Nouryon

Amaze™ SP Polymer

Advancing natural styling formulations

Proposed INCI: Sodium Polyitaconate

In recent years, the development of a new styling trend has become much more evident in every aspect of the world around us. Gone are the days of elaborate hair styles, requiring hard holding films to lock in the look that took hours to create. There is now a rise in a much more minimalistic approach to hair styles; hair should look neat but styled in a way to give a "low key" look. This development of natural or nude styling brings with it the use of lighter textures to present hair with a flawless and effortless style, accentuating each individual's natural hair type. While this does not seem like a complex trend to follow, it becomes much more difficult when formulators must use the portfolio of synthetic polymers developed for traditionally elaborate styles to create something which will give consumers a weightless, invisible style.

Amaze™ SP polymer is a new entry into the hair styling market designed to offer consumers a more natural hold in use. It can be formulated into a variety of hair styling products ranging from mousses to creams and even some sprays. The polymer itself is derived from a natural source and manufactured using an extremely eco-conscious process to deliver a sustainable styling polymer which performs in a manner not often seen by formulators. While it can be compared to some of the synthetic or partially synthetic offerings in the market, Amaze™ SP polymer brings with it several benefits that truly differentiate it from what formulators have come to accept as normal styling polymers.

Suggested use levels, as supplied

Non-Aerosol Hairspray	1 – 6%.
Mousse	1 – 6%
Creams and Lotions	1 – 6%
Waxes and Pomades	1 – 6%

Recommended applications

Amaze™ SP polymer is a unique, hair styling product derived from plant based sources. Amaze™ SP is a naturally derived homopolymer of itaconate. The polymer is polymerized in the presence of base under green conditions with water as the only solvent. The green processing uses very low energy and produces zero waste or by-products. As the itaconate source is non-GMO, this styling polymer is suitable for use in natural certified formulations. It is supplied as a 100% active powder which can easily be incorporated into any aqueous based formulations while also offering compatibility with ethanol. The polymer is anionic and quite polar, so some special considerations should be taken when formulating with the product. Being 100% naturally derived, Amaze SP delivers performance similar to PVP/VA or BIOSTYLE™ polymers with some additional benefits.

Features and benefits

Feature	Benefit
Readily water soluble	Shorter mixing time in production
Alcohol tolerance up to 40%	Broad range of use for several regions
Superior performance to PVP/VA	Excellent formulating latitude, broad range of use, easy to incorporate into existing product formulations
Natural derivation	Improved sustainability and renewability versus synthetic polymers, friendly INCI name for product labels, acceptable for use in certified natural formulations
Compatible with commonly used formulation ingredients	Robust and reliable performance
Requires no neutralization	Streamlines formulating

Formulation guidelines

Solubility
Amaze™ SP polymer is soluble in water as well as water/ethanol solutions. Amaze SP polymer at 3% loading can tolerate up to 40% ethanol

Neutralization
Amaze™ SP polymer does not require neutralization. However, other polymers in the final formulation may require neutralization and should be done as recommended by the manufacturer.

Compatibility
Amaze™ SP polymer is compatible with numerous commonly found hair styling ingredients and preservatives including but not limited to panthenol, silicones, sorbitol, EDTA, propylene glycol, and polyethylene glycols. With appropriate pH and processing adjustments, Amaze™ SP polymer is also compatible with other Nouryon personal care products such as BALANCE® CR polymer, AMAZE™ XT polymer, BALANCE® RCFg polymer, FLEXAN® II polymer, and DynamX® H2O polymer.

Use in emulsions
Due to the nature of the material, Amaze™ SP polymer can cause some compatibility issues when formulated into emulsions. However, Amaze™ SP polymer shows an increased stability in these systems when the pH is brought to a more neutral range.

Color
Over time, the color of Amaze™ SP polymer has been seen to shift from an off-white to yellow in both the raw material as well as in formulations. It has been observed that when exposed to temperatures above 40°C, the color shift of the product is accelerated so this should be accounted for when heating formulations or storing the product. As the product is 100% natural, no additional processing has been performed to isolate the cause of this discoloration. However, while the product and formulations will yellow, the final application will remain clear and colorless. If the color is not ideal, it has also been seen that the yellowing can be mitigated through the inclusion of a colorant or dye in the formulation.

Performance properties

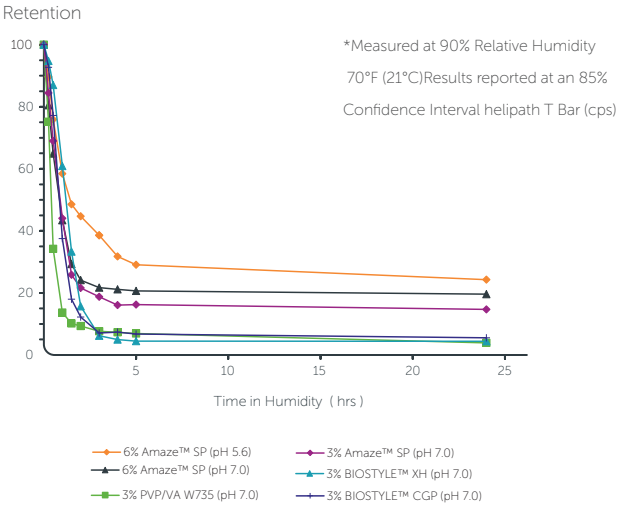
On-Hair subjective evaluations
Subjective evaluations were performed by a group of trained panelists on hair tresses to determine the performance of Amaze™ SP polymer compared to PVP/VA in pump hair spray formulations. As can be seen in the study below, tresses were treated with 3% and 6% Amaze™ SP polymer and compared to 3% PVP/VA. The tresses were then dried before panelists evaluated the swatches in a forced comparison to determine any difference in the performance attributes. The data below is a result of this comparison and is reported at a 95% confidence level.

Table 1. Subjective on-hair performance of Amaze™ SP polymer vs. PVP/VA

3% PVP/VA vs.	3% Amaze™ SP polymer	6% Amaze™ SP polymer
Gloss	NSD	NSD
Stiffness	NSD	+
Spring	-	NSD
Webbing	-	NSD
Dry Comb	+	NSD
Flake	NSD	NSD
Anti-Stat	-	+
Feel	+	NSD

High humidity curl retention
As highlighted in Figure 1, Amaze™ SP polymer offers a statistically superior difference in humidity resistance when compared to PVP/VA Copolymer and BIOSTYLE™ polymers, as measured by curl retention after 24 hours. Additionally, there was no significant difference observed when varying the amount of Amaze™ SP polymer from 3% to 6% in application, nor was there a difference in applying the product as is or with a more neutral pH.

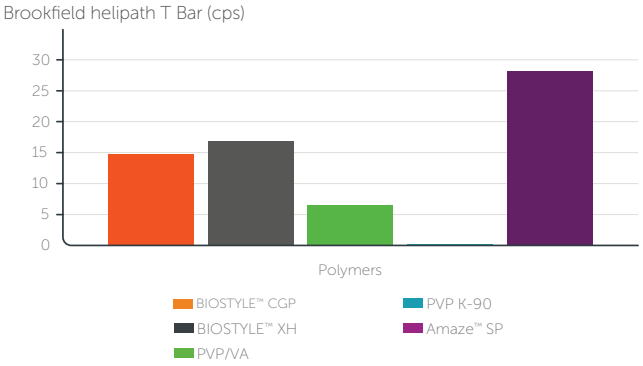
Figure 1: High Humidity Curl Retention of Amaze™ SP polymer vs. PVP/VA and BIOSTYLE™ polymers



Volume enhancement

In Figure 2, the degree of volume enhancement offered by Amaze™ SP polymer compared to PVP/VA and BIOSTYLE™ polymers can truly be seen. While the BIOSTYLE polymers are known to build volume, Amaze™ SP polymer presents even more volume generation when applied to fine hair; these samples were evaluated at 3% polymer loadings at 50% Relative Humidity | 72˚F (22˚C).

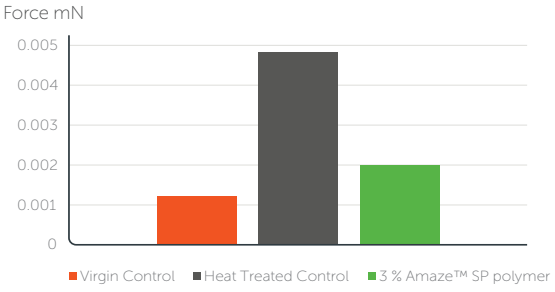
Figure 2: Volume Enhancement of Amaze™ SP polymer vs. PVP/VA and BIOSTYLE™ polymers



Thermal protection

Figure 3 shows that Amaze™ SP polymer offers a substantial amount of protection from heated styling tools up to temperatures of 450˚F (232˚C). When compared to a heat-treated control with no thermal protection, Amaze™ SP provides an improvement of nearly 80%

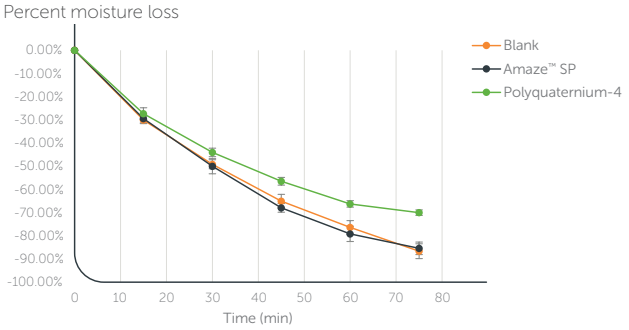
Figure 3: Thermal Protection of Amaze™ SP polymer vs. heated blank



Accelerated drying time

Amaze™ SP polymer has been observed to dry significantly faster than other hair styling film formers. These observations are evident both objectively (as can be seen in Figure 4 below) as well as subjectively. While the faster drying Amaze™ SP polymer can be felt with heated styling tools, the difference in drying times is most obvious in air dried applications. The reason for this is because of the polymer behavior on hair. As opposed to a traditional film forming polymer which creates an even continuous film, Amaze™ SP is observed to interact at specific sites along the hair shaft. This behavior allows for the hair to remain partially exposed to the environment, and thus release excess moisture on the hair into the air.

Figure 4: Drying time of Amaze™ SP polymer vs. Polyquaternium-4



Basic Aerosol Mousse Formulation – 3% Polymer

*Measured at 30% Relative Humidity | 70°F

Curl definition/anti-frizz evaluation

In evaluations, Amaze™ SP polymer was observed to provide equivalent curl definition and anti-frizz benefits to synthetic polymers. These benefits were observed from a basic solution, a combing cream, and in mousses at 3% polymer

Storage and handling

Amaze™ SP polymer should be stored under ambient conditions; under these conditions, the product has a 24-month shelf life. The product is supplied in either a cardboard box or a fiber drum and should be kept tightly sealed and in a cool location to prevent unintended microbial contamination or yellowing.

Health and safety

Information on Amaze™ SP polymer relating to the EU Cosmetic Regulation 1223/2009 or EU Cosmetic Directive 76/678/EC is available on request.

For more information and sample formulations contact us at personalcare.marketing@nouryon.com.

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Nouryon

We create ingredients for the manufacture of life's essentials. You'll find our products all around you, in things like food, buildings, and everyday items like your children's toys.

Sustainability is at the heart of everything we do, and we rank #1 in the Dow Jones Sustainability Index. To keep devising sustainable, innovative solutions for the problems posed by everyday life, we want to work with the very best people and partners – like you.

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