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Heavy Metal Adsorption Characteristics of Zeolite Synthesized from Fly Ash

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1. Introduction

A large amount of fly ash, exceeding 40% of raw coal material, is generated annually from the combustion of coal in power plants. Most of the fly ash, however, has been disposed by dumping, giving rise to serious environmental pollution. Only a small amount of fly ash is used as an additive to cement(Jiang and Roy, 1992), mortar and soil stabilization. Recently the development of a more efficient utilization method and the production of high valued compounds from waste ash have been the objects of recent research work world-wide.

The constituents of fly ash are mainly aluminosilicate glass, mullite, and quartz with a small amount of residual coal and ore minerals. Since the glass is a readily available source of Si and Al for zeolite synthesis, fly ash has been used as raw materials for synthesizing zeolite.

In this study, zelolites were synthesizd from raw fly ash. The adsorption abilities of the synthesized zeolites for heavy metals were also investigated.

2. Experimental

The sample was pretreated with HGMS(high gradient magnetic separator) in order to remove Fe_2O_3 and TiO_2 which were reported as the undesirable components of the zeolite synthesis(Tazaki et al., 1989). All the experiments were performed using the same batch of fly ash.

Zeolite were synthesized using the teflon lined stainless steel vessels in a digital-type forced-convection electric oven at 70-200 °C during 1-2 days.

X-ray diffraction and SEM techniques were employed to characterize the synthesized zeolites.

Batch reactor experiments had been performed to investigate the effects of initial solution concentration and adsorbent amount. The concentrations of heavy metal in solution was determined by an Atomic Absorption Spectrophotometer (UNICAM

939/959).

3. Results and Discussion

Varying the temperature and alkali concentration range, five different zeolites were obtained. Faujasite, Na-P1, hydroxy sodalite, analcime and cancrinite phases were identified under various experimental conditions.

Figure 1 compares the lead removal performance of the zeolites synthesized from fly ash. The order of decreasing selectivity for metal ions was as follows: $Pb^{+2}>Cd^{+2}>Cu^{+2}>Zn^{+2}>Fe^{+2}$.

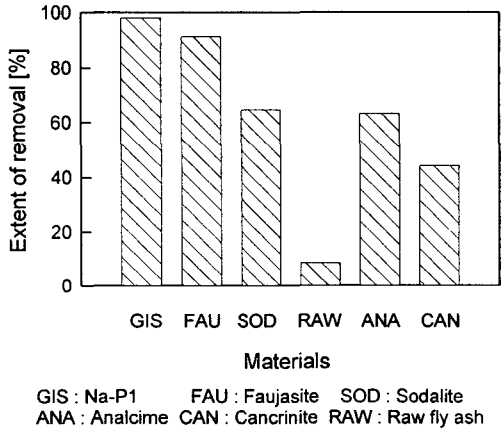

Fig. 1. Comparison of Pb removal efficiency.

4. Conclusion

Fly ash obtained from Power Plant was used the synthesizing zeolite. Varying the temperature and alkali concentration range, five different zeolites were obtained. Faujasite, Na-P1, hydroxy sodalite, analcime and cancrinite phases were identified under various experimental conditions. Zeolites can easily synthesized from waste fly ash and shows the promising possibility for the removal of heavy metal ions.

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