BIOSORPTION OF CATIONIC DYES FROM AQUEOUS PHASE USING VIRGIN AND IMMOBILIZED FUNGAL BIOMASS

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(Nityanand Singh Maurya)

ABSTRACT

In the present work, uptake of dyes using biosorbents prepared from dead macro fungi (*Fomes fomentarius* and *Fomitopsis carnea*) was evaluated. The biosorbent KL, prepared from *Fomitopsis carnea*, which showed high dye uptake potential, was selected for the preparation of immobilized biosorbent. This biosorbent was immobilized using polyvinyl alcohol (PVA) to produce four immobilized biosorbents KI1, KI2, KI3 and KI4 having varying concentration of PVA and virgin biosorbent. Eleven cationic dyes from different chemical classes were evaluated for their sorption on to the biosorbents. Safranin O and Alcian Blue were used for detailed equilibrium and kinetic investigations. Parametric studies like effect of temperature, pH and ionic strength were carried out for uptake of these dyes using both virgin and immobilized biosorbents.

Surface of biosorbents is different from conventionally used adsorbents, i.e., activated carbon. A kinetic model, based on active available binding sites (AABS) was proposed. The performance of the proposed model (Proposed Biosorption Kinetic, PBK) was compared with the other existing kinetic models like Second Order, Lagergren's equation, Pore-Diffusion, and Furusawa and Smith. These models were evaluated under various environmental conditions, and the kinetic constant was determined under various environmental conditions (mixing speed, temperature and biosorbent dose) employing both the biosorbents KL and KI1. Results indicated that PBK model generated kinetic profiles could match the data more closely as compared to Lagergren's equation, Pore-Diffusion, and Furusawa and Smith. Though, same kinetic profile was obtained for Second Order model and PBK model, they provided different values of model constants. Interaction between dye cation and the biosorbent was evaluated using desorption studies, temperature studies (isotherm and kinetics) and FT-IR studies.

The increase in dye uptake potential of biosorbents with pH of dye solution indicated the possibility ion exchange type of dye sorption mechanism. Increased ionic strength led to decrease in dye uptake capacity. It also indicated the possibility of ion exchange as dominating sorption mechanism. However, increase in Langmuir saturation capacity with temperature indicated chemical sorption type interaction. Desorption of dye was more by mineral acid as compared to acetic acid. Therefore, desorption studies also indicated the possibility of ion exchange as a dominating dye sorption mechanism. However, in case of interactions of Safranin O with KL, FT-IR indicated a combination of chemical and ion exchange as dye sorption mechanism. This was also supported by the values of the head of adsorption (10.39 to 21.30 KJ/g-mole) and activation energy (20.43 to 48.34 KJ/g-mole).

Key words: Biosorption, cationic dyes, macro fungus, immobilization, isotherm, kinetics and kinetic model development, FT-IR.

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