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Beta-chitin nanocrystals as promising materials for dye removal from wastewater

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Wastewater treatment is a key subject related to some of the Sustainable Development Goals. Chitin nanofibers and nanocrystals have been studied for these applications, since they can interact with compounds such as metal ions and dyes, due to the presence of amino and N-acetyl groups in their structures [1]. In this work, beta-chitin flakes were submitted to acidic hydrolysis to produce chitin nanofibers (ChN) and then applied to remove Methylene Blue (MB) and Methyl Orange (MO) from aqueous solutions [2]. The acidolysis of beta-chitin was carried out with 3M HCl or 3M H_2SO_4 under reflux for 3h, and the resulting nanofibers were named as WHCl, WH_2SO_4 respectively. The stable nanofiber suspensions were diluted to 2,0mg/g and added to MO and MB solutions (with initial concentrations of 25mg/L and 50 mg/L). Adsorption assays were carried out at 25ºC, pH≈7. Kinetic assays were conducted from 5min to 120min, whereas samples at equilibrium (120min) were used for the thermodynamic assays. Due to the positive surface charge of ChN (ζ=+20mV), the interaction with MB was poor, and all ChN samples showed a MB removal efficiency (R%) lower than 1,0mg/g. On the other hand, WHCl showed R%≈70mg/g of MO in both concentrations (25 and 50mg/L). Kinetic assays indicated that the adsorption of MO follows a pseudo-second order model for both dye concentrations, leading to a removal capacity (qe) of 8,2 and 17,4 mg/g, respectively. According to the thermodynamic assays, the Langmuir model describes the adsorption mechanism. The maximum adsorption capacity (qm) of MO was calculated for WHCl (65,75 mg/g) and WH_2SO_4 (61,84 mg/g). These values are considerably higher than those found in the literature for adsorbents based on beta-chitin, indicating that these ChN are suitable for dye adsorption.

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