

Ultrathix™ P-100: A New Multi-Functional Rheology Modifier. Part One: Hair Care

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Abstract

The objective of our research was to develop a dual-functional ingredient that could provide both desirable hair styling properties and rheology modification from a single polymer. Such a feat would minimize inventory, simplify production and shorten batch times. If we could also enhance the physicochemical properties of the finished gel and/or enhance the styling properties above current state-of-the-art technology that would bring added value to cosmetic formulator.

As a result of our research an optimized proprietary polymer (patent pending) of lightly cross-linked Vinyl Pyrrolidone and Acrylic Acid that produces a unique crosspolymer with enhanced rheological and hair styling benefits over and above what is possible with a simple formulation blend of PVP and AA based rheology modifiers. Cross-linking the copolymer provides enhanced styling and rheology properties, including high humidity curl retention and improved skin feel and reduced tackiness, when compared to current commercial systems. It also allows the formulation of clear styling gels with low charge density cationic polymers such as Polyquaternium-11 or Polyimide-1. The clarity of which can not be matched with homopolymers of polyacrylic acid like Carbomer.

This new multifunctional rheology modifier for the personal care industry is a 100% active powder that is easily wetted and neutralized in ambient temperature water without requirement of heat to hydrate. It is easily neutralized with suitable organic or inorganic bases to desired pH (recommended range of 5.0-9.0) and has broad application in hair and skin care formulations.

Introduction

Rheology modifiers are no longer expected to just thicken, suspend and stabilize formulations. They must also function over a broad pH range and be compatible with a variety of ingredients.

Ideally, rheology modifiers are also expected to deliver consumer perceivable benefits to personal care formulations, while still delivering superior aesthetic properties including clarity in aqueous solutions.

Lightly cross-linked polyacrylic acid polymers such as Carbomer have long been the standard for thickening aqueous based personal care formulations due to their ability to provide desired rheological properties such as high thickening efficiency, high yield values and shear thinning flow characteristics. Yet Carbomer is not salt-tolerant, which limits its usefulness in a range of finished product applications. Polyvinylpyrrolidone polymers are widely used in many personal care applications not only as film formers but also as thickening agents, emulsifiers, lubricants and binders. While physical blends of these two individual polymers, the first for rheology modification and the other for styling benefits, continue to be the most popular combination in styling gels, these blends have some notable deficiencies. For example, their hygroscopic properties significantly impair style retention and contribute tackiness under high humidity conditions. The objective of the current study was to determine whether random copolymerization of Vinylpyrrolidone and Acrylic Acid monomers with simultaneous chemical cross-linking could produce a single multi-functional ingredient that improves performance while mitigating the negative attributes associated with the common blend of the two homopolymers.

Our research demonstrates that a single linear random copolymer comprised of lightly cross-linked monomers of Acrylic Acid and Vinylpyrrolidone does improve the performance of the two individual homopolymers in personal care systems. UltraThix™ P-100 (Acrylic Acid/VP Crosspolymer) provides the desired rheological properties with greater salt-tolerance as well as enhanced styling benefits including high humidity curl retention