Project Title

Waterborne polyurethane dispersions synthesized from jatropha oil for surface coating: Characterization, thermal, rheological properties and storage stability

Executive Summary

Polluting organic solvents [volatile organic compounds (VOCs)] that evaporate during the formulations of coatings cause a wide variety of air quality problems. Consequently, government regulator has stepped up their efforts to limit the amount of VOCs released to the atmosphere.There is a demand in developing environmentally friendly products. Among several options, water is the best choice to use as a medium in formulating coating systems. Polyurethanes (PUs) are widely used in the coating industry because of their excellent performance. The organic solvent-based [e.g., N,N-dimethylformamide (DMF) and N,N-dimethylacetamide (DMAc)] PUs will be restricted in their traditional applications sooner or later because of the demands of economics, safety, and environmental regulations. In contrast, aqueous PU dispersions would be candidates with promise to replace them. In this study, a series of waterborne polyurethane dispersions derived from jatropha oil-based polyol (JOL) with different OH numbers will be prepared. Jatropha oil-based polyols will be synthesized by epoxidation and oxirane ring opening using methanol. The JOLs produced will be then used to prepare jatropha oil based waterborne polyurethane (JPU) dispersions by reaction with isophrene diisocyanate (IPDI). Dimethylol propionic acid (DMPA) is used as an internal emulsifier to enable the dispersion of polyurethane in water. The influence of the OH number, DMPA content and hard segment content with the stability of the wet JPU dispersions, as well as the physical, mechanical and thermal properties of the dry JPU films will be investigated. Because storage stability is also an important characteristic of the dispersion, the colloidal stability of the resulting emulsions was also investigated in terms of particle size, particle size distribution (PSD), zeta potential and rheology.