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Chitosan augmented activated charcoal for adsorption of reactive red 21 dye from solution phase

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Polymers have been proven to be an interesting class of adsorbents applied in water treatment. Biopolymers are of special interest due to their unique properties such as biocompatibility, biodegradability and reusability. This work reports a composite formed by a chitosan biopolymer and activated charcoal using sodium citrate as a crosslinking agent. The chitosan-citrate-activated charcoal composite (CCA) has been characterized using FT-IR, SEM, EDAX, XRD, TGA-DTA and BET surface area analysis. The material has been found to be microporous in nature with a surface area of 165.83 m²/g that has led to high adsorption capacities toward the targeted pollutant. In aqueous phase, the dye adsorption studies have been carried out with reactive 21 (R-21) dye. Under optimum solution conditions, maximum Reactive Red (R-21) dye removal capacity has been found to be 40.12 mg g⁻¹. Intrinsic microporosity of CCA results in an enhanced capture capacity for Reactive Red (R-21) dye. Material sustainability studies have been carried out to evaluate various sustainability parameters.

Keywords: Adsorption, Isotherm, R-21, Thermodynamics