COMPOST AS BIOSORBENT FOR REMOVAL OF ACID DYES FROM THE WASTEWATER GENERATED BY THE TEXTILE INDUSTRY

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Abstract: The compost derived from cellulosic material coming from the Public Utility Company in Zabrze (Poland) was investigated for its capability for adsorbing acid dyes from aqueous solution at various concentrations of the dyes and the compost dosages. Four acid dyes were investigated: Acid Red 18 (AR-18), Acid Blue 9 (AB-9), Acid Green 16 (AG-16) and Acid Black 1 (ABk-1). The adsorption isotherms were determined by comparing the experimental data with the isotherm models (Freundlich, Langmuir and Dubinin–Radushkevich models). The sorption capacity of the compost depended on the initial concentrations of dyes in the solution, compost dosage, and on the structure of dyes. The maximum sorption capacities of the compost for adsorbing particular dyes may be ordered as follows: ABk-1 > AG-16 > AB-9 > AR-18.

The amounts of bound and the percentages of removed acid dyes from effluent depended on the adsorbent dosage. The growth of the dye removal percentages with growing adsorbent mass may be attributed to the growth of the adsorbent uptake surface with growth of the adsorbent mass.

The dyes were bound onto the surface of compost through the electrostatic interaction between the surface (negatively charged at $pH > pH_{PZC}$) and the dye cations (AG-16), and/or through the hydrogen bond between the functional groups of the humic matter in compost (-OH, –COOH) and the functional surface groups of AR-18, AB-9 and ABk-1 dyes (-OH, -NH_2).

At the experiment conditions, the Freundlich and Dubinin-Raduskevich adsorption isotherm models fitted the equilibrium data very well (much better than the Langmuir one). The values of 1/n in the Freundlich equation and E in the Dubinin-Raduskevich one indicate the favourable adsorption.

The studied compost may be used as a low-cost sorbent for the removal of acid dyes from wastewater released by textile industries. However, elevated values of chemical oxygen demand (COD) in the final solutions may enhance the solubility of humic compounds.