syndrome caused by Clostrdium botulinum neurotoxins (serotypes A-G). The Studies shown that the binding domains have a great importance in immunity against the disease of all subtypes. ThusIn this study binding domain of botulinum neurotoxin was used as antigene candidate.The emulsified vaccine with Freund' s adjuvant (FA) may induce some side effects, which are not suitable for further clinical application. As an adjuvant, gold nanoparticles (GNPs) could stimulate a stronger immune response without producing detectable toxicity and physiological damage than FA. We have investigated if GNPs based delivery system would enhance immune response to recombinant BoNT/E. A recombinant binding domain BoNT/E conjugated with GNPs was prepared and it was injected four times into mice in two groups, that one group alone and another one with FA . Then the antibody titers was compared with Antigene-FA group and ultimatly the mice were challenged by active BoNT/E. The results showed that immunized mice with GNP-Ag and GNP-Ag-FA produced high titers of antibody and immuno response comparable with FA-Ag group. With adjustment in protein extraction, purification and conjugation methods it will be better adjuvant in compare with FA because for its biocompatible and other properties.

Keywords:adjuvant,BoNT/E, gold nanoparticles, botulism, recombinant binding domain

Abstract # 46 **Poster**

Gold nanoparticles Sensors as a new model of labeling specific proteins on the cell surface

Mohamadreza Shemshady*[1], Narges Keihanpor[1],Nilofar Abdirad [2]

[1]Young Researchers Club, Islamic Azad University, Kermanshah, Iran.

[2] Department of Chemical engineering, Zagros University, Kermanshah, Iran

AuNPs coupled with biomolecules are attracting increasing attention because of the potential applications of these new materials in biology-related challenges. Mannose-encapsulated AuNPs have been shown by TEM to specifically bind FimH adhesin of bacterial type 1 pili in Escherichia coli, and to do so more strongly than free mannose in the competition assay. This process represents a new method of labeling specific proteins on the cell surface using carbohydrate-conjugated AuNPs, whereby the visualization of the target receptor on the cell surface is relatively easy under an electron microscope. AuNPs functionalized with a monolayer of 11-thioacetate-undecanol-derivatized neoglycoconjugates of lactose disaccharide and trisaccharide antigens can be used to mimic glycophosphinolipid clusters in plasmamembranes in order to investigate a new mechanism of cell adhesion through carbohydrate-carbohydrate interactions. Spontaneous formation of AuNPs was observed in aqueous solutions of sugar-persub- stituted PAMAM dendrimers without the addition of any additional reductant. AuNPs coated with haptenated mercaptodextrans containing 15 mercapto groups bind specifically to paramagnetic beads coated with the corresponding antibody. A mannose derivative has been self-assembled onto preformed, citrate-capped water-soluble AuNPs, and, through the use of a C2 tether, a rapid colorimetric detection test has been developed for the protein canavalinin A.

E-mail: r.shemshady@yahoo.com

Tel: 09183594905

Multivalent interactions of glycono-AuNPs containing galactosyl and glucosyl headgroups with the HIV-associated recombinant glycoprotein gp 120 have been studied.

Keywords: AuNP Sugar Sensors, nanoparticle applications, denderimeres.

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Nanoinstruments / Nanoanalyzers

Abstract # 47 **Key Lecture**

Study of Different Parameters for Fabrication of Nano- Patterns and Nanolithography by Scanning Tunneling Microscope

Mitra Abedini, Saeed Sarkar, Reza saber*

School of Advanced Technologies in Medicine, Department of Medical Nanotechnology, Tehran university of Medical sciences, Tehran, Iran

In this study we surveyed the possibility of nanometer scale lithography in ambient condition using a scanning tunneling microscope manufactured by Iran (Pars Nanosystem Company , NATSYCO). Optimized parameters for this purpose have been determined. The study will be hopefully an initiative step toward further progress in manufacturing nanobio chips and bio nano electromechanical systems utilized for diagnosis and treatment purposes in medical fields.

Our studies showed the scanning tunneling microscope lithography yielded the same result in each test and thus it was reproducible. In our experiment nanostructures fabricated on the surface like emerged points at first. Then we could create linear structures, more complex forms, and finally we could write the words.

Nanostructures were created on gold surfaces by tungsten, gold, platinum-palladium tips. It is found that voltage used in lithography effects not only the nanostructures creation but also their size such that the higher the voltage is, the greater the size of nanostructures will be. Speed is also another important factor that can affect nanostructures size and their continuity. Time interval sequential pulses influences nanostructures integration and its value should be specified based on conditions and purpose of lithography.

Tip geometry, humidity and temperature can considered among effective factors so well further studies are recommended to determine their effects. The size of nanostructures created ranged from 20 to 150 nm.

Keywords: STM, nanostructures, gold surfaces, lithography

Abstract # 48 **Lecture**

Nanoscopic Characterization of microRNA Oligomers via Interaction with Gold Nanorods

Arash Tahmasebifar[1], Majid Shahbazi[2,*], and Pooria Gill[3]

1. PhD Student of Molecular Medicine, Faculty of Advanced Medical Technologies, GolestanUniversity of Medical Sciences (GOUMS), Gorgan, Iran
2. Associated Professor of Molecular Medicine, Faculty of Advanced Medical Technologies,Golestan University of Medical Sciences (GOUMS), Gorgan, Iran
3. Assistant Professor of Nanobiotechnology, Faculty of Advanced Medical Technologies,Golestan University of Medical Sciences (GOUMS), Gorgan, Iran

*** Corresponding Author:** Majid Shahbazi; PhD (shahbazim@goums.ac.ir)

Background & Purpose: The best known of small RNA oligomers in biological science are small interference RNAs (siRNA) and microRNAs (miRNA) with 19–25 nucleotides that have a wide range capability in molecular medicine such as regulate gene expression, development, responses to stress, growth and other biological processes (1, 2).The several procesures have been introduced for their charactrization and identify miRNAs involving molecular approaches (3).It is believed that if these factors was made under control ,can be prevented the spread of cancer cells wich dependent on ocurate detection of structure and their interaction with biomoleculs.Given the advent of new technologiesand their applicationindetection field ofsingle molecules, especially in nanomedicine area, scanning probe microscopes(SPM) (4) such as scanningtunneling microscope(STM)with the atomicresolution and nanoanalysis capabillity ,can bea suitable tool fornanoscopic characterization (nanotopography and nanoelectrodynamics)(5) of these small molecules. In this reserch, we describeshow to use ofscanningtunneling microscopefor characterization of microRNAs via interaction with gold nanorods (7,8) as determining eligibility of these nanostructurs for delivery of biomoleculs.

Materials & Methods: MicroRNA oligomers with 22 nucleotides were synthesizedby Bioneer (Korea). Then the obtained product was conjugated with gold nanorods. STM nanoscopy was performed to deposite GNR-microRNA nanoplexes on HOPG surface.Tomakea single layer arrangment of the nanoparticles, very highdilutions of nanoplexes wereprepared to be characterized structuralchanges of gold nanorods on the surface of graphite chip with the highly orderedatomicarrangement(HOPG) by using scanning tunneling microscope.

Results: Obtained twoandthree-dimensionalnanographs fromgoldnanorods were observed as a monolayeronHOPG surface using nanoscope that show theappropriatedilutionsofthenanorodsto achievethe single layer status. Also after addition of microRNA to GNRs, variety of deformation, aggregation and topographicalchanges were exploredinthesenanostructures.The cause of these changes is sever ionic electroestatic interactions related to RNA phosphate groups (negative charge) witha positively chargedsurface of CTAB-coated GNR.

Conclusion: This type of study can be applied asa novel toolfor characterization of microRNAs interactionaftercarrying with gold nanorods. This appearsdue tohigh sensitivityof the this nano-analyzer , can be provided to single molecular analysisof these biologicalagents after interaction or annealing to pharmaceutical-,diagnostic-, and therapeuticnanocarriers.

Keywords: MicroRNA oligomers; Scanning tunneling microscope; Gold nanorod; Nanoscopy

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Abstract # 49 **Poster**

Preconcentration and spectrophotometric determination of oxymetholone in the presence of its main metabolite (mestanolone) using modified maghemite nanoparticles

Rahimi M. [*1,2], Mirzaei M.[1], Rahimi Nezhad A.[1]

1: Cyclotron & Nuclear Medicine Department, Agricultural, Medical and Industrial Research School (AMIRS) Atomic Energy Organization Of Iran

2: Faculty of Chemistry, Bu-Ali Sina University, Hamedan, IRAN

A novel and sensitive extraction procedure using maghemite nanoparticles (γ-Fe_2O_3) modified with sodium dodecyl sulfate (SDS), as an efficient solid phase, was developed for removal, preconcentration and spectrophotometric determination of trace amounts of oxymetholone (used as doping agent [1])(OXM), in the presence of mestanolone (MSL). Combination of nanoparticle adsorption and easily magnetic separation was used to the extraction and desorption of OXM. The preparation of γ-Fe_2O_3 nanoparticles were obtained by co-precipitation method and their surfaces were modified by SDS [2]. The size and properties of the produced γ-Fe_2O_3 nanoparticles was determined by X-ray diffraction analysis, FT-IR and scanning electron microscopy measurements. OXM and MSL became adsorbed at pH 3.0. The adsorbed drugs were then desorbed and determined spectrophotometrically using a selective complexation reaction for OXM. The calibration graph was linear in the range 15.0–3300.0 ng mL^{-1} of OXM with a correlation coefficient of 0.994. The detection limit of the method for determination of

[*] Corresponding author. Tel. / Fax: +98-26-34436397

E. mail: m.rahimi.356@gmail.com

OXM was 4.0 ng mL^{-1}. The method was applied to the determination of OXM in human urine samples.

Keywords:*Oxymetholone; Mestanolone; Spectrophotometric determination; Maghemite nanoparticles; Preconcentration.*

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Abstract # 50 **Poster**

Preconcentration and spectrophotometric determination of low concentrations of histamine in biological samples by solid phase extraction using magnetic nanoparticles

Saeedeh Sepehrikiya[a], Saeed Sepehrikiya[b], Donya Arefi[a*] ,fatemeh khosravi[c]

a. Department of pharmacutical Chemistry, Faculty of pharmacy,Zabol University of Medical Sciences, Zabol, Iran
b. Zabol University of Medical Sciences, Zabol, Iran
c.Department of Chemistry,Faculty of Science, University of sistan and baloochestan,zahedan,,I.R. Iran
Donya_Arefi@yahoo.com(+985422253527)

Nano materials are new solid materials that have attracted to SPE methods substantially due to their special properties. Recently, magnetic nanoparticles as adsorption materials have been employed for preconcentration of trace metal and drug analytes from real samples. In this work introduces an approach, magnetic nanoparticles modified with FeCl3 were synthesized. The magnetic iron oxide nanoparticles(MIONs) were synthesized by mixing of ferrous and ferric chlorides with a molar ratio of 1:2 in an ammonium hydroxide solution with constant stirring [1, 2]. We developed an efficient and cost-effective method for the preconcentration of trace amount of histamine in human plasma samples using this novel magnetic solid phase in pH =7.0. The possible parameters affecting the enrichment were optimized. It is shown that the novel magnetic nano-adsorbent is quite efficient for fast adsorption of histamine. Various parameters affecting the adsorption of histamine on MIONs, such as pH of solution, type, volume and concentration of desorbing reagent and amount of adsorbent and matrix effects, have been investigated. The calibration graph for the determination of histamine was linear in the range of 0.05–2.0μg mL^{-1}. The limit of detection (LOD) based on three times the standard deviation of the blank was 0.022μg mL^{-1} (n=5) for histamine. The relative standard deviation (R.S.D.) was below 7.5% for histamine. The preconcentration factor of 100 was achieved in this method. The method was applied to an assay of histamine in human plasma.

Keywords: Histamine , Preconcentration , solid phase extraction

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Abstract # 51 **Poster**

The effect of ultrasound wave on Diagnosis and Treatment Patients Hypothyroidism

Rostami E[1],KashanianS[2]*

[1] Faculty of Chemistry, Razi University, Kermanshah, Iran

[2] Department of Chemistry, Sensor and Biosensor Research Center (SBRC) &Nanoscience and Nanotechnology Research Center (NNRC), Faculty of Chemistry, Razi University, Kermanshah, Iran.

Corresponding author' e-mail:*kashanian_s@yahoo.com

Tel & fax : 0831-4274559

Background & Purpose: Hypothyroidism patients are commonly treated by levothyroxine sodium. As one of the medical science purposes is diagnosis and treatment of these patients, ultrasound, a non-invasive way to diagnosis and deliver drugs to the innermost areas of the human body, may be successfully applied. Levothyroxine is very slightly soluble in water. Indeed, Nanoparticles loaded by levothyroxine is more effective for drug absorption which increases yield of drug action.

Materials & Methods: Chitosan nanoparticles were synthesized with tripolyphosphate (TPP) by ionic crosslinking and ultrasonic method [1]. The TPP-chitosan nanoparticles were characterized with transmission electron microscopy and scanning electron microscopy.

Results: The particle size of chitosan nanoparticles were in the range of 190-300 nm and encapsulation efficiencies of levothyroxine were85%. To study how ultrasound causes levothyroxine to be released from chitosan nanoparticles, both cumulative and pulsatile release were examined.

Conclusion: Ultrasound wave enhanced the ability of diagnosis of hypothyroidism. Cumulative release revealed the advantages of ultrasound in controlled drug delivery.

Key words: Ultrasound wave, chitosan, nanoparticles

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Microfluidics & Nanofluidics

Abstract # 52 **Lecture**

Capillary Loop-mediated Isothermal Amplification as an Alternative Technique for Accelerating the Conventional LAMP

Adele Rafati[1] and Pooria Gill [2,*]

1. Department of Medical Biotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

2. Department of Medical Nanotechnology, Faculty of Advanced Medical Technologies, Golestan University of Medical Sciences, Gorgan, Iran

***Corresponding Author:** Pooria gill; PhD of Nanobiotechnology (pooriagill@yahoo.com)

Background and Purpose: Nucleic acid amplification technology (NAAT) is an essential and unavoidable step in molecular diagnostics(1, 2) and among them, loop–mediated isothermal amplification is a simple isothermal NAAT method that does not require expensive devices or complex detection systems and is performed under isothermal condition(3). Due to these properties, LAMP is the best candidate to down scale this biological reaction for lab-on-a-chip application(4). Capillary tubes, as a microreactor instead of microtube, can be a preliminary step towards achieving a lab-on-a-chip approach for the design of LAMP microfluidic.

Materials and Methods: LAMP reaction in capillary tubes have been adapted as microreactor for molecular detection of specific sequence of DNA (λ-DNA) based on the hypothesis that LAMP reaction consuming time, will decrease in comparison to conventional LAMP without any change in specificity. In order to determine the minimum time required for LAMP reaction incidence in capillary tubes, capillary LAMP reactions were kept in oven at 60 ^{0}C for 15 min, 30 min, 45 min and 60 min. The determined time was then selected for conventional LAMP reaction in microtube and the results obtained were compared with each other.

Results: The obtained results agreed with the stated hypothesis. LAMP reaction incidence time was reduced to 15 min from 60 min in capillary tubes, whereas 15 min for incidence of conventional LAMP reaction would not be sufficient.

Conclusion: Because of the importance in point-of-care and the early state detection of infectious diseases, the improvement of capillary LAMP reaction will be performed to achieve the microfluidic aim. It can also aid in some diagnostic procedures by providing a faster approach than the conventional methods currently in use. Capillary glass tubes used as a microreactor with high aspect ratio (surface to volume ratio) could be suggested for molecular diagnosis procedures in comparison to polymer-based microtubes.

Keywords: LAMP , Microfluidic , NAAT

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Abstract # 53 **Lecture**

Improving the Selectivity of a Microfluidic Gas Analyzer for Detection of Biomarker Gases

Sobhan Erfantalab[1] and Ali Hooshyar Zare[1]

[1]Electronic Materials Laboratory, Electrical Engineering Department, K. N. Toosi University of Technology, Tehran, 16315-1355, Iran

Background and purposes: Microfluidics has become popular in recent years owing to the extensive use of microfluidic devices in medical applications [1, 2]. Breath analysis for disease detection is also becoming more important day by day, but the required expensive devices, such as gas chromatograph and mass spectrometer [2], and related elaborate analytical methods hamper its common use. Low-cost, portable, and easy-to-use devices for biogas analyses are sought after. Our laboratory has reported the design and fabrication of a microfluidic device for gas analysis [3, 4] we, here, report a considerable improvement on the selectivity of this device on biogas recognition.

Materials and methods: A microfluidic channel is designed with 60 um × 3 mm × 50 mm dimensions and fabricated on PMMA substrate. The channel conducts the gas into a microcavity where an oxide semiconductor gas sensor is installed. The dynamic responses of this sensor interacting with the diffused biomarker molecules at the end of the channel is recorded and utilized for analyses. Experiments are carried out on different biomarkers including acetone, benzene, ethanol, n-hexane, all in the 500-3000 ppm concentration range, and toluene in the 1000-3000 ppm range. We also included hydrogen contamination detection for the purpose of comparison with other works.

Results: By fabricating and assessment of the channels with different channels, we show that decreasing the channel depth improves the selectivity of the device. The normalized responses recorded for different concentrations of the mentioned biomarkers are recorded and compared with each other using appropriate signal processing techniques. The discriminative features of these response pattern are extracted and distinguishable in a 3-D feature space, affording biomarker recognition.

Conclusion: The modified device is capable of biomarker detection and recognition among the targets introduced. We demonstrate experimentally successfully discrimination among hydrogen, acetone, benzene, ethanol, n-hexane and toluene, using this simple and disposable microfluidic device, at the stated concentration ranges in air.

Keywords: microfluidics; gas analysis; biomarker gases; molecular diffusion; gas sensor

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Abstract # 54 **Poster**

Microfluidics application in cell-based assays for medical diagnosis.

Maryam Homaei[1] and Hosein Tehrani[1]

1. Department of Medical Biotechnology, Tarbiat Modares University, Tehran, Iran

*Corresponding author:Maryam Homaei, MS

Department of Medical biotechnology, Faculty of Medical Science, Tarbiat Modares University, Al-Ahmad Expressway, Tehran PO Box 1415- 331, Iran

Tel: +98 21 8801 1001; Fax: +98 21 8801 3030; Email: m.homaei@modares.ac.ir

In recent years research on microfluidic devices have attracted more attention due to their advantages such as low cost, portability, short detection time, reduced power and reagent consumption. Microfluidic devices have been developed in three main areas of cell based assays which are cell manipulation, cell treatment and cell analysis.

In the first area, cell manipulation chips were designed based on the applied force; producing magnetic, mechanical, optical and electrical microfluidics. These devices are able to separate or purify even in a single cell level. In the cell treatment area, microfluidics have valuable applications such as cell lysis, cell culture as well as electroporation and electrofusion. This kind of devices can lyse cells using mechanical, electrical and thermal methods. In addition, these microfluidics are useful for cell culture processes because of the small scale of the channels that are well suited to physical dimension of cells. They provide 3D microstructure and precise control of cellular microenvironment in comparison with the conventional methods. Electroporation and electrofusion microfluidics avoid the risk of using high voltage and have up to 100% efficiency in gene transfer.

In the cell analysis area, useful microfluidic devices have been developed; microcytometer, chemical cytometer, and ion channel study devices are some examples. Unlike conventional flow

cytometer which uses fluorescence detection, microfluidic flow cytometers employ various detection methods including confocal fluorescence, impedance spectroscopy, light scattering and digital image detection.

Keywords: Microfluidics, cell-based analysis, diagnosis

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Microarrays and Nanochips

Abstract # 55 **Key Lecture**

Microarrays and Nanobiochips; their applications

Dr Hossein A.Tehrani

Department of Medical Biotechnology, Tarbiat Modares University, Tehran, Iran

*Corresponding author: Hossein A.Tehrani, PhD

Department of Medical biotechnology, Faculty of Medical Science, Tarbiat Modares University, Al-Ahmad Expressway, Tehran PO Box 1415- 331, Iran

Tel: +98 21 82884533; Fax: +98 21 82884555; Email: h.tehrani@modares.ac.ir

Microarray and nanobiochips technologies have been widely used in research and industry. It has been estimated that they have a market of billions dollars with many companies selling products and many academic institutes and researchers have been conducted their research in this field.

A microarray (also commonly known as chip or biochip) is a collection of microscopic DNA, RNA or proteins spots attached to a solid surface, for example in DNA chip each spot contains picomoles of a specific DNA sequence, known as probes. These can be a short section of a gene or other DNA element that are used to hybridize a cDNA or cRNA sample under high-stringency conditions. Fluorophore-, silver-, or chemiluminescence-labeled targets are then used to determine relative abundance of nucleic acid sequences in the target.

Protein arrays can be potentially used to perform protein–protein, protein–DNA, protein– drug, or enzyme substrate screening assays in a sensitive, parallel and automated manner. On the other hand, there are two types of protein microarrays: antibody microarrays and functional protein microarrays. In chip fabrication, the probes are attached via surface engineering to a solid surface by a covalent bond to a chemical matrix. The solid surface can be glass, plastic or silicon chip. Microarrays also differ in fabrication, workings, accuracy, efficiency, and cost.

This technology is now commonly used in many biologic and drug discovery studies to profile gene expression within cells.The number of patent applications in biochip technology has increased per year, indicating that there are competitive markets with many opportunities.

Current research focuses on increasing the sensitivity and the speed of these technologies, while minimizing their size and cost.

Keywords: microarray, biochips, nanobiochips

Abstract # 56 **Poster**

Study of silver nanoparticles effect against biofilm formation by *A. baumannii*

Hendiani S[1*], Abdi-Ali A[1], Kharrazi Sh[2], Mohammadi P[1]

[1] Department of biology, Faculty of Science, Alzahra University, Tehran, Iran

[2] Schools of Advanced Technologies in Medicine, Tehran University of Medical Science, Tehran, Iran

[*] University of Alzahra, Tehnra, Iran.

Saghar.hendiani@yahoo.com; Phone number: 09354815666

Background and purpose: Biofilms are communities of bacteria attached to a surface which enclosed in a matrix (1). Acinetobacter biofilms play a role in infectious diseases such as cystic fibrosis, periodontitis, in bloodstream and UTI because of their ability to indwell medical devices (2).Silver nanoparticles is a broad-spectrum antimicrobial that effect against bacteria, fungi and viruses (3).In this survey,silver nanoparticles effect against biofilm formation by *A. baumannii*was studied.

Materials and methods: Of 75 clinical isolates, 10 isolates were selected which had the highest rate of biofilm formation and 100 µl of biofilm formation and 100 µl of silver nanoparticles dilutions were added to a well of a 96-well microtiter plate and incubated at 37°c for 24h. Then stained with crystal violet and minimum biofilm inhibitory concentration (MBIC) was calculated (4).

Results: Results showed that in concentration of 100 ppm biofilm formation was dramatically increased but was inhibited at concentrations of 0.8-6.25 ppm.

Conclusion: According to the importance of *A. baumannii* biofilms in medicine and prevalence of its antibiotic-resistant, the use of silver nanoparticles is recommended for biofilm inhibition and eradication.

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Key words

Acinetobacter baumannii, Biofilm, MBIC

Microelectromechanical Systems (MEMS)

Nanoelectromechanical Systems (NEMS)

Abstract # 57 **Key Lecture**

Artificial olfaction systems: state-of-the-art, applications, and technical bottlenecks

Faramarz Hossein-Babaei

Electronic Materials Laboratory, Electrical Engineering Department, K. N. Toosi University of Technology, Tehran, 16315-1355, Iran; fhbabaei@kntu.ac.ir

Using the information obtained by odor detection and classification as a noninvasive method of disease state monitoring and clinical diagnosis is reemerging [1]. Here, after a brief introduction on the standard gas analyses techniques, the state-of-the-art in the fabrication of sensor array-based olfaction systems is reviewed. It will be shown that the aging-caused quality factor drift in the array components is the most serious technical shortcoming of these systems preventing their common use. In our laboratory, the problem has been approached from two different directions involving virtual array formations [2-4]. Both approaches are promising and are resulting in olfaction systems with compensable drifts [5]. These systems are briefly described, and the possibility of interdisciplinary co-operations is discussed.

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Abstract # 58 **Poster**

NanoRBC

Ali Maleki[1,2], Mohammad Shahjahani [3]

1. Treatment management deputy of social security organization, Kermanshah, 2. PhD Student of hematology, Tehran University of Medical Sciences 3. MSc in hematology, Tarbiat Modares University

RBC substitutes are a group of oxygen carriers designed as a temporary replacement for transfusion. Although the research trend in the field of blood substitutes has had a slow pace in recent years, a number of new generation products have passed successful clinical trials, so that they have even found routine clinical use in some surgeries.

Recent advances in the field of generating artificial cells have conducted the attempts to reach artificial red blood cells towards a new direction. Nanoscale artificial RBC are a new type of blood substitutes in which synthetic polymeric membranes have been used to enclose polyhemoglobin. In these cells, sizing 80-150 nm, a number of enzymes present in RBCs have been inserted in addition to polyhemoglobin as oxygen carrier. This will not only solves the oxygen delivery problem but prevents the generation of free oxygen radicals during injection in severe hemorrhages.

Blood substitutes have several advantages over allogenic RBC including no requirement of cross match, being free from infectious agents and long-term storage capacity at room temperature. Therefore, achieving such substitutes can obviate many existing limitations associated with blood transfusion. As some of these products have recently found therapeutic applications and their production technology is at hand in our country, the need for related research in this field will become obvious over time.

Key words: blood substitutes, Poly hemoglobin, NanoRBCs