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A novel combined process of MFPAC coagulation and mineralized refuse adsorption for landfill leachate pretreatment

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ABSTRACT

A novel composite coagulant of MFPAC was prepared from Fe_3O_4 nanoparticles and polyaluminum chloride (PAC). Landfill leachate was pretreated by MFPAC coagulation combined with mineralized refuse adsorption. Higher COD and color removals were achieved by using the MFPAC magnetic coagulant than by adding the coagulant PAC alone. Under the working conditions of 1:3 Fe_3O_4/PAC mass ratios, 1.5 g/L MFPAC dosage, and pH 7.5, the removal rates of COD and color reached 63% and 67%, respectively. Infrared spectra showed that MFPAC is a type of hydroxyl-containing ligand with a nano-Fe_3O_4 multi-core and a hydroxyl polymer of aluminum and iron that is similar complex valence and crystal structure as that of PAC. The effluent of MFPAC coagulation was further treated using mineralized refuse adsorption. Under the working conditions of <2 mm particle size of mineralized refuse, 700°C roasting temperature, 40 mg/L adsorbent dosage, and pH 9.0, the removal rates of COD and ammonia nitrogen reached up to 57% and 68%, respectively, after 12 h of treatment. Infrared spectra analysis revealed that OH, C=O, and C–O played key roles in the adsorption process. After the landfill leachate was treated with the combined process, the removal rates of COD, color, and ammonia nitrogen were enhanced to 84%, 80%, and 74%, respectively. The encouraging results demonstrated that the combined process could provide a viable alternative to the pretreatment of landfill leachate.

Keywords: Adsorption; Coagulation; Landfill leachate; MFPAC; Mineralized refuse

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