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Adsorption of anionic dyes from aqueous solutions using chemically modified straw

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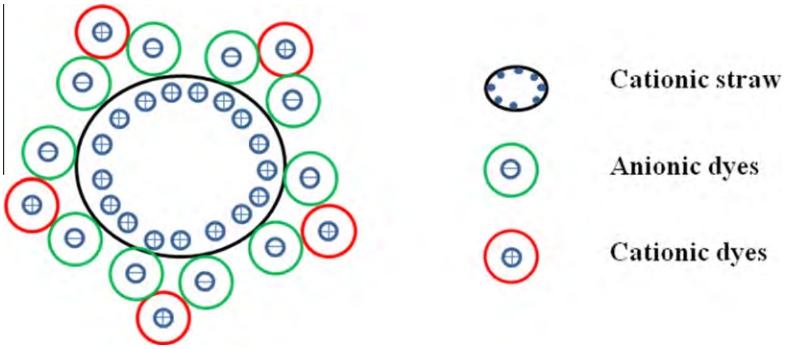
HIGHLIGHTS

- A quaternary ammonium cationic modified straw (MWS) was prepared.
- The fundamental adsorption behavior of MWS for two anionic dyes was studied.
- They followed a monolayer chemical adsorption mechanism with ion exchange process.
- The used adsorbent was effective in removal of cationic dye in secondary adsorption.

GRAPHICAL ABSTRACT

The cationic modified wheat straw adsorbent showed high removal efficiency for two anionic dyes. Then, the anionic dyes loaded adsorbents were successfully applied to eliminate a cationic dye in the secondary adsorption.



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ABSTRACT

The effective disposal of redundant straw is a significant work for environmental protection and full utilization of resource. In this work, the wheat straw has been modified by etherification to prepare a kind of quaternary ammonium straw adsorbents. The adsorption behaviors of the modified straw for methyl orange (MO) and acid green 25(AG25) were studied in both batch and column systems. The adsorption capacity of the straw for both dyes improved evidently after modification. The maximal MO and AG25 uptakes were more than 300 and 950 mg g^{-1}, respectively. Furthermore, the adsorption equilibrium, kinetics and column studies all indicated that the adsorption behavior was a monolayer chemical adsorption with an ion-exchange process. In addition, after adsorption of anionic dyes, the used adsorbents were successfully applied to adsorb a cationic dye directly at suitable conditions in the secondary adsorption. This was due to the altered surface structures of the used adsorbents.

1. Introduction

Nowadays, with the rapid development of modern industries, the environmental contamination associated with the dyes present in wastewater of various industrial sections, such as dyeing, printing, textile, leather, and coating industries, has drawn much attention. It is estimated that more than 70,000 tones of dyes are discharged in effluent from textile and associated industries in the world every year. The release of dyes has posed serious environmental problems. Colored dye effluents may interfere with light penetration in the receiving water bodies thereby disturbing the

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