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Dispersion stability of organoclay in octane improved by adding nonionic surfactants

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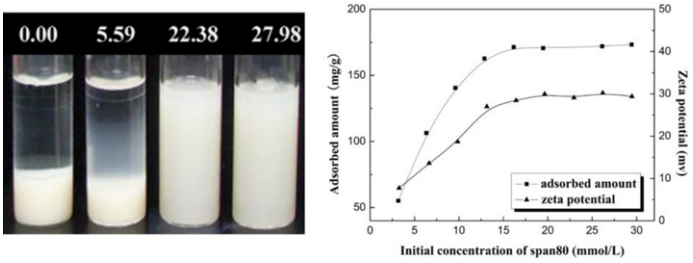
HIGHLIGHTS

- Dispersion of organoclay in octane could be stabilized by nonionic surfactants.
- Nonionic surfactant adsorbed at the surface and entered the interlayer of organoclay.
- The adsorption of nonionic surfactants increased the surface potential of particles.
- The stability is improved by a combination of steric and electrostatic effects.

GRAPHICAL ABSTRACT

The adsorption of Span 80 on organoclay in octane could increase the particle surface potential and improve the dispersion stability.



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ABSTRACT

Dispersion stability of organoclay (surfactant-modified montmorillonite) in nonpolar solvents can be dramatically improved by adding nonionic surfactants sorbitan monoleate (Span 80), sorbitan trioleate (Span 85) and 1-oleoyl-rac-glycerol (GMO). The effects of the surfactants on the basal spacing, size and surface potential of organoclay were investigated. The increase of the basal spacing of organoclay indicated that the surfactants have intercalated into the organoclay interlayer, which promoted the exfoliation of organoclay. Correspondingly, the reduction of the size of organoclay particles was observed. We also measured the surface potential of organoclay and found it increased with the surfactant concentration and then reached a constant value. The adsorption behavior of surfactants on the particles and the variation of the surface potential of the particles were in consistent with the dispersion stability of organoclay in nonpolar solvents. We believe that the improvement of the dispersion stability caused by adding a nonionic surfactant is the result of the combination of steric and electrostatic effects.

1. Introduction

Dispersions of particles in nonpolar solvents have many applications in ceramics [1,2], display technology [3], inks [4,5], paints, lubricants and oil-based drilling fluid [6]. Usually, dispersions of particles in nonpolar solvents are unstable, and dispersants are used to improve the stability of the dispersions.

The mechanisms of dispersant to improve the stability of dispersions include steric and electrostatic stabilization. Most commercial dispersions are stabilized by both mechanisms [7]. When the dispersant molecules can strongly anchor to the surface of particles and have long chains that extend into solutions to separate the particles from each other, the dispersant can supply enough steric stabilization for dispersion [1]. Many researchers have reported polyisobutenyl succinimide (PIS) is an effective dispersant for particles in nonpolar media due to the amine in its head group to anchor to the surface of particles and the long hydrocarbon chains to supply enough steric stability [6,8–10]. Georges et al. [8] reported that PIS could adsorb on carbon particles to form a brush layer. Thus the carbon particles are stabilized by steric stabilization and stable dispersions are obtained. Dubois-Clochard et al. [9] found that the affinity of PIS for particles increase with the number

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