UNIVERSITI TEKNOLOGI MARA

ADSORPTION STUDIES ON CROSSLINKED CHITOSAN/EGGSHELL/TITANIA FOR METHYL ORANGE REMOVAL

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ABSTRACT

Adsorption is the most efficient method for treating dye-contaminated wastewater. One of the widely available natural polymers, chitosan, is a promising adsorbent. However, raw chitosan has disadvantages including a low surface area and poor chemical stability in an acidic media, which hinder its adsorption efficiency. Therefore, chitosan must be modified before being used as an adsorbent. In the present study, chitosan was modified physically and chemically and then applied for the adsorption of methyl orange dye. The chitosan flakes were successfully converted to chitosan beads using eggshell and titania for physical modification. These modifications were conducted to improve the chitosan surface property and adsorptive performance. The chitosan beads were then chemically modified with crosslinkers; benzaldehyde, salicylaldehyde, and benzil to increase their stability in the acidic solution. The optimum crosslinker was selected via potentiometric titration analysis, swelling and dissolution studies, and the adsorption performance of methyl orange (MO) removal, with benzaldehyde exhibits the most optimum properties. The physicochemical properties of the prepared adsorbents were characterized via XRD, BET, FTIR, and FESEM-EDX. The effects of pH, initial dye concentration, and adsorbent dosage on the adsorption performance of adsorbents were investigated. The percentage removal of MO decreases with increasing pH and MO concentrations. In contrast, the MO removal efficiency increases as adsorbent dose increases. The optimum conditions were 150 minutes, 0.3 g adsorbent dose, and pH 4 for crosslinked Chitosan/**2**Eggshell/**1**Titania-Benzaldehyde (CS/**2**ES/**1**TiO2-**BAL**). The adsorption data were assessed using equilibrium adsorption isotherms and kinetics models. The Langmuir isotherm model significantly described the isotherm data due to higher correlation coefficients (R^2 = 0.99), with a maximum adsorption capacity of 4.49 mg/g. Thus, the applicability of monolayer coverage of the MO on the surface of the CS/**2**ES/**1**TiO2-**BAL** is demonstrated. The kinetic study revealed that the pseudo-first-order rate model better agreed with the experimental data. In conclusion, this study has demonstrated the potential of CS/**2**ES/**1**TiO2-**BAL** as an adsorbent for treating dye contaminated water.

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