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Application of Modified Vermiculite for Cationic Textile Dyestuffs Removal: Sorption and Regeneration Studies

Authors : W. Stawiński, A. Wegrzyn, O. M. Freitas, S. A. Figueiredo

Abstract : Water is a life supporting resource, crucial for humanity and essential for natural ecosystems, which have been endangered by developing industry and increasing human population. Dyes are common in effluents discharged by various industries such as paper, plastics, food, cosmetics, and textile. They produce toxic effects on animals and disturb natural biological processes in receiving waters. Having complex molecular structure and resistance to biological decomposition they are problematic and difficult to be treated by conventional methods. In the search of efficient and sustainable method, sorption has been getting more interest in application to wastewaters treatment. Clays are minerals that have a layer structure based on phyllosilicate sheets that may carry a charge, which is balanced by ions located between the sheets. These charge-balancing ions can be exchanged resulting in very good ion-exchange properties of the material. Modifications of clays enhance their properties, producing a good and inexpensive sorbent for the removal of pollutants from wastewaters. The presented work proves that the treatment of a clay, vermiculite, with nitric acid followed by washing in citric acid strongly increases the sorption of two cationic dyes, methylene blue (C.I. 52015) and astrazon red (C.I. 110825). Desorption studies showed that the best eluent for regeneration is a solution of NaCl in ethanol. Cycles of sorption and desorption in column system showed no significant deterioration of sorption capacity and proved that the material shows a very good performance as sorbent, which can be recycled and reused. The results obtained open new possibilities of further modifications on vermiculite and modifications of other materials in order to get very efficient sorbents useful for wastewater treatment.

Keywords : cationic dyestuffs, sorption and regeneration, vermiculite, wastewater treatment
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