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Deanship of Scientific Research
Publication Series

Toxicity and growth inhibitory activities of methanol extract and the β-carboline alkaloids of Peganum harmala L. against two coleopteran stored-grain pests

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Abstract:

Methanol extract and the β-carboline alkaloids were extracted from the seeds of Peganumharmala L (Zygophyllaceae). Their toxicity, growth inhibitory and effects on the progeny production of Triboliumcastaneum (Herbst) (Coleoptera: Tenebrionidae) and Rhyzoperthadominica (F) (Coleoptera: Bostrichidae) was studied. To assess any additive effects among the extracted β-carbolines, they were tested as binary mixtures (1:1) or as a crude alkaloid fraction. All extracts exhibited a considerable adulticidal effect with increasing activities in response to increased exposure period. Using the contact toxicity bioassay, the crude β-carboline fraction was the most effective (LC50›s were 20.1 and 36.7) µg/cm2, 48 h post-treatment against R. dominica and T. castaneum, respectively. LC50›s of (harmaline+harmine), (harmaline+harmane), and methanol extract were (31.2, 39.4), (33.7, 47.2), and (39.8, 65.2) µg/cm2, 24 h post treatment against R. dominica and T. castaneum, respectively. At 48 h post-treatment, LC50 of (harmaline+harmine) reached 22.4 µg/cm2 against R. dominica. When mixed with the insect›s diets, toxicity of all extracts were increased with the crude alkaloidal fraction the most toxic (LC50›s were 7.8 and 14.7) mg/kg grains, 48 h post exposure against R. dominica and T.

castaneum, respectively. When the 2nd instar larvae were fed sublethal doses-treated grains, development and F1 progeny of both insects were significantly affected ($P \leq 0.001$). At 3.5 mg/kg grains of the crude alkaloidal extract, percentages of malformed larvae and pupae of T. castaneum were 19.7 and 33.4 %, respectively. In this case, a total life span of 81.3 days was recorded for the treated individuals compared to 44.2 for the control. A reduction in the adult progeny of 56.9, 44.0 and 43.6% was obtained with 3.5 mg/kg of the crude alkaloids, (harmaline+harmine) and methanol extract, respectively. Meanwhile, the reduction in adult progeny of R. dominica reached 79.2 % with the same concentration of the crude alkaloid extract.

Journal of Stored Products Research 47 (2011) 255261-.

Growth, structural and optical properties of well-crystalline Al-doped ZnO nanowire and their based field effect transistor (FET)

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Abstract:

Well-crystallized Al-doped ZnO nanowires were synthesized in large quantity on silicon substrate by using metallic zinc and aluminum powders in the presence of oxygen. The synthesized nanowires were examined in terms of their morphological, structural and optical properties. The detailed morphological and structural properties reveal that the synthesized products are nanowires, grown in high density and possessing well crystalline structures. The optical property of as-synthesized Al-doped ZnO nanowires was examined by room-temperature photoluminescence (PL) spectroscopy which shows a broad band in the visible region with a suppressed UV emission. The origination of broad visible emission could be correlated with the presence of structural defects due to insertion of Al-atoms in the lattices of as-grown nanowires. The electrical properties of as-synthesized Al-doped ZnO nanowires were explored by fabricating single nanowire based field effect transistors (FETs). The fabricated single Al-doped ZnO nanowire based FET exhibits carrier concentration and electron mobility of ~4.80 □ 1017 cm-3 and ~25.02 cm2V-1s-1, respectively.

Science of Advanced Materials 3, 7192011) 724-)

Highly sensitive Hydrazine Chemical Sensor Based on Mono-Dispersed Rapidly Synthesized PEG-coated ZnS Nanoparticles

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Abstract:

Monodispersed PEG-coated ZnS (P-ZnS) nanoparticles (NPs) were synthesized by facile microwave process and utilized as efficient electron mediators for the fabrication of highly sensitive hydrazine chemical sensor. The detailed morphological and structural properties revealed the monodispersity and good crystallinity for synthesized P-ZnS NPs. A high-sensitivity of ~89.3 μA/cm2□M and low limit of detection of 1.07 μM, based on S/N ratio, were obtained for the fabrication of hydrazine chemical sensor based on P-ZnS NPs. To the best of our knowledge, this is the first report which demonstrates the utilization of P-ZnS NPs for the fabrication of efficient hydrazine chemical sensor. By this work, it could be concluded that simply synthesized ZnS NPs can be used as efficient electron mediators for the fabrication of effective hydrazine chemical sensors.

Talanta 85, 24112011) 2416-)

Low-temperature growth of well-crystalline Co3O4 hexagonal nanodisks as anode material for lithium-ion batteries

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Abstract:

Uniform hexagonal-shaped cobalt oxide (Co3O4) nanodisks were prepared in large scale via facile aqueous solution based hydrothermal process at 110ºC. The detailed structural characterizations confirmed that the synthesized products are hexagonal cobalt oxide nanodisks, possessing very well-crystalline cubic spinel structure. A coin cell of type -2032 was assembled using the synthesized Co3O4 nanodisks and its charge- discharge profile was analyzed between the voltages 0.01 and to 2.5 V vs Li/Li+ reference electrode. The electrochemical cell composed of Li/Co3O4 delivered an initial lithium insertion capacity of 2039mAh/g. Although the cell exhibited high irreversible capacity during the first four cycles, the columbic efficiency has been improved upon cycling.

ElectrochemicaActa 56, 85342011) 8538-)

High-Yield Synthesis of Well-Crystalline □-Fe2O3 Nanoparticles: Structural, Optical and Photocatalytic Properties

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Abstract:

In this paper, we report the high-yield facile synthesis, detailed characterization and photocatalytic application of α-Fe2O3 nanoparticles. The synthesis was done via simple hydrothermal process by using aqueous mixtures of iron chloride, hexamethylenediamine and NH3.H2O at low temperature of 110 ºC. The morphologies of the synthesized products were examined by using field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) which confirmed that the synthesized structures are almost spherical shaped nanoparticles with the average diameters of ~ 35 ± 5 nm, and are grown in high yield. The detailed structural characterizations and composition of the as-synthesized nanoparticles were investigated by using X-ray diffraction (XRD), high-resolution TEM (HRTEM), energy dispersive spectroscopy (EDS) attached with FESEM and Fourier transform infrared spectroscopy (FTIR) which substantiated that the as-synthesized nanoparticles are well crystalline and pure α-Fe2O3. The UV-Vis absorption spectrum of the synthesized nanoparticles demonstrated the existence of two optical band gaps which correspond to direct and indirect transitions, respectively. The as-synthesized α-Fe2O3 nanoparticles exhibit good photocatalytic properties on photocatalytic degradation of methylene blue.

Journal of Nanoscience and Nanotechnology 11, 34742011) 3480-)

A Convenient and Simple Approach for the Fabrication of High-Sensitive Non-Enzymatic Glucose biosensor based on ZnO Nanorods

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Abstract:

In this paper, a convenient and reliable approach has been presented for the fabrication of efficient and high-sensitive non-enzymatic glucose sensor by using well-crystalline ZnOnanorods as effective electron mediator. ZnOnanorods were synthesized by hydrothermal process at low-temperature using simply available laboratory chemicals i.e. zinc nitrate and sodium hydroxide. The detailed morphological study by field emission electron microscopy (FE-SEM) reveals that the synthesized nanorods are grown in high density. The as-synthesized nanorods are well-crystalline and possessing wurtzite hexagonal phase as confirmed by detailed structural characterizations using X-ray diffraction (XRD) and high-resolution transmission electron microscopy (HR-TEM). Fourier transform infrared (FT-IR) substantiated that the synthesized nanorods are pure ZnO. The fabricated non-enzymatic glucose biosensor based on ZnOnanorods exhibits high sensitivity of ~5.601 ± 0.02 μA cm−2 mM−1, detection limit of ~0.5 μM with a correlation coefficient (R) of 0.97531 and response time of 10 s. This research opens a way that simply synthesized ZnOnanomaterials could be used as efficient electron mediators for the fabrication of efficient non-enzymatic glucose biosensors.

Sci. Adv. Mat. 3, 12011) 7-)

Urea sensing properties of Cu-doped Titanate nanostructure

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Abstract:

This paper presents the urea sensing properties of Cu-doped titanate nanostructure. Cu-doped nanomaterial was prepared using hydrothermal method at 150□C for 48 hours followed by calcination at 350□C. Thick films were deposited using screen printing technique on electropolished aluminum substrates. Morphological changes occurred from particle to mixed structure of particle and flakes during hydrothermal process. Urease was immobilized on the films by soaking in urease solution (100 units) for 5 h which is covalently attached on the surface. In general, conductivity of film increased after urease immobilization as observed in the buffer solution. The conduction linearly increases over the wide range of urea concentration i.e. 1mM to 500 mM. Urease immobilization was confirmed from IR spectroscopy analysis of the films giving additional peaks.

Advanced Science Letter 4, 34512011) 3457-)

Growth of La0.7Sr0.3MnO3 Thin-Films on SrTiO3 (100) substrate by Pulsed Laser Deposition: Structural, Optical and Electrical Properties

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Abstract:

This paper reports the growth and properties of La0.7Sr0.3MnO3 (LSMO) thin films on SrTiO3 (100) perovskite single crystal substrates via pulsed laser deposition (PLD) process using Kr: F (λ = 248 nm) laser line as an exciton source. The SrTiO3 (100) perovskite single crystal was used as substrate due to its good lattice matching with the deposited thin films (La0.7Sr0.3MnO3). The LSMO thin films were deposited at without oxygen pressure and other two different oxygen pressures, i.e. at 100 mTorr and at 300 mTorr oxygen pressures. For the deposition of thin films, the target material was prepared by mixing and sintering the exact amounts of manganese oxide (Mn3O4), strontium oxide (SrCO3) and lanthanum oxide (La2O3). Finally, a sintered pellet of La0.7Sr0.3MnO3 was used as a target for the deposition of the thin films. The as-grown LSMO thin films were characterized in terms of their structural, optical and electrical properties.

Advanced Science Letter 4, 34752011) 3479-)

Well-Crystalline □-Fe2O3 Nanoparticles for Hydrazine Chemical Sensor Application

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Abstract:

This paper reports a facile synthesis, characterization and hydrazine chemical sensor applications of α-Fe2O3 nanoparticles (NPs). The α-Fe2O3 nanoparticles were synthesized by simple hydrothermal process at low-temperature of 130°C and characterized in detail in terms of their morphological, structural and compositional properties. The detailed characterizations revealed that the as-synthesized nanoparticles are well crystalline and possessing rhombohedral α-Fe2O3 structure. The as-synthesized α-Fe2O3 nanoparticles were used as efficient electron mediators for the fabrication of hydrazine chemical sensor which exhibits high sensitivity and low-detection limit. The obtained sensitivity and detection limit of the fabricated chemical sensor was found to be ~1.59 μA/ cm2 μM and 3.84 μM, respectively. Importantly, to the best of our knowledge, this is the first report in which α-Fe2O3 was used as an electron mediator for the fabrication of amperometric chemical sensor. Therefore, this work shows that simply synthesized α-Fe2O3 can be used for the fabrication of robust hydrazine chemical sensors.

Sci. Adv. Mater. 3, 9622011) 967-)

Well-crystalline ZnO nanowire based field effect transistors (FETs)

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Abstract:

Well-crystalline ZnO nanowires were grown on Si(100) via non-catalytic thermal evaporation process using metallic zinc powder in presence of oxygen. The detailed morphological characterizations by field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) confirmed that the synthesized products are nanowires with the typical diameter and lengths of ~55 ± 5 nm and several micrometers, respectively and are grown in high density over the silicon substrate. The detailed structural characterizations by high-resolution TEM and X-ray diffraction confirmed that the synthesized nanowires are well-crystalline and possessing wurtzite hexagonal phase. The presence of Raman-active optical-phonon E2high mode at 437 cm-1 in the Raman-scattering spectrum confirms good crystal quality for the as-grown ZnO nanowires. The electrical transport properties of the as-grown nanowires were explored by fabricating single nanowire based field effect transistors (FETs). The fabricated single ZnO nanowire based FET exhibits carrier concentration and electron mobility of ~7.49 □ 1017 cm-3 and ~8.42 cm2V-1s-1, respectively.

Journal of Nanoscience and Nanotechnology 11, 51022011) 5107-)

Growth, Properties and Dye-Sensitized Solar Cells (DSSCs) Applications of ZnO Nanocones and Small Nanorods

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Abstract:

Crystalline ZnOnanocones (NCs) and small nanorods (SNRs) were synthesized via facile aqueous solution process at low-temperature of 80 ± 5 ºC. The synthesized ZnO nanostructures were characterized in detail in terms of their morphological, structural, optical and photovoltaic properties. The morphological investigations of as-synthesized nanostructures were performed by field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) which confirms the formation of ZnOnanocones and nanorods in large quantity. The structural and compositional properties of as-synthesized ZnO nanostructures were evaluated by X-ray diffraction (XRD) pattern, energy dispersive spectroscopy (EDS), Fourier transform infrared (FTIR) spectroscopy and Raman-scattering spectroscopy techniques. The studies reveal the well-defined crystallinity and pure phase ZnO for as-grown nanostructures. UV-Vis spectroscopy was used to determine the optical properties of as-synthesized ZnO nanostructures. The as-synthesized

ZnO NCs and SNRs were used as anode materials for the fabrication of dye-sensitized solar cells (DSSCs). The fabricated DSSCs using ZnO NCs and SNRs exhibited overall light-to-electricity conversion efficiencies of ~0.91% and 0.64 %, open-circuit currents (VOC) of 0.703 V and 0.650 V, short-circuit currents (JSC) of ~ 2.29 mA/cm2 and ~1.46 mA/cm2 and fill factors (FF) of 0.55 and 0.67, respectively.

Science of Advanced Materials 3, 6952011) 701-)

Utilization of CuO Layered Hexagonal Disks for Room-Temperature Aqueous Ammonia Sensing Application

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Abstract:

In this paper, CuO layered hexagonal disks based ammonium hydroxide chemical sensor has been fabricated which demonstrated good sensitivity and detection limit. The CuO layered hexagonal disks were synthesized in large quantity via facile hydrothermal process at low-temperature of 130 ºC and characterized in detail in terms of their structural and optical properties [1]. The detailed structural and optical properties of as-synthesized CuO layered hexagonal disks confirmed the good crystallinity with monoclinic structure and good optical properties for synthesized products [1]. The fabricated ammonium hydroxide chemical sensor based on CuO layered hexagonal disks demonstrate a good sensitivity of 0.07166 μA cm-2 mM-1, detection limit = 1.333 μM, response time less than 10 s, linear dynamic range (LDR) from 5.0 μM to 5.0 mM. This study reveals that simply synthesized CuO materials can be efficiently as an electron mediator to fabricate efficient chemical sensors.
AIP Conf. Proc. 1370, 97 (2011); doi: 10.10631.3638088/

Growth and photocatalytic properties of Sb-doped ZnOnanoneedles by hydrothermal process

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Abstract:

This paper reports a facile hydrothermal synthesis of Sb-doped ZnOnanoneedles by using aqueous mixtures of zinc chloride, antimony (Sb) chloride, hexamethylenetetramine (HMTA) and ammonium hydroxide at low temperature of 110 ºC. The morphological characterizations of as-synthesized nanoneedles were done by field emission scanning electron microscopy (FESEM) which reveals that the nanoneedles are grown in large-quantity and arranged in such a special manner that they made flower-like morphologies. The structural characterization of as-synthesized nanoneedles was investigated by X-ray diffraction (XRD) pattern which confirm the well-crystalline and wurtzite hexagonal phase of as-synthesized products. The compositional characterization of as-synthesized nanoneedles was characterized by energy dispersive spectroscopy (EDS), which verify that the synthesized nanoneedles are composed of zinc, Sb and oxygen. For application point of view, the synthesized nanoneedles were used as photocatalyst for photocatalytic degradation of methylene blue (MBB) and it was found that it exhibit good photocatalytic properties towards the photocatalytic degradation of methylene blue

AIP Conf. Proc. 1370, 121 (2011); doi: 10.10631.363809/

Growth of branched In-doped ZnO nanowires: Structuraland Optical Properties

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Abstract:

Well-crystallized branched Indium (In)-doped ZnO nanowires were grown on silicon substrate via simple thermal evaporation process by using metallic zinc and indium powders in the presence of oxygen. The as-grown branched nanowires were examined in terms of their morphological, structural and optical properties using field emission scanning electron microscopy (FESEM) attached with energy dispersive spectroscopy (EDS), X-ray diffraction and room-temperature photoluminescence (PL) spectroscopy. The morphological and structural characterizations confirmed that the as-grown products are branched nanowires, grown in high-density and possessing well-crystalline structures. The room-temperature photoluminescence (PL) spectrum exhibited a very small UV emission and a broad band in the visible region indicating the presence of structural defects due to insertion of In-atoms in the lattices of as-grown nanowires. The presence of a strong green emission in the room-temperature PL spectrum demonstrates that these structures can be used for specific applications of ZnO-based phosphors, such as field emissive display technology, etc.

AIP Conf. Proc. 1370, 142 (2011); doi: 10.10631.3638095/

Large-scale synthesis of ZnO balls made of fluffy thin nanosheets by simple solution process: Structural, Optical and Photocatalytic properties

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Abstract:

This paper reports a large-scale synthesis of ZnO balls made of fluffy thin ZnOnanosheets by simple solution process at low-temperature of 65 ± 2 ºC. The synthesized ZnO structures were characterized in detail in terms of their morphological, structural, optical and photocatalytic properties. The morphological and structural examinations were done by using field emission scanning electron microscopy (FESEM) attached with energy dispersive spectroscopy (EDS), transmission electron microscopy (TEM) combined with high-resolution TEM (HRTEM), X-ray diffraction (XRD) pattern and Fourier transform infrared spectroscopy (FTIR) measurements. The detailed morphological characterizations confirmed that the synthesized products are ZnO balls which are made by accumulation of hundreds of thin ZnOnanosheets. Interestingly, it is seen that the nanosheets are arranged in such a special fashion that they made ball-like morphologies. Detailed structural examinations revealed that of as-synthesized ZnO products are well-crystalline and possessing wurtzite hexagonal phase. The optical property, measured by UV-Visible spectroscopy, substantiated good optical

properties for as-synthesized ZnO balls. The as-synthesized ZnO balls were utilized as an efficient photocatalysts for the photocatalytic degradation of methylene blue (MB) dye. Almost complete degradation of MB was observed in presence of ZnO balls composed of nanosheets within 70 minute under UV-light irradiation. By comparing the photocatalytic performance with commercially available TiO2-UV-100, it was observed that the synthesized ZnO balls exhibited superior photocatalytic performance as compared to TiO2-UV-100 photocatalyst.

Journal of Colloidal and Interface Science 363, 5212011) 528-)

Structural and Optical Properties of CuO Layered Hexagonal Disks Synthesized by Low-Temperature Hydrothermal Process

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Abstract:

Layered hexagonal disks of CuO were synthesized on a large scale via low-temperature hydrothermal growth process at 130 °C by using copper nitrate, hexamethylenediamine (HMDA) and NH4OH. The detailed morphological investigations by field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) clearly revealed that the synthesized CuO structures are made by the well layer-by-layer accumulation of several sheets which arranged themselves in such a special fashion that they exhibit the hexagonal disks of CuO. The detailed structural characterizations of the hexagonal CuO disks were done by high-resolution TEM (HRTEM) and X- ray diffraction (XRD) which confirmed that the synthesized structures possessing well nanocrystalline nature and monoclinic structure. The purity and composition of the synthesized products were examined by using energy dispersive spectroscopy (EDS), elemental mapping and Fourier transform infrared spectroscopy (FTIR). Using UV-Vis spectroscopy at room temperature we obtained indirect and direct band gap values slightly blue shifted to the bulk values. Finally, a plausible growth mechanism has been proposed for the formation of CuO layered hexagonal disks.

Journal of Physics D: Applied Physics 44, 155405 (2011)

Utilization of ZnO Nanocones for the Photocatalytic Degradation of Acridine Orange

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Abstract:

A facile aqueous solution process was used to synthesize well-crystalline ZnOnanocones at low-temperature of 60 ºC by using easily available chemicals, i.e. zinc nitrate hexahydrate and sodium hydroxide. The detailed morphological, structural and optical properties of the synthesized nanocones were investigated by using field emission scanning electron microscopy (FESEM) attached with energy dispersive spectroscopy (EDS), transmission electron microscopy (TEM) equipped with high-resolution (HRTEM), X-ray diffraction (XRD) pattern, Fourier transform infrared (FTIR) spectroscopy and UV-Vis. spectroscopy measurements. The detailed structural and optical properties of the as-synthesized nanocones confirmed that the obtained products are pure, well crystalline, possessing wurtzite hexagonal phase and exhibiting good optical properties. For application view point, the as-synthesized nanocones were used as photocatalyst for the efficient photocatalytic degradation of Acridine Orange. It was observed that Acridine orange was almost completely degraded within 110 minutes. This research demonstrates that the simply synthesized ZnO nanostructures could be efficient photocatalyst for the photocatalytic degradation of various organic dyes and chemicals.

Journal of Nanoscience and Nanotechnology 11, 40612011) 4066-)

Direct Growth of ZnO Nanosheets on FTO Substrate for Dye-Sensitized Solar Cells Applications

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Abstract:

ZnOnanosheets were directly grown on fluorine-doped tin oxide (FTO) substrate via simple solution process at low temperature by using zinc chloride and hexamethylenetetramine (HMTA). The morphological characterizations by SEM and TEM confirmed that the deposited structures are nanosheets in which some are assembled in flower-shaped morphologies. The detailed structural investigations revealed that the deposited nanosheets are pure and crystalline ZnO and composed of Zn and O only. The obtained ZnOnanosheets on FTO substrate was used as a photoanode to fabricate the dye sensitized solar cells (DSSCs). The fabricated DSSCs exhibited an overall light-to-electricity conversion efficiency of 1.45 %. A short-circuit current of 4.51 mA/cm2, open-circuit voltage of 0.610 V and fill factor of 0.53, was achieved from the fabricated ZnOnanosheets based DSSCs.

Journal of Nanoscience and Nanotechnology 11, 35602011)3564-)

Growth and properties of Ag-doped ZnO nanoflowers for highly sensitive phenyl hydrazine chemical sensor application

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Abstract:

We report here the fabrication of a robust, highly sensitive, reliable and reproducible phenyl hydrazine chemical sensor using Ag-doped ZnOnanoflowers as efficient electron mediators. The Ag-doped ZnOnanoflowers were synthesized by facile hydrothermal process at low-temperature and characterized in detail in terms of their morphological, structural, compositional and optical properties. The detailed morphological and structural characterizations revealed that the synthesized nanostructures were flower-shaped, grown in very high-density, and possessed well-crystalline structure. The chemical composition confirmed the presence of Ag into the lattices of Ag-doped ZnOnanoflowers. High sensitivity of ~557.108 ± 0.012 mA.cm-2.(mol L-1)-1 and detection limit of ~5×109- mol L-1 with correlation coefficient (R) of 0.97712 and short response time (10.0 s) were observed for the fabricated chemical sensor towards the detection of phenyl hydrazine by using a simple current-voltage (I-V) technique. Due to high sensitivity and low-detection limit, it can be concluded that Ag-doped ZnOnanoflowers could be an effective candidate for the fabrication of phenyl hydrazine chemical sensors.

Talanta, In Press (2012)

Ultra-sensitive ethanol sensor based on rapidly synthesized Mg(OH)2 hexagonal nanodisks

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Abstract:

Magnesium hydroxide (Mg(OH)2) hexagonal nanodisks were synthesized via a facile microwave-assisted hydrothermal process and used, for the first time, as an efficient electron mediators for the fabrication of efficient ethanol chemical sensor. The synthesized hexagonal nanodisks were characterized in terms of their morphological and structural properties. The detailed morphological and structural investigations reveal that the synthesized Mg(OH)2 hexagonal nanodisks are grown in high density, and possessing hexagonal crystal structure. Using as-synthesized Mg(OH)2 hexagonal nanodisks, an efficient and robust ethanol chemical sensor has been fabricated which showed a very high and reproducible sensitivity of ~6.89 ± 0.01 μA.cm-2.mM-1 with a response time of less than 10 s, linear dynamic range from 0.1 □M to 10 mM and a correlation coefficient of R= 0.9957. The limit of detection (LOD) was estimated to be ~ 73 nM. This work demonstrate that the simply synthesized Mg(OH)2 nanostructures can effectively be used for the fabrication of efficient ethanol chemical sensors.

Sensors and Actuators B: Chemical (In Press, 2012)

Temperature-Dependant Volumetric and Compressibility Studies of Drug-Surfactant Interactions in Dimethylsulfoxide (DMSO) Solutions

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Abstract:

In this work we present apparent molar volume, □v and apparent molar adiabatic compressibility, □□ values of sodium dodecyl sulphate (SDS) in DMSO and in DMSO solution of 0.25 % w/v 6-methyl-4(2-hydroxy-3-methoxyphenyl)-2-thioxo-1,2,3,4-tetrahydro pyrimidine-5 carboxylic acid ethyl ester (a pyrimidine derivative drug). The study was carried out over a temperature range (20 – 40 oC) covering a wide range of SDS concentration (2 - 11 mmol dm-3). Being highly sensitive to the extrinsic experimental conditions, a difference observed in the SDS concentration dependence of both □v and □□, values in pure DMSO and in 0.25 % w/v DMSO solution of 6-methyl-4(2-hydroxy-3-methoxyphenyl)-2-thioxo-1,2,3,4-tetrahydro pyrimidine-5 carboxylic acid ethyl ester is regarded as being due to the differing extent of SDS – DMSO interactions; the data tend to indicate the existence of relatively strong SDS – drug interactions.

Adv. Sci. Lett. 5, 1782012) 181-)

Ultra-high Sensitive ammonia chemical sensor based on ZnO Nanopencils

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Abstract:

This paper reports a very simple, reliable and facile methodology to fabricate ultra-high sensitive liquid ammonia chemical sensor using well-crystalline hexagonal-shaped ZnOnanopencils as an efficient electron mediator. A low-temperature facile hydrothermal technique was used to synthesize ZnOnanopencils. The synthesized nanopencils were characterized in detail in terms of their morphological, structural and optical properties which confirmed that the synthesized nanomaterial is well-crystalline, possessing wurtzite hexagonal phase and possessing very good optical properties. A very high sensitivity of ~26.58μA cm−2 mM−1 and detection limit of ~5 nM with a correlation coefficient (R) of 0.9965 and a response time of less than 10 s were observed for the fabricated liquid ammonia by I-V technique. To the best of our knowledge, by comparing the literature, it is confirmed that the fabricated sensor based on ZnOnanopencils exhibits highest sensitivity and lowest detection limit for liquid ammonia. This research opens a way that simply synthesized nanomaterials could be used as efficient electron mediators for the fabrication of efficient liquid ammonia chemical sensors.

Talanta 89, 1552012) 161-)

Temperature dependant structural and electrical properties of ZnO nanowire networks

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Abstract:

In this paper, we report a successful growth of zinc oxide nanowire networks by simple thermal evaporation process by using metallic zinc powder in the presence of oxygen. The morphological investigations of the synthesized nanowire networks are conducted by using field emission scanning electron microscopy (FESEM) which reveals that the grown products are in high-density over the whole substrate surface and possessing nanowire networks like structures. The structural and compositional properties of the grown nanowire networks are analyzed by X-ray diffraction (XRD), transmission electron microscopy (TEM) and energy dispersive spectroscopy (EDS), respectively which confirm that the synthesized products are well-crystalline, with wurtzite hexagonal phase ZnO. The as-grown ZnO nanowire networks grown on silicon substrate are utilized to fabricate n-ZnO/p-Si heterojunction diode and presented in this paper. The I-V characteristics of the fabricated heterojunction diode at different temperatures (77K – 477K) are also investigated. High values of quality factor, which are obtained from this study, indicate a non-ideal behavior of the fabricated device. The mean barrier height of ~ 0.84eV is also estimated and presented in this paper.

Journal of Nanoscience and Nanotechnology 12, (2012)

Microwave Assisted Rapid Growth of Mg(OH)2 Nanosheet Networks for Ethanol Chemical Sensor Application

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Abstract:

This paper reports a facile microwave-assisted synthesis of magnesium hydroxide Mg(OH)2) nanosheet networks and their utilization for the fabrication of efficient ethanol chemical sensor. The synthesized nanosheets networks were characterized in terms of their morphological, structural and optical properties by using various analysis techniques such as field emission scanning electron microscopy (FESEM), X-ray diffraction pattern (XRD), Fourier transform infrared (FTIR) and UV-Vis. spectroscopy. The detailed morphological and structural investigations reveal that the synthesized (Mg(OH)2) products are nanosheet networks, grown in high density, and possessing hexagonal crystal structure. The optical band gap of as-synthesized Mg(OH)2) nanosheet networks was examined by UV-Vis. absorption spectrum, and found to be 5.76 eV. The synthesized nanosheet networks were used as supporting matrixes for the fabrication of I-V technique based

efficient ethanol chemical sensor. The fabricated ethanol sensor based on nanosheet networks exhibits good sensitivity (~3.991 μA.cm-2.mM-1) and lower detection limit (5 μM), with linearity (R=0.9925) in short response time (10.0 sec). This work demonstrate that the simply synthesized Mg(OH)2 nanosheet networks can effectively be used for the fabrication of efficient ethanol chemical sensors.

Journal of Alloys and Compounds 519, 42012) 8-)

Volumetric and Compressibility Studies of Salt Induced Hydrophobic Interactions in Pre – Micellar Region of Sodium Dodecyl Sulfate

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Abstract:

Apparent molar volume, □v and apparent molar adiabatic compressibility, □□ of sodium dodecyl sulphate (SDS) in water and in 0.1 mol dm-3 aqueous solutions of LiCl and NaCl have been determined form density and speed of sound of measurements. Both these parameters are found to be highly sensitive to the presence electrolyte, in the concentration range 0.001 – 0.01 mol dm-3, which corresponds to the pre – micellar region of SDS; it indicates extensive intermolecular hydrophobic interaction in the presence of electrolytes. From a comparison between the two electrolytes in affecting the □v and □□ values, NaCl is found to be more effective than LiCl. Above ~ 0.01 mol dm-3, the data indicate that solution loses its hydrophobic hydration character due to the micellization of surfactant. The constancy in □v and □□ values further suggested that no structural – transition occurs under these experimental conditions. Classic structural hypothesis of hydrophobic hydration proposed by 'Frank and Evans' [1(a)] has been invoked to account for the negative □v and □□ values of SDS observed in aqueous solutions of LiCl and NaCl. All these observations are ultimately found to justify that salt induced hydrophobic interaction is much more effective than solvent induced, however, the contribution of hydration characteristic of the ions is also found to play its own role.

Adv. Sci. Eng. Med. 4, 812012) 84-)

Highly Sensitive Ammonia Chemical Sensor Based on -Fe2O3 nanoellipsoids

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Abstract:

This paper reports the facile synthesis of α-Fe2O3 nanoellipsoids by low-temperature hydrothermal process and effectively utilized for the fabrication of highly sensitive aqueous ammonia chemical sensor by I-V technique. The as-synthesized α-Fe2O3 nanoellipsoids were characterized in terms of their morphological, structural and optical properties. The detailed structural and optical properties confirmed the rhombohedral α-Fe2O3 structure and indirect (1.87 eV) and direct (2.15 eV) band gap, respectively, for synthesized nanoellipsoids. The fabricated aqueous ammonia sensor based on nanoellipsoids exhibits very high and reproducible sensitivity of ~4.678 μA.cm-2.mM-1 and detection limit ~0.04 nM with correlation coefficient (R) of 0.995 in short response time (10.0 sec). The presented work demonstrates that simply synthesized iron oxide nanostructures can efficiently be used for the fabrication of reliable and reproducible chemical sensors.

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تأسست عام ١٤٢٧هـ

ملخصات الأبحاث العلمية

ملخصات أبحاث أعضاء هيئة التدريس والتي تم نشرها في
مجلات علمية محكمة للعام الدراسي ١٤٣٣/١٤٣٤هـ

سلسلة إصدارات عمادة البحث العلمي
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