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A new era in nanotechnology : Graphene the new horizon

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A honeycomb two dimensional lattice of monolayer carbon atoms is a new material called graphene which is discovered recently. Graphene consists of a single atomic layer of sp2 hybridized carbon atoms that result in a hexagonal lattice. Around each carbon atom, three strong σ bonds are established with the other three surrounding carbon atoms. Graphene opened a new era in nanotechnology. The outstanding mechanical, electrical and physical properties of graphene warrants its use in a variety of areas such as hydrogen technology, electronics, sensing and drug delivery, among many others. The zero band gap of the graphene sheets renders the construction of graphene based field effect transistors very difficult. Therefore, several groups have been proposed different methods to open a band gap in graphene. The electronic structure of pristine graphene sheet and three different adsorption sites of H_2S onto graphene sheet were studied. Calculations show that the adsorption of H_2S on top site open very small direct energy gap. Comparing the angular momentum decomposition of the atoms projected electronic density of states of pristine graphene sheet with that of H_2S-pristine graphene for three different sites (bridge, top and hollow), we found significant influence and strong hybridization between H_2S molecule and graphene sheet. Thus pristine graphene sheet is very good adsorbent materials for H_2S molecule. In addition, the linear and nonlinear optical susceptibilities of pristine graphene and H_2S adsorbed at three different sites onto graphene sheet are calculated so as to obtain further insight into the electronic properties. Calculations show that the adsorption of H_2S on top site cause significant changes in the linear and nonlinear optical susceptibilities. That is attributed to the fact that adsorbing H_2S onto graphene sheet causes significant changes in the electronic structures, and strong hybridization between H_2S molecule and graphene sheet, as a result of the strong hybridization, strong covalent bonds were established between C, H, and S. DFT calculations based on all-electron full potential linearized augmented plane wave (FP-LAPW) method, was used. In order to understand the adsorption properties of H_2S molecule adsorbed onto graphene, all possible adsorption configurations (top, bridge and hollow -sites) were considered.

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A new prepared carbon nanotube enhanced ionic liquid mediated solid phase microextraction fiber by sol-gel technique for the determination of polycyclic aromatic hydrocarbons in the urine samples using gas chromatography

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A novel ionic liquid (IL) mediated poly(dimethylsiloxane) (PDMS) enhanced with multi-walled carbon nanotube (MWCNT) was prepared by the covalent functionalization of MWCNTs with hydroxyl-terminated PDMS using sol-gel technique. Prepared fiber was used successfully for the separation and determination of trace amounts of polycyclic aromatic hydrocarbon (PAH) compounds in four urine samples using headspace solid phase microextraction (HS-SPME) coupled to gas chromatography-flame ionization detection (GC-FID). The proposed fiber has high thermal stability and long durability and it can be used more than 200 times at 300°C without any significant change in its sorption properties. The effects of important parameters such as the exposure time, sampling temperature, sample ionic strength and stirring rate on the extraction efficiency have been studied and optimized. Under the optimal conditions, the method detection limits (S/N=3) were in the range of 0.0005-0.004 ng mL^{-1} and the limits of quantification (S/N=10) were between 0.002 and 0.01 ng mL^{-1}. The relative standard deviations (RSDs) for one fiber (repeatability) (n=5) were 4.9-7.5% and RSDs between fibers or batch to batch (reproducibility) (n=3) in the range of 6.1-8.9%. The developed method was applied successfully to determine trace levels of PAHs in real urine samples. The relative recoveries for the spiked samples with 0.05 ng mL of each of PAH compounds were 89.3- 107.2%.

Biography

Ali Sarafraz Yazdi has completed his Ph.D. at the age of 30 years from Birmingham University in England. He is the full Professor in analytical chemistry in Ferdowsi University of Mashhad, Iran. He has published more than 60 papers in reputed journals and serving as a reviewer of many reputed journals.

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