Abstract

The pollution of water by the addition of different contaminants has become a major concern. Therefore, it is very important to remove these contaminants from water bodies. The present investigation focuses on the development of an efficient adsorbent (activated carbon) from locally available waste scrap wood and application of the prepared adsorbent for removal of different pollutants.

The activated carbon was developed by carbonization of Acacia Auriculiformis scrap wood followed by microwave treatment. The process of carbonization was optimized by Box-Behnken design and the optimum process parameters were found to be 750 °C, 3.5 h and 300 mL/min of nitrogen flow. The adsorbents were characterized by various techniques. The surface area and pore volume of prepared char were found to be 514.2 m^2/g and 0.36 cc/g which were further enhanced to 695 m^2/g and 0.5 cc/g respectively after microwave treatment. A micro porous structure was observed in the scanning electron microscope (SEM) image of the prepared activated carbon.

The prepared activated carbon exhibited good adsorption efficacy (85.71% removal) for a typical textile dye DB 86. The equilibrium and kinetic behavior were well predicted by Langmuir isotherm and pseudo second order kinetic model.

The activated carbon was also used to remove a pharmaceutical drug ibuprofen from its aqueous solution and 99.90% removal of the drug was achieved. The equilibrium and kinetic data were well fitted to Langmuir isotherm and pseudo second order kinetic model.

The activated carbon was further employed to remove two heavy metals Pb(II) and Cu(II) through batch adsorption study. The Pb(II) and Cu(II) removal efficiency were found to be 99.80% and 99.96% respectively. The adsorption performance of the activated carbon was also tested for the removal of Cu(II) from a copper plating industry effluent and 99% removal was obtained in this case.

The activated carbon was also used for fluoride adsorption and an adsorption efficiency of 88% was achieved in case of fluoride adsorption.

Therefore in the present research an effective adsorbent was produced from waste scrap wood and it was successfully employed for the removal of various pollutants. Desorption studies were also performed for all the cases.

Keywords: Acacia Auriculiformis, Adsorption, Analysis of Variance, Copper (II), Direct Blue 86, Fluoride, Ibuprofen, Lead (II), Methylene Blue, Microwave assisted activated carbon, Response surface methodology, Wastewater treatment, Water pollution.