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PÔSTER

B-CYCLODEXTRIN-MODIFIED ZEOLITE FROM FLY ASH: SYNTHESIS, CHARACTERIZATION, AND USE AS CADMIUM, LEAD AND ZINC ADSORBENT

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Abstract

Coal Combustion Products (CCPs) are the solid inorganic materials that remain after coal is burned to generated electricity in power plants. The major solid residues included in CCPs are fly ash, bottom ash, boiler slag and FGD materials. With nearly 70% of the total amount fly ash is the most important CCP. Every year a crude estimation of 600 million tons of fly ash generated worldwide and about 4 million tons in Brazil.
In this work, zeolite from coal fly ash (ZFA) was prepared by conventional alkaline hydrothermal treatment and modified with β-Cyclodextrin (CD). CD is a cyclic oligosaccharide composed of seven α-D-glucose units connected through α-(1,4) linkages with an internal hydrophobic cavity. CD is the most accessible environmental friendly “safe agent” for material modification due to its low-price and harmless properties. Modified zeolites with CD (CDZFA) were prepared at different modification conditions, such as contact time, ratio of zeolite from coal fly ash mass/volume of CD and different CD concentration (Table 1).

Table 1. Experiments carried out in order to synthesize CDZFA

Sample	[CD] ($g\ L^{-1}$)	Adsorbent concentration ($g\ L^{-1}$)	$t_{contact}$ (h)
CDZFA-1	1	20	7
CDZFA-2	10	20	7
CDZFA-3	4	150	7
CDZFA-4	0.5	20	7
CDZFA-5	1	50	7
CDZFA-6	1	20	24
CDZFA-7	1	2	7

Preliminary adsorption experiments using the crystal violet dye as a model compound indicated that CDZFA-1 was the most effective adsorbent. Zeolitic materials, ZFA and CDZFA-1, were examined for the adsorption of toxic metals Pb^{+2}, Cd^{+2} and Zn^{+2} from water in a batch technique. The effects of metal ion concentration and pH on the adsorption were investigated. The zeolitic materials before and after adsorption of metal ions were characterized using thermo analysis (TG/DTG; DSC), FTIR spectroscopy and zeta potential. The metal ion adsorption efficiencies for zeolite from coal fly ash and modified zeolite were compared and both adsorbents exhibited strong affinity for the ions. The reduction of metal ions from water by modified zeolite reached up to 99.49% for Cd^{2+}, 99.88% for Pb^{2+} and 99.93 % for Zn^{2+}. According to the obtained results,β-Cyclodextrin-modified zeolite from fly ash developed in this study has the potential to be a promising low-cost adsorbent for the removal of toxic metal ions from industrial wastewater.