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The preparation of organo-bentonite by a new gemini and its monomer surfactants and the application in MO removal: A comparative study

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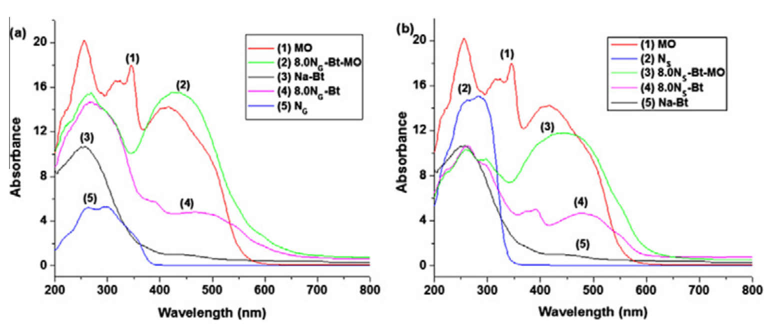
HIGHLIGHTS

- N_G is more effective than N_S in expanding basal space and in removing MO.
- N_S mainly stays in interlayer, however N_G on the clay surface due to its big head.
- MO removal by N_G-Bt/N_S-Bt is pH dependent.
- The complex of MO–N_G-Bt/MO–N_S-Bt forms during MO removal.

GRAPHICAL ABSTRACT

Solid-state UV–vis spectra of the samples employed in this study.



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ABSTRACT

Gemini surfactant, 1,1′-(butane-1,4-diyl)-bis(3-(tetradecyloxycarbonyl)pyridinium) dibromide (designated as N_G), and the corresponding monomer, 1-ethyl-3-(tetradecyloxycarbonyl)pyridinium bromide (N_S), were prepared and utilized to modify sodium bentonite (Na-Bt). The surfactant modified bentonites (N_G-Bt for the gemini modified bentonite and N_S-Bt for the monomer modified one) were then used for methyl orange (MO) removal from the wastewater. The results indicated that the gemini surfactant N_G was more effective than the monomer N_S at expanding the interlayer space of Na-Bt and in removing MO from wastewater. The maximum basal spacing of N_G-Bt (4.02 nm) was almost twice as that of N_S-Bt (2.63 nm). MO removal efficiency was 9.68% for 4.0N_S-Bt and 99.88% for 4.0N_G-Bt at a dosage of 0.06 g, respectively. N_S easily intercalated into the interlayer of Na-Bt, however more N_G mainly stayed on the solid surface owing to its bigger head. The adsorption of both N_G and N_S on Na-Bt obeyed the pseudo-second-order kinetic model and Langmuir isotherms. The solid-state UV–vis spectrometry evidenced the formed complex of N_G/N_S with MO on Na-Bt, and the stronger interaction of N_G-Bt with MO.

1. Introduction

Dyes are used widely as coloring agents in textile, cosmetic, leather, printing, food, plastic and so on. Due to their resistance to degradation, they remain in wastewater. Dyes and their metabolic products might be cancerogenic and mutagenic [1,2]. Several conventional methods, for instance, coagulation and flocculation, membrane filtration, biological treatments, adsorption and advanced oxidation processes, are available for the treatment of dye wastewater, in which the adsorption is the most effective and convenient one [3–7]. Clay minerals are potential absorbents.

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