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REMOVAL OF 4-CHLOROPHENOL BY SURFACTANT MODIFIED ZEOLITES AND SURFACTANT MODIFIED ALKALI-TREATED NATURAL ZEOLITES

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Abstract

Chlorophenols are contaminants in soils, sediments, surface waters and groundwater, largely because of their worldwide utilization in the last 50 years as wood preservatives and general biocides in industry and agriculture. The toxicity of chlorophenols and their persistence in the environment require advanced treatment techniques for their removal.
Surfactant-modified natural zeolites (SMZs) represent an important class of sorbents for water treatment. This work presents a comparative study on the removal of 4-chlorophenol by using two sorbents: surfactant modified zeolite (SMZ) and alkali-treated modified zeolite (AT-SMZ). The alkali-treatment of a low-cost natural zeolite is used in order to decrease the particle size and to improve the utilization of the external cation exchange capacity (ECEC) for surfactant ion-exchange.
The zeolitic tuff from Mirsid (Romania) containing ≅ 68% clinoptilolite was alkali-treated, using a 0.2M NaOH solution at 80ºC, for 30 minutes. The raw zeolite, the alkali-treated samples and the SMZs were characterized by XRD, TG-DTG, FT-IR and nitrogen physisorption. The structural integrity was preserved upon alkali-treatment while the external surface area and the amount of surfactant retained on the zeolite surface, increased for the alkali-treated SMZs.
The sorption kinetics and the retention isotherms for an aqueous solution containing 4-chlorophenol (50 mg/L) were determined by using surfactant modified zeolites, produced from both raw zeolite and desilicated samples. The results showed that the adsorption capacity of the surfactant modified desilicated samples increases by 20% compared to the surfactant-modified zeolite samples which also showed good adsorption capacities.
In conclusion, the desilication of natural zeolites by alkali-treatment, followed by surfactant modification is a promising strategy to develop new sorbents for water and wastewater treatment.

Key words: 4-chlorophenol, adsorption, isotherm, surfactant-modified zeolites, zeolites

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