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A comparative study for the removal of aniline from aqueous solutions using modified bentonite and activated carbon

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ABSTRACT

This study was aimed to explore the potential of modified bentonite as low-cost adsorbent for the adsorption of aniline from aqueous solution. Natural bentonite was modified with hexadecyltrimethylammonium bromide (HDTMA) (referred as HDTMA-Bent herein), a commonly used surfactant, to increase its adsorption potential. The influence of important experimental parameters, including initial aniline concentration, contact time, solution pH, and adsorbent dosage were studied to optimize the experimental conditions. The results showed that with the increase in adsorbent concentration or initial pH value of the solution, the aniline removal efficiency was also increased. The prepared adsorbents were characterized using scanning electron microscopy, Fourier transform infrared spectroscopy, and X-ray diffraction (XRD) analysis. According to XRD analysis, the increase in the microscopic platelets of modified bentonite could be the reason of enhanced adsorption of aniline. The adsorption kinetics followed the pseudo-second-order model and equilibrium data were fitted well with the Langmuir isotherm model. The maximum adsorption capacity of 9.46 mg/g was observed for HDTMA-Bent for aniline removal. To compare the adsorption results with those obtained from commercial activated carbon (AC), similar batch experiments were also conducted. The results exhibited that HDTMA-Bent has a considerable efficiency (more than 83% under the optimum conditions) and its adsorption capacity is about 12.5% as efficient as commercial AC in removing aniline from aqueous solutions. Furthermore, HDTMA-Bent is ca. 40 times cheaper than the AC suggesting that it can be effectively used as a low-cost adsorbent for aniline removal from water.

Keywords: Modified bentonite; Activated carbon; Aniline; Adsorption; Surfactant

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