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# Humic acid covered alumina as adsorbent for the removal of organic dye from coloured effluents

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**ABSTRACT**

In the present study, the potential use of humic acid (HA) covered alumina (ALHUM) as alternative and novel adsorbent material for the removal of methylene blue (MB) a basic dye, from aqueous solution within a batch process, was investigated. The covering efficiency was assessed by comparing the surface chemistry, the surface charge and the microstructure, of the natural and the HA covered alumina samples, and by using various tools such as streaming induced potential measurements and scanning electron microscopic analysis. The data indicate that increasing the coverage of the alumina support by HA, leads to enhancement of the dye removal from water. Such cationic dye removal from water was also found to increase by increasing either the aqueous phase pH or the temperature of the adsorption medium. However, decreases in the MB adsorbed amount were observed upon the increase of the divalent cation ($Ca^{2+}$, $Ba^{2+}$ and $Cu^{2+}$) affinity toward the ALHUM and/or the aqueous solution ionic strength. These features highlight the suitability of ALHUM adsorbent for the treatment of water polluted with organic dyes. Three adsorption kinetic models (pseudo-first-order, pseudo-second-order and intra-particle diffusion) were used to fit the experimental kinetic data. The kinetic of MB adsorption was found to follow pseudo-first-order model. In addition, the adsorption data at the equilibrium were fitted to various theoretical predictions, and good agreements were found with the Dubinin–Radushkevich isotherm models, as compared with, the Langmuir and the Freundlich theoretical isotherms. The removal efficiency of ALHUM was above 75% indicating that the ALHUM can be used as efficient adsorbent for cationic dye removal and for clean and ecofriendly processes.

*Keywords:* Alumina; Humic acid; Organic dyes; Adsorption

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