Nouryon

Biostyle® XH polymer

Sustainable solutions for styling

INCI: Maltodextrin/VP Copolymer

Today's consumers are becoming increasingly demanding when it comes to the products they'll use to create beautiful, long-lasting hairstyles. The development of hair styling products that meet performance and cost targets combined with the consumers' desire for formulas that contain more naturally-derived or sustainable ingredients are growing in complexity. To meet these requirements, formulators need to explore new alternatives outside of the traditional portfolio of synthetic polymers that have long been utilized as the hair fixative ingredients in styling aids.

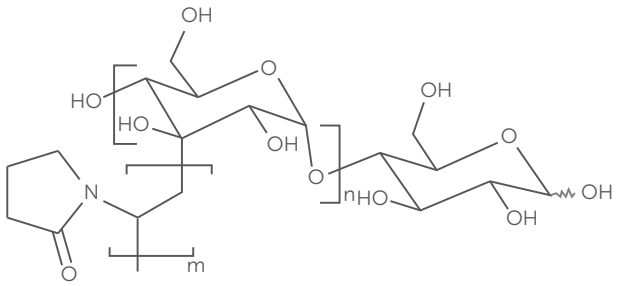
Biostyle XH polymer is a naturally-derived hair fixative designed especially for use in products including clear hair gels, mousses, creams, waxes, and other styling aids. Biostyle XH polymer provides the features of exceptional clarity and consumer preferred rheology that are typically associated with synthetic fixative polymers, yet Biostyle XH polymer is partially derived from renewable resources. A proprietary, patented hybrid polymer formed by the reaction of NVP and maltodextrin, Biostyle XH polymer represents a new way for formulators to create more natural and sustainable styling products while maintaining cost-in-use targets without any sacrifice of performance properties.

Biostyle XH polymer combines the benefits of natural and synthetic materials to meet today's formulating and consumer needs. It offers the well-known styling performance similar to PVP K-90, while allowing the formulator to develop more sustainable and renewable styling aids without any compromise on cost, gel clarity, product aesthetics, or on-hair performance.

Recommended applications

Biostyle XH polymer is a nonionic hair fixative containing partial natural content, supplied as a 25% aqueous solution. It is a unique, patented graft polymer produced via the reaction of maltodextrin and vinyl pyrrolidone. Biostyle XH polymer delivers performance similar to PVP K-90, and improved stiffness compared to Biostyle CGP polymer, PVP K-30, and PVP/VA in hair gel formulations.

Suggested structure of Biostyle XH polymer



Suggested use levels, as supplied

Application	% active
Hair gels	4-36
Mousse	4-25
Creams and lotions	4-25
Waxes and pomades	4-25

Product highlights

Features	Benefits
Excellent carbomer compatibility	Clear gels with consumer-preferred rheology
Low turbidity	Exceptional gel clarity
Performance at low use level	Cost effective
Liquid solution form	Shorter mixing time in production
Equivalent performance to PVP K-90	Excellent formulating latitude, broad range of use, easy to incorporate into existing product formulations
Partial natural content	Improved sustainability and renewability versus synthetic fixative polymers, friendly INCI name for product labels
Compatible with commonly used formulation ingredients	Robust and reliable performance, ease of formulation
Alcohol tolerance up to 34%	Broad range of use for several regions
Nonionic	Excellent compatibility with commonly used gel ingredients
Requires no neutralization	Streamlines formulation, reduces cost

Formulation guidelines

Supplied as a ~25% active solution in water, Biostyle XH polymer is a liquid and saves on mixing time at the production scale. The polymer is Carbomer compatible, and should be added to the batch after the Carbomer has been neutralized. Biostyle XH polymer can be formulated from 1-9% active in hair styling gels and 1-6% active in other styling applications.

Solubility

Biostyle XH polymer is soluble in water, as well as water and ethanol solutions. Biostyle XH polymer at 3% active content will tolerate up to 34% ethanol.

Neutralization

Biostyle XH polymer does not require neutralization. Other polymers in the final formulation (such as Carbomer) should be neutralized as recommended by the manufacturer.

Compatibility

Biostyle XH polymer is compatible with Carbomer and most common formulation ingredients, including, but not limited to panthenol, silicones, glycerin, sorbitol, EDTA, GLDA, propylene glycol, and polyethylene glycols. This polymer does have limited compatibility with Benzophenone-4. As highlighted in the following table, Biostyle XH polymer is compatible with other rheology modifiers, including Amaze™ XT polymer (Dehydroxanthan Gum), Natrosol™ 250 HHR CS (Hydroxyethylcellulose), Structure® 2001 polymer (Acrylates/Steareth-20 Itaconate Copolymer), Carbopol® Ultrez 10 (Carbomer), and Carbopol Ultrez 21 (Acrylates/C10-30 Alkyl Acrylate Crosspolymer) polymers.

Biostyle XH polymer with various thickeners and their gel properties

3% Biostyle XH polymer with	% solids	pH	Visc* (cps)	Turbidity (ntu)
Amaze XT polymer	1.0	7.35	45,240	30.9
Natrosol 250 HHR CS	2.0	6.30	27,310	16.4
Carbopol Ultrez 10	0.3	6.26	32,330	21.5
Carbopol Ultrez 21	0.3	6.41	41,760	8.1
Structure 2001 polymer	1.5	6.06	36,190	9.4

*Viscosity Brookfield Helipath T-C spindle, 10 rpm at 25°C

Biostyle XH polymer may be blended with other fixative polymers to tailor final formulation performance properties, including Amaze XT polymer (Dehydroxanthan Gum), the Celquat® polymer series (Polyquaternium-4), Balance® RCFg polymer (Acrylates Copolymer), the Amphomer® polymer series (Octylacrylamide/Acrylates/Butylaminoethyl Methacrylate Copolymer), the DynamX® polymer series (Polyurethane-14 (and) AMP-Acrylates Copolymer) and Flexan® II polymer (Sodium Polystyrene Sulfonate) polymers.

Gentle preservative systems, including the Euxyl® series and Sensiva® series, are also compatible with Biostyle XH polymer.

Performance properties

Hair gel formulations

Biostyle XH polymer has robust compatibility with Carbomer and other thickeners, while also forming crystal clear gels with high viscosity and excellent formulation stability. in the table below compares the properties of Biostyle polymer gels with other nonionic hair fixative gels.

Biostyle polymers vs other nonionic polymer gels

Description	Polymer solids, wt%	Carbomer* wt%	pH	Visc** (cps)	Turbidity (ntu)
PVP K-30 gel	3.0	0.5	6.29	42,700	9
PVP/VA gel	3.0	0.5	6.15	43,000	15
Biostyle CGP gel	3.0	0.5	6.34	45,500	12
Biostyle HX gel	3.0	0.5	6.08	44,000	16
PVP K-90 gel	3.0	0.3	6.40	46,140	19

*Carbomer neutralized with AMP
**Viscosity Brookfield Helipath, T-C spindle S-93, 10 rpm at 25°C

Gels featuring the Biostyle polymers using Carbomer as the rheology modifier can be formulated using aminomethyl propanol (AMP) or triethanolamine (TEA) neutralization. This comparison shows that crystal clear styling gels, as indicated by the low turbidity values, can be formulated using the Biostyle polymers without compromising viscosity or overall performance. High clarity gels and solutions using naturally derived fixatives are now possible with the Biostyle polymer technology!

On-hair subjective evaluations

Subjective evaluations were conducted by trained panelists on hair tresses to determine the performance of Biostyle XH polymer compared to PVP K-90 in hair gel formulations. In the below studies, hair tresses were treated with a gel comprised of 3% Biostyle XH polymer and 0.3% Carbomer and compared to PVP K-90 at the same polymer and Carbomer levels. The panelists evaluate the dry swatches and are forced to pick one swatch over the other for each performance attribute. The data is reported at the 95% confidence level.

Subjective on-hair performance of Biostyle XH polymer vs PVP K-90 gel

PVP K-90 gel vs	Biostyle XH polymer gel
Gloss	NSD
Stiffness	NSD
Dry comb	NSD
Flake	NSD
Anti-stat	NSD
Feel	NSD

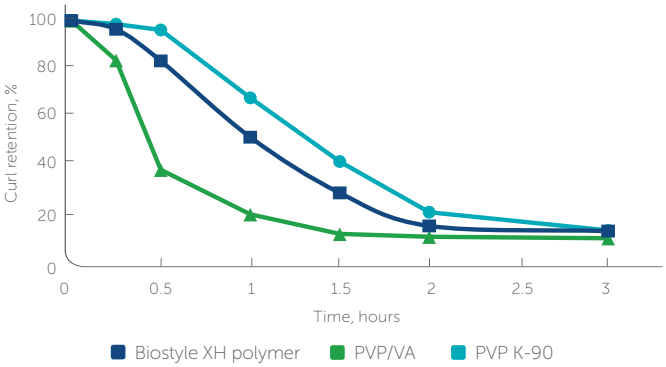
NSD = No statistical difference

The results above indicate that there were no statistical differences seen in any of the subjective properties. Biostyle XH polymer provides a more sustainable formulating option compared to the synthetic PVP K-90 system.

High humidity gel curl retention

As highlighted below, Biostyle XH polymer offers no statistically significant differences in style retention compared to PVP K-90 and PVP/VA copolymer, as measured by high humidity curl retention after 3 hours at 90% relative humidity and 21°C conditions.

High humidity curl retention of Biostyle XH polymer vs nonionic hair gels



90% relative humidity, 21°C (70°F) conditions
Basic hair gel – 3% active polymer, Carbomer systems: pH ~6.5

Performance in mousse systems

Biostyle XH polymer is clear and compatible with cationic polymers, such as Polyquaternium-4, and is a more affordable choice for high performance mousse systems. In the below studies, hair tresses were treated with a 6% VOC mousse comprised of 2% total active polymer and 6% isobutane/propane propellant. The panelists evaluate the wet and dry swatch properties and are forced to pick one swatch over the other for each performance attribute. The data is reported at the 95% confidence level. When investigating blends of Biostyle XH polymer and Celquat L-200 polymer compared to a Celquat L-200 polymer control, test results below.

Subjective on-hair performance of Biostyl XH polymer / Celquat L-200 polymer blends vs Celquat L-200 polymer in mousse

Celquat L-200 polymer mousse vs	75% Celquat L-200 polymer / 25% Biostyle XH polymer	50% Celquat L-200 polymer / 50% Biostyle XH polymer
Wet feel	NSD	NSD
Wet comb	NSD	NSD
Gloss	NSD	NSD
Stiffness	NSD	NSD
Dry comb	NSD	-
Flake	NSD	NSD
Anti-stat	NSD	NSD
Feel	NSD	NSD

NSD = No statistical difference

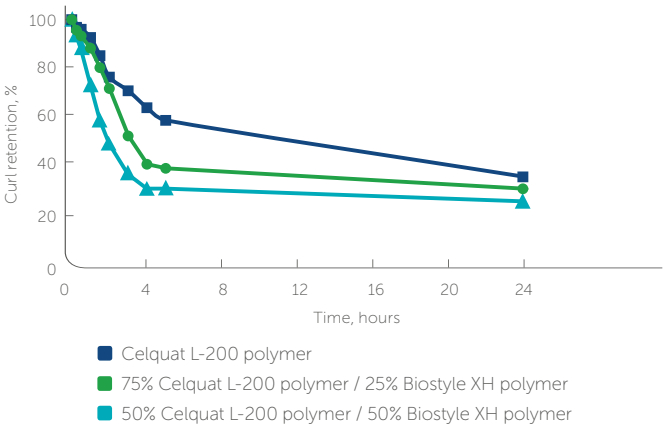
The results indicate that 25–50% of the Celquat L-200 polymer could be replaced with Biostyle XH polymer without any significant performance differences in wet properties (wet combing, wet feel). For the dry on-hair properties, 25% of the Celquat L-200 polymer could be replaced without any statistically significant performance differences in gloss, stiffness, dry combing, flaking, anti-static, and dry feel. Furthermore, 50% of Celquat L-200 polymer could also be replaced with Biostyle XH polymer without any significant performance differences in all of the dry on-hair properties, with the exception of stiffness.

Biostyle XH polymer utility in mousse systems can offer high performance with significant formula cost savings, while adding a greener touch to your product ingredient labels.

High humidity mousse curl retention

As highlighted i the next figure, Biostyle XH polymer / Celquat L-200 polymer blends offer no statistically significant differences in style retention compared to Celquat L-200 polymer alone, as measured by high humidity curl retention after 24 hours at 90% relative humidity and 21°C conditions.

High humidity curl retention of Biostyle XH polymer / Celquat L-200 polymer blends vs Celquat L-200 polymer in mousse



90% relative humidity, 21°C (70°F) conditions
Basic hair gel – 2% active polymer, 6% VOC systems

Storage and handling

Biostyle XH polymer should be stored under ambient conditions. The product is supplied in drums and should be kept tightly sealed and sampled minimally to prevent unintended microbial contamination. This product is supplied as a ~25% solids polymer solution in water that is preserved.

Health and safety

Information on Biostyle XH polymer relating to the EU cosmetic directive 76/768/EECC is available on request.

Contact us directly for detailed product information and sample request
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Nouryon

Nouryon is a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of more than 7,900 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands. Visit our website and follow us @Nouryon and on LinkedIn.

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