Parametric and kinetic study of adsorptive removal of dyes from aqueous solutions using an agriculture waste

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Wastewater treatment is the subject of several studies through decades. Interest is continuously oriented to provide cheaper and efficient methods of treatment. Several methods of treatment exit including coagulation flocculation, filtration, precipitation, ozonation, ion exchange, reverse osmosis, advanced oxidation process. The use of these methods proved limited because of their high investment and operational cost. Adsorption can be an efficient low-cost process to remove pollutants from wastewater. This method of treatment calls for an solid adsorbent which constitutes the purification tool. Agricultural wastes have been widely exploited in this case .As we know the agricultural wastes are an important source of water pollution once discharged into the aquatic environment (river, sea ...). The valorization of such wastes and their use allows the prevention of this problem with an economic and environment benefits. In this context our study aimed testing the wastewater treatment capacity by adsorption onto holocellulose resulting from the valorization of an agriculture waste. In this study, methylene blue (MB) and methyl orange (MO) are selected as models pollutants for evaluating the holocellulose adsorbent capacity. The kinetics of adsorption is performed using UV-visible spectroscopy. In order to study the effect of the main parameters for the adsorption process and their mutual interaction, a full factorial design (type nk) has been used.23 full factorial design analysis was performed to screen the parameters affecting dye removal efficiency. Using the experimental results, a linear mathematical model representing the influence of the different parameters and their interactions was obtained. The parametric study showed that efficiency of the adsorption system (Dyes/ Holocellulose) is mainly linked to pH variation. The best yields were observed for MB at pH=10 and for MO at pH=2.The kinetic data was analyzed using different models , namely , the pseudo-first- order kinetic model the pseudo-second-order kinetic model , and the Intraparticule diffusion model . It was observed that the pseudo –second –order model was the best model describing the adsorption behavior of MB and MO onto holocellulose. This suggested that the adsorption mechanism might be a chemisorptions process. In general, the results indicated that holocellulose is suitable as sorbent material for adsorption of MO and MB from aqueous solutions for its high effectiveness and low cost.