SYNTHESIS OF IRON-MODIFIED ZEOLITE FOR ARSENIC REMOVAL FROM GROUNDWATER

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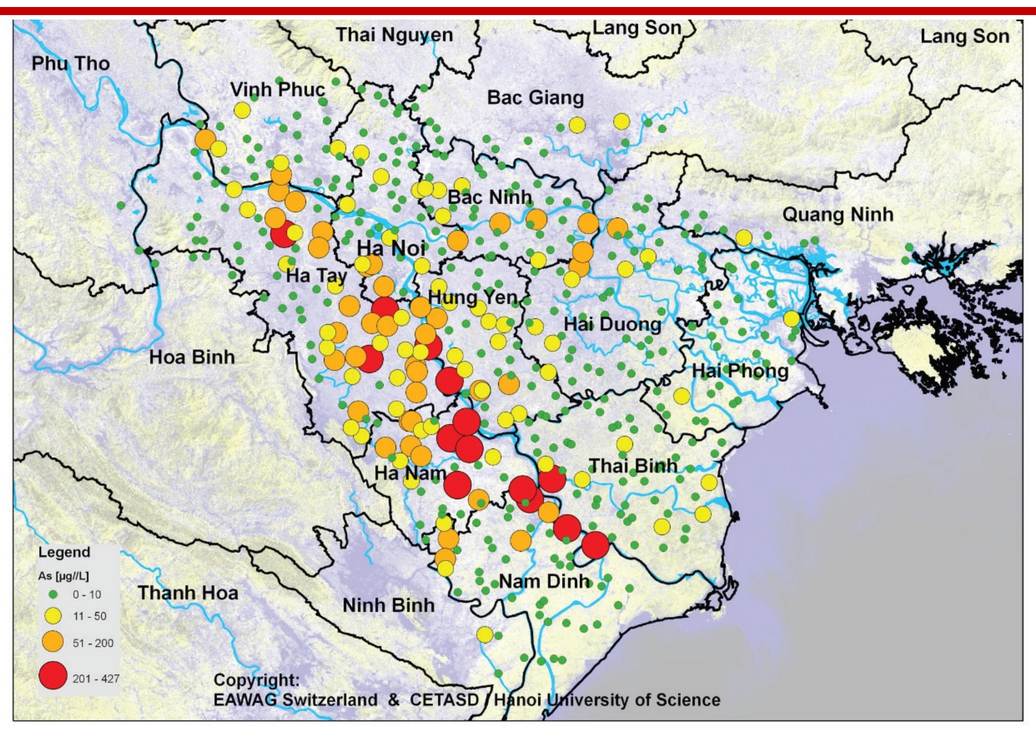
1 Introduction

Fly ash from Phalai thermo-electricity plant



Map of arsenic contamination in the north, VN

2 Materials and methods

Preparation of zeolite from fly ash

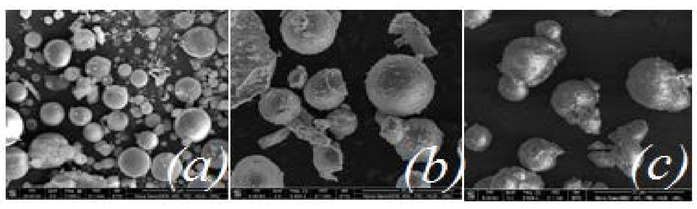
Coal fly ash was taken to heat flask, added with KOH solution, and then well stirred The mixture was heated in 2 hours at 400^{o}C. After that, the product was cooled down, added with distilled water, and steadily stirred at room temperature condition. The mixture was magnetically stirred at 175^{o}C in 8 hours continuously. After washing and drying to unchangeable mass, the material was preserved in glass bottle [1] (modified). Finally, the product – KOH zeolite was analyzed by XRD and SEM methods by using X – ray powder diffraction Siemens D5000 and 5210LV scanning electron microscope (Japan), respectively, at the Faculty of Physics, VNU University of Science

Preparation of Iron – modified zeolite

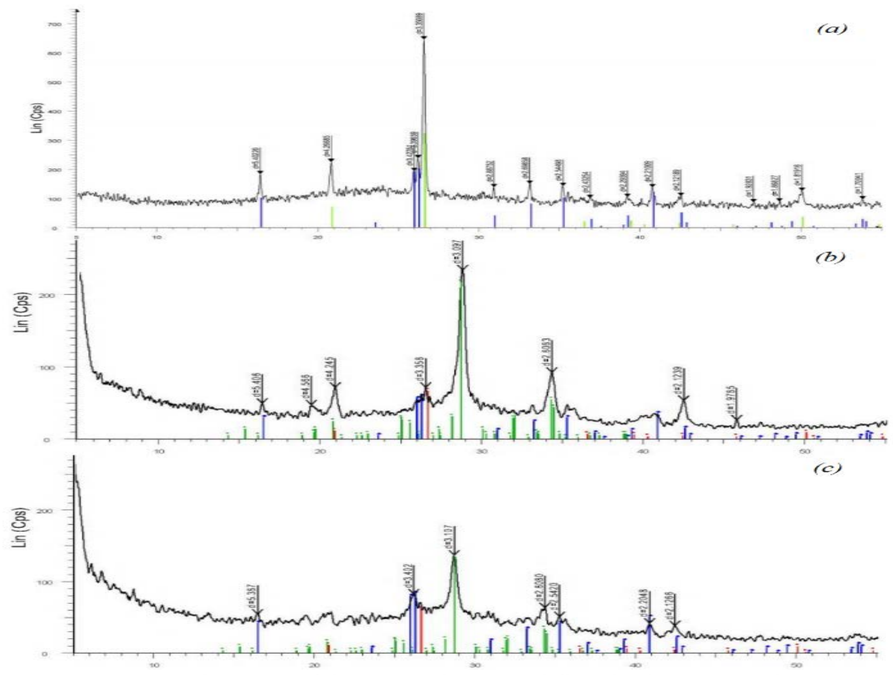
The mixture between KOH zeolite and ferric nitrate solution was shaken reciprocally for 1 hour and centrifuged by KUBOTA 5200 in 5 minutes. The liquid was discarded. Ferric nitrate solution was added again and the process was repeated twice more. The solid was then washed and dried at 110° C [12](modified). The product was called Iron – modified zeolite and characterized by both XRD and SEM methods.

3 Results and discussion

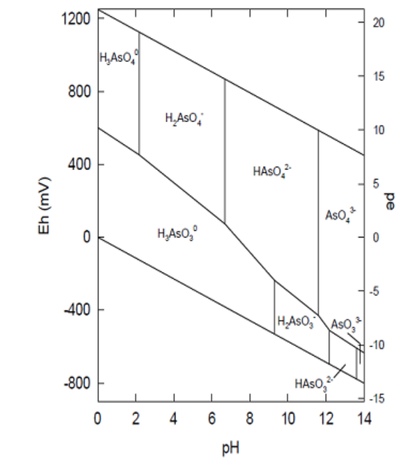
Adsorbent characterization



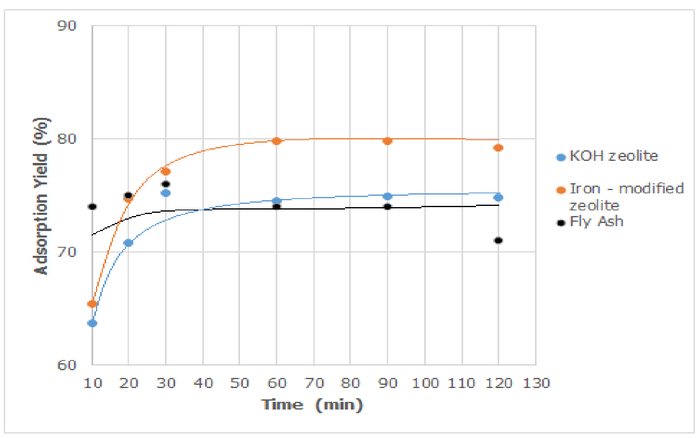
SEM Images of adsorbent (a) Coal fly ash; (b) KOH zeolite; (c) Iron – modified zeolite



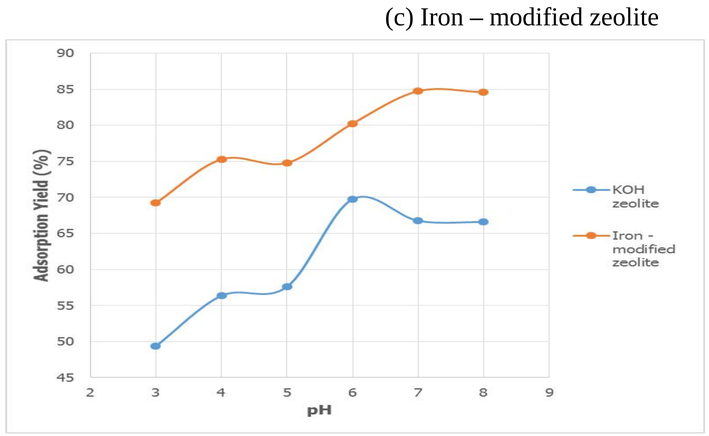
XRD diagrams of the materials (a) Coal fly ash; (b) KOH zeolite; (c) Iron – modified zeolite



Existence forms of arsenic in environment depending on Eh and pH



Effect of time



Effect of pH

Langmuir and Freundlich adsorption isotherms

Material	Parameter	Langmuir model	Freundlich model
KOH zeolite	Linear equation	y = 5.0992x + 0.0909	y = 0.3042x + 0.1799
	R^2	0.9347	0.5394
	K	0.0178	1.5132
	q_{max} (µg/g)	11.0011	
	n		3.2873
Modified zeolite	Linear equation	y = 6.8810x + 0.0065	y = 0.4847x + 0.0077
	R^2	0.8794	0.6287
	K	0.0009	1.0179
	q_{max} (µg/g)	153.8462	
	n		2.0631

Conclusion

Iron – modified zeolite was prepared from fly ash through phase (1) preparation of KOH zeolite from coal fly ash and phase (2) modification with ferric nitrate. The final adsorbent had changes in its physical and chemical properties. Besides, there was a new anion adsorption side on the material surface, which increased the arsenic adsorption capacity.

Coal fly ash, KOH zeolite and Iron – modified zeolite had ability to adsorb arsenic in solution. The equilibrium times for those materials were around 60 minutes. However, arsenic in solution was best removed by Iron – modified zeolite. The adsorption properties of Iron – modified zeolite depended on pH values and the optimal pH is 7 for arsenic removal with efficiency of 85%. The equilibrium data for Iron – modified zeolite were best fitted to Langmuir isotherm with R^2 = 0.88, K_L = 0.0009 and the maximum adsorption capacity q_{max} = 153.85 µg/g.