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Poster Presentation

Adsorption of Heavy Metals onto Modified Diatomite

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Diatomite ($SiO_2.nH_2O$) is a pale-colored and lightweight sedimentary rock composed principally of silica microfossils of aquatic unicellular algae. Diatomite consists of a wide variety of shape and sized diatoms in a structure containing up to 80–90% void. Diatomite's high porous structure, low density and high surface area results in a number of industrial applications such as filtration media for various inorganic and organic chemicals, absorbent, catalyst carrier, filler and so on. Regarding wastewater treatment a number of laboratory-scale studies have demonstrated that diatomite is a promising material for removing waterborne radio nuclides, heavy metal ions, and basic textile dyes. In aqueous solution diatomite particles are negatively charged, and possesses strong attract ability for positively charged species. Diatomite exists in large deposits around the world, and it has wide future applications in various industrial processes [1]. Diatomite modified by treating with hydrochloric acid for purification of silica on diatomite's surface and reduction of the contribution of undesirable aluminium, calcium, magnesium, iron and alkaline elements [2].

Figure 1 shows SEM micrograph of modified diatomite. The morphology of both modified diatomite at pH 3 and pH 7 were generally cylindrical in shape with the average particle size of 10 µm in width and 15 µm in length as shown in Figure 1(a) and Figure 1(b), respectively. The average pore size was 0.25 µm and 0.35 µm of the modified diatomite at pH 3, Fig. 1(a) and at pH 7, Figure 1(b), respectively. The adsorption percentage of **Cd**(II), **Pb**(II), Cu(II) and **Zn**(II) solutions onto modified diatomite at pH 3 were **83.04 %**, 83.25%, 40.97 % and 84.48%, and at pH 7 were 99.65%, 96.62%, 96.68% and 99.36%, respectively as shown in Figure 2.

Acknowledgement
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References

1. Gao, B., Jiang, P., An, F., Zhao, S. and Ge, Z. Studies on the surface modification of diatomite with polyethyleneimine and trapping effect of the modified diatomite for phenol. *Appl. Surf. Sci.* 2005, 250: 273-279.
2. Goren, R., Baykara, T. and Marsoglu, M. A study on the purification of diatomite in hydrochloric acid. *Scand. J. Metall.* 2002, 31(2): 115-119.

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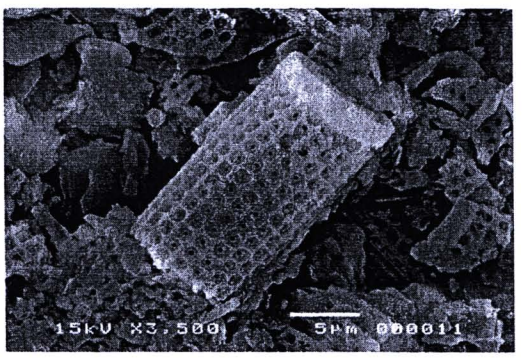
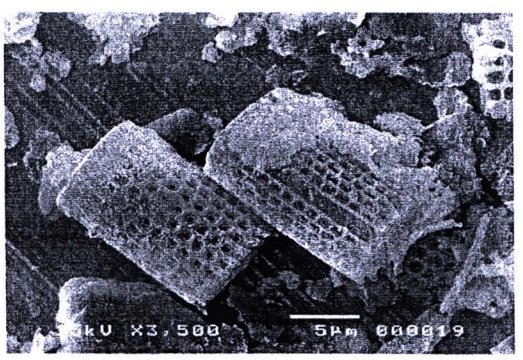


(a)



(b)

Figure 1 SEM micrograph of modified diatomite at (a) pH=3 and (b) pH=7

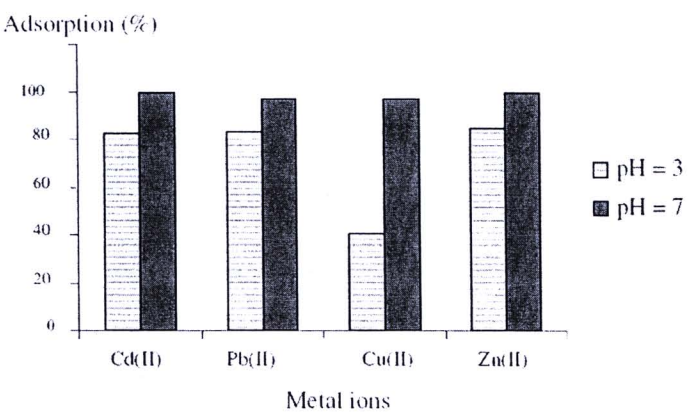


Figure 2 The adsorption percentage of standard solutions onto modified diatomite

C1_C0146 DETERMINATION OF BENZOIC ACID, SORBIC ACID AND CAFFEINE BY DERIVATIVE ZERO-CROSSING SPECTROPHOTOMETRIC METHOD

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Abstract: A simple method based on derivative zero-crossing spectrophotometry was developed for simultaneous determination of benzoic acid, sorbic acid and caffeine. Absorption spectra of the three compounds in the wavelength range of 190-400 nm were strongly overlapping. Maximum absorption wavelength of 230, 260 and 273 nm of benzoic acid, sorbic acid and caffeine, respectively, were observed. The determination of these compounds was accomplished by using the 4, 4 and 3 derivatives of the absorption spectra, respectively. By using derivative zero-crossing technique, linear calibration graphs were in the range of 1-40 mg/L benzoic acid, 1-10 mg/L sorbic acid and 1-40 mg/L caffeine by measuring at 244, 288 and 298 nm, respectively. This method was applied to some beverage samples.

C1_C0150 KINETIC DETERMINATION OF IODATE IN DRINKING WATER USING CERIUM(IV)-ARSENIC(III) REACTION

C1

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Abstract: The kinetic method using the catalytic effect of iodide in the redox reaction between Ce(IV)-As(III) has been widely used to determine trace iodine in sample. Only iodide can catalyse this reaction. To apply this method for determination of iodate, it is necessary to reduce iodate to iodide prior to kinetic determination. From these results, iodate was reduced to iodide in the presence of As(III) acid solution and chloride ion within 1 min. The developed method was successfully tested for determination of iodine in form of iodate in drinking water. The kinetic methods including full kinetic and fixed-time methods were validated with an ICP-MS method. There was no significant difference between results obtained from the kinetic methods and from the ICP-MS method.

C1_C0156 DETERMINATION OF SELECTED NITROFURAN DERIVATIVES IN HONEY BY FLOW INJECTION CHEMILUMINESCENCE BASE ON LUMINOL-HYDROGEN PEROXIDE REACTION

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Abstract: Simple and sensitive flow injection chemiluminescence (FI-CL) method was proposed for the direct analyses on some nitrofurans in honey. The chemiluminescence reaction is based on the enhancing effect of nitrofurazone on the CL reaction between luminol and hydrogen peroxide in alkaline media. The elicited chemiluminescence intensity of the resulting reaction mixture was measured at a PMT operated at a voltage of 0.86 kV. The operational and chemical variables were optimised to obtain maximum sensitivity for each nitrofurans. The linear detection ranges of nitrofurazone, nitrofurantoin and furazolidone were found to be linear over the range of 0.01–5.0, 0.5-8.0 and 1.0-20.0 mg l^{-1}. Results detailing the optimization of the analytical signal, calibration and common interferences were also described. The proposed FI-CL methods will be used for the analysis of selected nitrofurans residue in honey after solid phase extraction. The method validation will be compared versus existed LC/MS method.

C1_C0160 ADSORPTION OF CADMIUM ION ONTO NATURAL AND MODIFIED DIATOMITE

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Abstract: Adsorption of cadmium ion onto natural and modified diatomite was studied. Natural diatomite was modified by the hydrothermal method. The characterization of natural and modified diatomite was investigated by scanning electron microscopy (SEM) and specific surface area (BET) analysis techniques. The morphology of both diatomites was generally cylindrical in shape with the average particle size 15 μm

in width and 30 μm in length. The surface areas were 54.26 and 55.67 m^2/g, respectively. The adsorption of cadmium standard solution was determined by atomic absorption spectroscopy (AAS). The adsorptions capacity of diatomite was 1.52 and 2.46 mg/g, respectively. The element composition of both diatomites after adsorption of cadmium standard solution was measured by energy dispersive spectrometry (EDS). The energy level values of cadmium were 3.72 and 4.02 keV.

C1_C0164 DESIGN AND CONSTRUCTION OF CONTACT ANGLE MEASUREMENT DEVICE USING COMMERCIAL DIGITAL CAMERA

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Abstract: Contact angle measurement device was developed by Sensor Research Unit, Department of Chemistry, Faculty of science, Chulalongkorn University. Image of water drop on the surface was taken by a commercial digital camera. The development of the device consists of two parts: construction of device and software development. The software can measure both contact angle on the left side and right side of the water droplet. For accurate measurement of the contact angle, light can be couple into the water drop under bright field, dark field, and total internal reflection modes. From our preliminary observations the homemade device has the same performance as the commercial contact angle measurement device. The cost for construction of this device was lower than 2,000 Bath (not including camera digital price).

C1_C0166 HOLLOW FIBER MEMBRANE DIALYSIS FOR SAMPLING OF IODIDE IN FOOD SAMPLE

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Abstract: Iodine is an essential element for humans. Lack of iodine leads to iodine deficiency disorder. To ensure sufficient iodine uptake, many food products have been fortified with iodine. Therefore, determination of iodine content in iodine fortified food is important in order to control the quality of food products. However, sample preparation step for determination of iodine in food sample has been tedious, time-consuming, and involved many steps. Recently, membrane separation techniques have gained widespread uses in sample preparation as they are size selective separation and simple operation. In this work, flow based hollow fiber membrane dialysis has been developed for sampling of iodine as iodide ion in food sample. Iodide ion was determined by catalytic colorimetric method based on thiocyanate-nitrite assay (Thio-Nit). Our designed dialyzer provided the average % dialysis of 2.5 % (0.6 % SD). The preliminary results showed that there was no significant effect of donor composition and initial iodide concentrations on % dialysis. The determination of iodide content in milk sample by this method was also presented. The sample preparation step was less than 10 min compared to alkali dry ashing which were approximately 3-5 hrs.

C1_C0167 EVALUATION AND CONTROL OF STEEL CLEANLINESS BY INFRARED SPECTROSCOPY

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Abstract: Inorganic inclusion in steel were determined and characterized by ATR-FTIR spectroscopy for the first time. Homemade Ge μIRE was employed as an IRE. The slime extraction (electrolysis) was employed for extracting the inorganic inclusions from the steel samples and for destroying the steel surface to reveal the inclusions inside the steel. From our preliminary observation, we found three common inorganic inclusions i.e., Al_2O_3, SiO_2, and CaO, which are previously determined by other conventional methods.

C1_C0177 DETERMINATION OF COPPER (II) IN SWIMMING POOLS BY FLAME ATOMIC ABSORPTION SPECTROMETRY

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Poster Presentation

Characterization of Natural and Manganese Chloride Modified Diatomite Via Hydrothermal Method

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Abstract

Diatomite ($SiO_2.nH_2O$) is a fine-granulated siliceous sedimentary rock or unlithified sediment of biogenic origin. It typically consists of amorphous silica, presented in the form of opaline diatom skeletons or frustules. Due to its specific properties such as high silica content, numerous fine microscopic pores, large specific surface area, high absorption capacity and low density. Other intrinsic properties are low thermal conductivity, relatively high melting-point, chemical inertness and small grain size. Diatomite has been used in a number of industrial applications, e.g. as a filtration media for various beverages, inorganic and organic chemicals, and as an adsorbent for pet litter and oil spills. Although diatomite has a unique combination of physical and chemical properties, its use as an adsorbent in wastewater treatment has not been extensively investigated [1-2]. The researchers attempted to increase sorption capacity of diatomite adsorbed heavy metals by chemical modification of their surface. Natural and modified diatomite with hydrochloric acid by hydrothermal method were studied the adsorption of heavy metals [3]. Despite the efforts made to utilize diatomite as an adsorbent, more studies on increasing the adsorption capacity are required [4]. In this research, natural diatomite was modified the surface by manganese chloride to improve the potential to use as an adsorbent for removal of heavy metals. The effect of surface modification of diatomite via hydrothermal method on metal ions adsorption was further studied.

Natural diatomite from China was washed with deionized water, filtered and dried in an oven at 100 °C for 24 hr then modified by added with 1M manganese chloride tetrahydrate followed heated at 100 °C for 2 h via hydrothermal method. Modified diatomite was filtered and dried in an oven at 100 °C for 24 h. Consequently metal oxides (aluminium oxide and ferric oxide) were eliminated from natural diatomite. The active sites at silica surface with large specific surface area are great importance in adsorption and ion exchange applications [5]. The morphology of diatomite was investigated by scanning electron microscope (Jeol-JSM-6335F, Japan). The generally cylindrical in shape with particle size was 8×15 μm (Fig.1 (a)). The morphology of modified diatomite was distorted from cylindrical in shape. Manganese was covered and filled in the pore and surface of modified diatomite (Fig.1 (b)). It is useful to determine the particle shape and appropriate size distribution of the adsorbent [5,6]. The chemical composition was analyzed by energy dispersive X-ray spectrometer (Oxford-Inca 6647, England). The characteristic X-ray radiation of natural diatomite showed silicon (Si) = 1.750 keV, oxygen (O) = 0.525 keV as show in Figure 2 (a). The characteristic X-ray radiation of modified diatomite showed silicon (Si) = 1.750 keV, oxygen (O) = 0.525 keV and manganese (Mn) = 6.105 keV as shown in Figure 2 (b).

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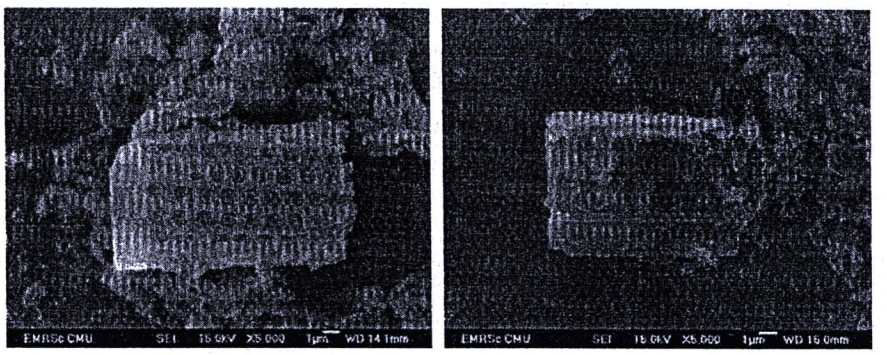
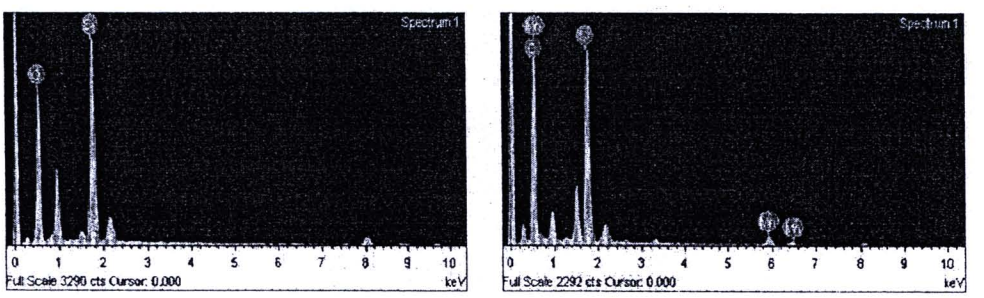
References

1. B. Gao, P. Jiang, F. An, S. Zhao, Z. Ge, Studies on the surface modification of diatomite with polyethyleneimine and trapping effect of the modified diatomite for phenol, Appl. Surf. Sci. 250, 273-279 (2005).
2. Y. Al-degs, M.A.M. Khraisheh, M.F. Tutunji, Sorption of lead ions on diatomite and manganese oxides modified diatomite, Water Res. 35(15), 3724-3728 (2001).
3. P. Pookmanee, P. Jansanthea, S. Phanichphant, Adsorption of heavy metal onto natural and modified diatomite, KMITL Sci. J. 8(2B), 1-8 (2008).
4. Y.S. Al-degs, M.F. Tutunju, R.A. Shawabkeh, The feasibility of using diatomite and Mn-diatomite for remediation of Pb^{2-}, Cu^{2-} and Cd^{2+} from water, Sep. Sci. Technol. 35(14), 2299-2310 (2000).
5. M.A.M. Khraisheh, Y.S. Al-degs, W.A.M. Mcminn, Remediation of wastewater containing heavy metals using raw and modified diatomite, Chem. Eng. J. 99, 177-184 (2004).
6. M.A.M. Khraisheh, M.A. Al-Ghouti, S.J. Allen, M.N. Ahmad, Effect of OH and silanol groups in the removal of dyes from aqueous solution using diatomite, Water Res. 39, 922–932 (2005).



(a) (b)

Figure 1 SEM micrograph of (a) natural diatomite and (b) modified diatomite



(a) (b)

Figure 2 EDS spectrum of (a) natural diatomite and (b) modified diatomite

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Poster Presentation

Removal of Heavy Metals from Aqueous Solution by Natural and Modified Diatomite

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Abstract

Diatomite has a unique combination of physical and chemical properties, highly porous structure, small particle size and high surface area. It is used as an adsorbent in wastewater treatment [1]. Heavy metals like copper (Cu), zinc (Zn) and cadmium (Cd) are not biodegradable and tend to accumulate in living organisms causing various diseases and disorders. It is becoming a severe menace to public health that the heavy metals concentrations increases owing to fast development of some local industries such as electroplating, batteries manufacturing, mining, ceramic and glass industries [2-3]. The adsorption of heavy metals by diatomite was treated with hydrochloric via hydrothermal method [4]. In this research, morphology and physical property of natural and modified diatomite were studied. Modified diatomite was prepared by manganese chloride via hydrothermal method. Morphology of natural and modified diatomite was investigated by scanning electron microscopy (SEM). The particles of both diatomites were generally cylindrical with the range of particle size of 6-10 μm in width and 13-17 μm in length. Heavy metals from aqueous solutions were adsorped onto natural and modified diatomite after soaking for 24h. And these results were corresponded with the data from energy dispersive spectroscopy (EDS). The characteristic X-ray radiation of each element had different energy values; copper = 1.11, 8.03 and 8.91 keV, zinc= 1.28, 8.62 and 9.67 keV and cadmium = 0.60 and 3.13 keV, respectively. The adsorption of heavy metals onto natural and modified diatomite was determined using atomic adsorption spectroscopy (AAS). The adsorption capacities (Q) of heavy metals from aqueous solutions onto modified diatomite were higher than from natural diatomite.

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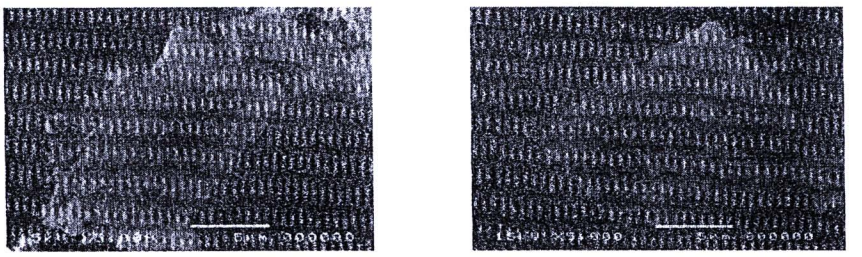
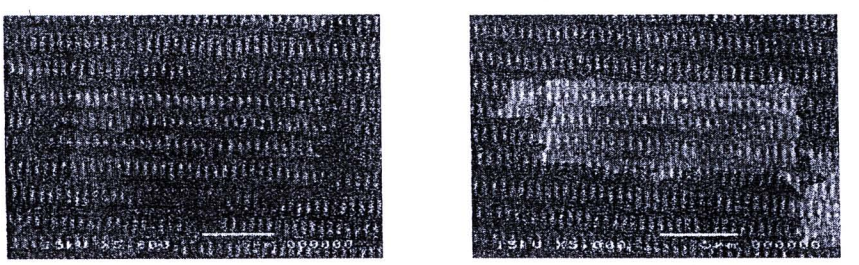
References

1. M.A.M. Khraisheh, Y.S. Al-degs, W.A.M. Mcminn, Remediation of wastewater containing heavy metals using raw and modified diatomite, Chem. Eng. J. 99, 177-184 (2004).
2. Y. Al-degs, M.A.M. Khraisheh, M.F. Tutunji, Sorption of lead ions on diatomite and manganese oxides modified diatomite, Water Res. 35(15), 3724-3728 (2001).
3. E. Li, X. Zeng, Y. Fan, Removal of chromium ion (III) from aqueous solution by manganese oxide and microemulsion modified diatomite, Desalination 238, 158-165 (2009).
4. P. Pookmanee, P. Jansanthea, S. Phanichphant, Adsorption of heavy metals onto modified diatomite, Proceedings of the 25th MST Annual Conference, Thailand, 133-134 (2008).



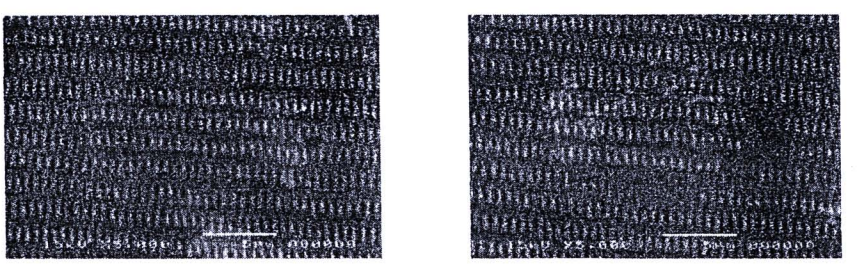
(a) (b)

Figure 1 SEM micrograph of (a) natural and (b) modified diatomite after adsorption of copper standard solution.



(a) (b)

Figure 2 SEM micrograph of (a) natural and (b) modified diatomite after adsorption of zinc standard solution.



(a) (b)

Figure 3 SEM micrograph of (a) natural and (b) modified diatomite after adsorption of cadmium standard solution.