ABSTRACT

Adsorption of textile dyes onto rice husk based adsorbents from aqueous solutions was studied. Batch experiments were conducted to determine the effect of method of treatment of rice husk on adsorption. Raw rice husk, chemically or thermally activated rice husk were tested for adsorption of Malachite green and Nylosan blue. The maximum adsorption was observed at solution pH values above 6 for Malachite green and below 3 for Nylosan blue. The adsorbent to solution ratio, solution dye concentration, contact time and adsorbent particle size affect the degree of dye removal. Carbonizing at 700°C for 1 hr was observed as the optimum condition for thermal activation. Base washed rice husk and thermally activated rice husk showed high adsorption capacities compared to acid washed rice husk, phosphoric acid treated rice husk and raw rice husk. Malachite green dye showed high adsorption compared to Nylosan blue for all the varieties of rice husk based adsorbents tested. RH based adsorbents were compared with the commercially available granular activated carbon. Equilibrium data were satisfactorily fitted to Langmuir and Freundlich isotherms. Kinetic data were fitted to the Pseudo second order model and initial adsorption rates and rate constants were determined.

Fixed bed column studies were conducted for raw rice husk, base washed rice husk and thermally activated rice husk and breakthrough curves were obtained. Bed capacity, breakthrough time, length of the unused bed and time required for full bed exhaustion under ideal condition was calculated from breakthrough curves. Bed capacities for Malachite green and Nylosan blue for thermally treated rice husk were 45 and 30 mg/g respectively. Experimental data obtained from unsteady state fixed bed column studies were used for scale-up calculations and industrial scale fixed bed adsorber dimensions were estimated.

Tests on real textile waste water consists of a mixture of dyes showed that Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) levels can be reduced to 210 mg/l and 30 mg/l respectively using thermally activated rice husk.