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DIRECT ACID ACTIVATION OF BITUMINOUS COAL AND ITS EFFECTS ON THE ADSORPTION OF PHENOL

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Abstract

In this study, the production of adsorbent from bituminous coal, which is directly treated with concentrated sulfuric acid, is investigated. The changes in the coal structure caused by the acid treatment are carried out by BET, FTIR and SEM analyzes and the adsorption capacities of the adsorbents are tested in phenol removal. According to the results of BET analysis, sulfuric acid treatment results in changes in the porous structure of original coal leading lower average pore diameters and higher surface areas. The phenol adsorption capacity of bituminous coal is increased considerably when a pretreatment procedure of washing and drying is included in the sulfuric acid treatment. While phenol removal efficiency of the original coal is only 7.64%, it reaches up to 78.56% after the treatment. The results of batch adsorption experiments also show that the inclusion of microwave and ultrasonic waves in the sulfuric acid treatment does not enhance phenol removal efficiencies. It is proposed that the most likely mechanism for phenol adsorption on bituminous coal is based on hydrogen bonding of phenolic hydroxyl with surface oxygen sites. Kinetic studies also demonstrate that the adsorption mechanism follows the pseudo second order kinetic model, which indirectly states that the rate limiting step is chemical sorption and adsorption rate is dependent on adsorption capacity.

Key words: acid activation, adsorption, coal, hydrogen bonds, oxidation, phenol removal

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