Multifunctional Synthetic Rheology Modifiers for Personal Care Formulations: More Than Just Thickeners

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Abstract

Acrylate and polyurethane copolymers from Rohm and Haas (Aculyn™ Rheology Modifiers) offer several distinct advantages over other types of rheology modifiers. As liquids, they are easy to process. Changes in co-monomers allow for control of rheological performance, leading to a broad range of available properties and applications. Synthetic copolymers provide clear solutions and can enhance the performance of all types of personal care products from shampoos to make-ups to shaving creams.

Rheology modifiers have always been considered efficient thickeners. They are capable of providing additional benefits to the formulator. The anionic hydrophobically-modified rheology modifiers can be used as primary emulsifiers in formulations where a low level of surfactant is desirable. Because the rheology modifiers have pendant hydrophobes that are similar in nature to nonionic surfactants, these rheology modifiers can emulsify oils, and stabilize oil-in-water or water-in-oil emulsions. This offers an advantage because when the polymer is dry, as part of the film, re-emulsification of the polymers is far more difficult than when surfactants are used for stabilizing the emulsion. Further, when the anionic rheology modifiers are neutralized with a fatty amine, such as cetyl phosphate DEA, the resultant rheology modifier itself also imparts water resistance to a film on the skin, such as a sunscreen, without the addition of a typical waterproofing agent to the formulation. The anionic rheology modifiers are also capable of assisting in the stable suspension of particles or beads in clear, high surfactant containing formulations such as shampoos, shower gels and body washes. In these formulations, the need for compatibility with the commonly used sodium salts of surfactants, plus the requirement for clarity, make these rheology modifiers an important component of the formulations.

These polymers have undergone thorough safety and environmental evaluations and have been found to be very safe in normal use.

Key Words: Rheology modifier, acrylate copolymer, thickener, polyurethane, alkali soluble emulsions (ASE), hydrophobically-modified alkali soluble emulsions (HASE), hydrophobically-modified ethoxylated urethanes (HEUR), hydrophobically-modified polyol (HMP).

Introduction

Expectations by consumers of personal care products today are ever-increasing. New product forms and categories are appearing at a continually faster rate. In order to develop products that meet the consumers expectations and possess excellent appearance, feel and flow characteristics while exhibiting superior performance and functionality, formulation chemists look to specialty ingredients to gain competitive advantage. The features and benefits of synthetic copolymers make them attractive candidates as specialty ingredients for personal care formulations. The polymers are also multifunctional in providing benefits in addition to thickening.

Synthetic copolymers from Rohm and Haas are offered generally in aqueous solutions. As liquids, most can be directly incorporated into a formulation without any preparation (warming, de-clumping, dissolving, etc.), allowing for cold processing, and without the concerns often associated with powders (dustiness, hygroscopic nature, etc.). As a result, significant manufacturing efficiencies can be achieved. In addition, these synthetic copolymers can be processed with high shear pumps and, when diluted, with turbine mixers, high speed propellers and colloid mills without experiencing degradation. Continuous production processes with in-line static mixers are also possible for incorporating these rheology modifiers.

The acrylate synthetic copolymers from Rohm and Haas are prepared via emulsion polymerization. Polyurethane polymers are synthesized using solution polymerization techniques. Control of the molecular weight of the polymers has a significant impact on the behavior of the polymers as rheology modifiers. Careful selection of co-monomers also allows for control of performance characteristics in both the acrylate and polyurethane-based products.

Structures

Synthetic rheology modifiers can be divided into four categories based on their composition and behavior characteristics: **A**lkali **S**oluble **E**mulsions (ASE), **H**ydrophobically-modified **A**lkali **S**oluble **E**mulsions (HASE) and **H**ydrophobically-modified **E**thoxylated **UR**ethanes (HEUR), and **H**ydrophobically-modified **N**onionic