Biosorption study of methylene blue (MB) and brilliant red remazol (BRR) by coconut dregs

ABSTRACT

Water pollution has become a major issue in many countries, including Malaysia. Malaysia is one of the countries that suffers from this detrimental influence on water resource sustainability. Adsorption has been discovered to be a cost-effective and efficient method of removing contaminants such as pigments, dyes, and metal impurities. Many biomass-based adsorbent materials have been successfully used for the removal of dyes from aqueous solutions. In this study, the potential use of coconut dregs as the new biosorbent for the removal of Methylene Blue (MB) (basic dye) and Brilliant Red Remazol (BRR) (acidic dye) was investigated. The effects of adsorption time, adsorbent dosage, pH, and initial dye concentration on coconut dregs adsorption for MB and BRR dye were investigated using 2-Level Factorial Design of Design-Expert 7.1.5. The results indicated that the amount of dye adsorbed on the coconut dregs increased with increasing dye concentration, adsorbent dosage, and adsorption time. However, both MB and BRR dyes favor different pH for the adsorption process. The adsorption capacity of MB dye increased with increasing pH, while the adsorption capacity of BRR dye increased with decreasing pH. Removal of MB was optimum at pH 11, contact time of 240 min, a dosage of 0.25 g adsorbent, and an initial dye concentration of 50 mg/L. Meanwhile, for BRR dye, the optimum condition was pH 2, contact time of 180 min, the dosage of 0.25 g adsorbent, and an initial dye concentration of 50 mg/L. The equilibrium data for both dyes fitted very well with the Langmuir Isotherm equation giving a maximum monolayer adsorption capacity as high as 5.7208 mg/g and 3.7636 mg/g for Methylene Blue Dye and Brilliant Red Remazol dye, respectively. This study shows that coconut dregs can be one of the potential and low-cost biosorbents for the treatment of industrial dyes soon.