Rheology Modifiers

Enabling you to create the desired texture and function for your formulations
Rheology modifiers are essential ingredients to define product form and function. They affect the flow and feel of a product, determine application properties, and enable the creation of products with consumer preferred textures and visual appeal.

AkzoNobel provides a variety of synthetic and naturally derived polymers and surfactant thickeners to help formulators achieve desired and unique textures when developing the finest personal care products.

- AMAZÉ™ XT polymer
- BALANCE® RCFg polymer
- ELFACOS® GT 282S nonionic copolymer
- STRUCTURE® XL starch
- STRUCTURE® ZEA starch
- STRUCTURE® SOLANACE™ starch
- STRUCTURE® 2001 and 3001 polymers
- STRUCTURE® PLUS polymer
AMAZE™ XT polymer
INCI Name: Dehydroxanthan Gum

A 100% natural rheology modifier that provides exceptional suspension and enables clearer cleansing formulations than competitive polymers. It’s an effective thickening agent ideal for low pH systems. Gels formulated with AMAZE XT polymer suspend beads and air bubbles.

Key Benefits

- pH range: 3-10; Optimal suspension at pH 4.5
- Thickens and provides superior suspension
- Enables different textures and visual appeal
- Clear cleansing formulations
- Supports natural and sustainable product claims
- Sheer thinning
- Provides conditioned skin feel in rinse off applications
- Powder; easy to disperse in water
- No neutralization required
- Compatible with cationic ingredients (at low use levels)
- Ideal for exfoliating scrubs cleansers
- Typical usage: 0.25% to 2.5%
- Available globally
- Approved in China

Suspension

Yield stress ($\sigma_y$) is a material property that relates to the capacity of a fluid to suspend another material, from air bubbles to beads. As long as $\sigma_y$ is higher than the stress, the beads apply to the fluid and they will be suspended. This latter stress depends on both the size of the suspended elements and the difference of density between the fluid and the suspended material. In simple terms, air bubbles are more difficult to suspend than polymeric beads, and small bubbles are easier to suspend than larger bubbles.

Figure 1 compares the experimental Yield stress with the theoretical one for various beads size and density (reference density of suspending fluid considered to be water). The points were located along the X axis assuming that the suspended beads were 1mm in diameter.

*Important: Viscosity does not suspend, it slows down beads motion (floating or sedimentation). Only the creation of a network, typically noticed through the presence of elasticity, can provide true suspension. It is important to remember that rheological properties (=suspension here) may change with temperature.*

Suspension Yield stress ($\sigma_y$) is a material property that relates to the capacity of a fluid to suspend another material, from air bubbles to beads. As long as $\sigma_y$ is higher than the stress, the beads apply to the fluid and they will be suspended. This latter stress depends on both the size of the suspended elements and the difference of density between the fluid and the suspended material. In simple terms, air bubbles are more difficult to suspend than polymeric beads, and small bubbles are easier to suspend than larger bubbles.

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Yield Stress $\sigma_y$ (Pa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>0.75</td>
<td>0.3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1.25</td>
<td>2</td>
</tr>
<tr>
<td>1.5</td>
<td>3</td>
</tr>
</tbody>
</table>

*Viscosity measured at 23°C using Brookfield DV-1 spindle 4; 1% active AMAZE XT gel solution
**Transmittance (%) measured at 600nm after 3 weeks of gel preparation
**BALANCE® RCFg polymer**

**INCI Name:** Acrylates Copolymer

BALANCE RCFg polymer thickens and creates clear gels and unique rheology profiles for new texture in skin and hair care formulations. It also provides efficient thickening in both surfactant and sulfate-free systems over pH 6.5-12.

**Key Benefits**
- Thickens over pH 6.5-12
- Optimal viscosity and clarity at pH >6.5
- Unique Newtonian rheology at low shear rate and shear thinning at high shear rate
- Enables soft cushioning gels (shaving, shower gels)
- Builds viscosity in surfactants systems at low concentration
- Synergy effect with salts
- Also thickens sulfate-free systems
- Supplied as 30% active liquid-form emulsion
- Easy to use in typical manufacturing conditions; allows for cold processing
- Compatible with cationics
- Typical usage: 1.0% to 5.0%
- Available globally
- Approved in China

**Viscosity and clarity**

In water solution, optimal viscosity and clarity are observed >pH 6.5

- Figure 3: Effect of pH on viscosity and clarity of 2% BALANCE RCFg polymer in water solution
- Figure 4: Thickening effect of BALANCE RCFg polymer at low concentrations in a sulfated system at pH 6.5
- Figure 5: Viscosity build in a sulfate-free system

Test results show that BALANCE RCFg polymer provides effective thickening at low concentrations in surfactant systems.

**Suggested Applications**
- Shaving shower gels
- Shower gels
- Body washes
- Shampoos
- Sulfate-free shampoos
- Foaming facial cleansers
ELFACOS® GT 282S

INCI Name: Ceteareth-60 Myristyl Glycol

ELFACOS GT 282S nonionic copolymer is a unique rheology modifier (polyalkylene glycol derivative) that enables crystal clear cleansing systems. As a unique Newtonian associative thickener, it exhibits excellent viscosity synergism with surfactants and works in a wide pH range (2-12) with no impact on foam properties.

Key Benefits

• Thickens over wide pH range (2-12)
• Crystal clear formulations
• Synergistic thickening effect with most anionic and amphoteric surfactants
• Synergistic viscosity with salts
• No impact on foaming
• Newtonian profile; easy to pour
• Excellent stability, even at high temperature
• Easy to use, 100% active pastille
• Typical usage 0.5% to 4.0%
• Available globally
• Approved in China

Clarity

ELFACOS GT 282S nonionic copolymer exhibits exceptional clarity in aqueous systems.

Synergistic thickening

ELFACOS GT 282S nonionic copolymer exhibits excellent synergistic effect with most anionic and amphoteric surfactants.

Suggested Applications

• Shampoos
• Body washes
• Facial cleansing systems
• Liquid soaps

FORMULATION USED IN THE STUDY

SLES Solution (pH 6.5)

<table>
<thead>
<tr>
<th>INCI Name</th>
<th>wt/wt %</th>
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<tbody>
<tr>
<td>Water</td>
<td>40</td>
</tr>
<tr>
<td>Sodium Laureth Sulfate (20%)</td>
<td>40</td>
</tr>
<tr>
<td>Sodium Hydroxide (20%)</td>
<td>QS</td>
</tr>
<tr>
<td>Water</td>
<td>QS to 90%</td>
</tr>
<tr>
<td>Ceteareth-60 Myristyl Glycol, ELFACOS GT 282S nonionic copolymer</td>
<td>0.5</td>
</tr>
<tr>
<td>Citric Acid (20%)</td>
<td>QS</td>
</tr>
<tr>
<td>Water</td>
<td>QS to 100%</td>
</tr>
</tbody>
</table>

Figure 6: Clarity of ELFACOS GT 282S 10% in water solution

Figure 7: Thickening effect of 5% ELFACOS GT 282S with 14% surfactant

Figure 8: Viscosity of SLES base with 0.5% ELFACOS GT 282S and salt
STRUCTURE® XL starch
INCI Name: Hydroxypropyl Starch Phosphate

A naturally derived and biodegradable rheology modifier, STRUCTURE® XL starch enables more stable and natural emulsions for personal care applications. It reduces the size of emulsion droplets enabling efficient stability and also builds synergistic viscosity with emulsifiers. Easy to use, it takes only two minutes to completely disperse in cold water with no pre-mixes needed. It is also flexible over wide pH range (3-9).

Key Benefits
- Multifunctional: thickener and emulsion stabilizer
- Flexibility over a wide pH range (3-9)
- Easy to use
- Quickly and easily disperses in cold water with no pre-mixes needed
- Non-dusty powder
- Viscosity thickening synergy with nonionic and amino acid surfactants
- Good salt tolerance
- Positive influence on foam properties
- Rich creamy texture
- Enables naturally derived skin and hair care products
- Typical usage: 1% to 4%
- Available globally
- Approved in China

Stability
Addition of STRUCTURE XL starch to an emulsion base significantly reduces average emulsion particle size resulting in more stable emulsions.

Figure 9: Effects of STRUCTURE XL starch on emulsion particle size reduction

Synergistic thickening
When increasing the use level emulsifier (1.75%), STRUCTURE XL starch synergistically increases viscosity.

Figure 10: Effects of STRUCTURE XL starch on emulsion viscosity in a multi-fruit base at pH 4.0

Flexibility
Because of its nonionic character and broad compatibility, STRUCTURE XL starch provides the formulator with the flexibility to formulate over a wide pH range with high amounts of mono- and polyvalent salts (up to 20%) and a large variety of raw materials.

Figure 11: Flexibility of STRUCTURE XL starch over a wide pH range

FORMULATION USED IN THE STUDY

<table>
<thead>
<tr>
<th>INCI Name Multi-fruit</th>
<th>4.75% Emulsi/fier + 1.75% STRUCTURE XL wt/wt %</th>
<th>4.75% Emulsi/fier + 0% STRUCTURE XL wt/wt %</th>
<th>1.1% Emulsi/fier + 1.75% STRUCTURE XL wt/wt %</th>
<th>1.1% Emulsi/fier + 0% STRUCTURE XL wt/wt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distilled Water</td>
<td>70.00</td>
<td>71.75</td>
<td>70.00</td>
<td>71.75</td>
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<tr>
<td>Magnesium Aluminum Silicate</td>
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<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
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<tr>
<td>Dehydroxanthan Gum, AMAZE XT polymer</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
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<tr>
<td>Hydroxypropyl Starch Phosphate, STRUCTURE XL starch</td>
<td>1.75</td>
<td>-</td>
<td>1.75</td>
<td>-</td>
</tr>
<tr>
<td>Phase B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capric/Caprylic Triglyceride</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
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<tr>
<td>Stearyl Alcohol</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
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<tr>
<td>Glyceryl Monostearate (Cosmetic Grade)</td>
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<td>3.25</td>
<td>0.75</td>
<td>0.75</td>
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<tr>
<td>Polysorbate 20</td>
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<td>1.50</td>
<td>0.35</td>
<td>0.35</td>
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<tr>
<td>Propylene Glycol Stearate</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
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<tr>
<td>Cetyl Esters</td>
<td>0.75</td>
<td>0.75</td>
<td>0.75</td>
<td>0.75</td>
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<tr>
<td>Glycolin</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
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<tr>
<td>Dimethicone</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Phase C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple Extracts, Multifruit BSC D227</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Preservative</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>Q5</td>
<td>Q5</td>
<td>Q5</td>
<td>Q5</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>Q5 to 100%</td>
<td>Q5 to 100%</td>
<td>Q5 to 100%</td>
<td>Q5 to 100%</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Suggested Applications
- Naturally derived skin care products
- Emulsion-based skin and hair care
- Creams and lotions
- Low-pH cleansing creams and lotions, body washes and facial cleansers
- Natural shampoos and conditioners
STRUCTURE® ZEA starch
INCI Name: Hydroxypropyl Starch Phosphate

STRUCTURE ZEA is a naturally derived, corn-based rheology modifier that thickens, stabilizes and provides aesthetic enhancements in emulsion systems. Flexible over wide pH range (3-9), it is also ideal for boosting viscosity in formulations that require instant dispersion such as peroxide solutions or cold water (pH >10).

Key Benefits
- Multifunctional: Thickener and emulsion stabilizer
- Naturally derived polymer
- Biodegradable
- Shear thinning
- Does not require neutralization
- Flexible over pH range 3-9
- For instant viscosity applications: pH >10
- Excellent tolerance to electrolytes and cationics
- Enhances hair treatment formulations (curly and colored hair)
- Ideal for boosting viscosity in formulations that require instant dispersion such as peroxide solutions or cold water
- Typical usage: Instant soluble powders: 1%; Emulsion stability: 1% to 5%
- Available globally
- Approved in China

Thickening
STRUCTURE ZEA starch thickens at very low pH, though viscosity can be built up to pH 10. Optimal pH stability: 3-7.

Figure 12: Effect of pH on viscosity; 5% active polymer in water solution

![Figure 12: Effect of pH on viscosity](image)

Figure 13: Thickening efficiency of STRUCTURE ZEA starch when used in different levels (supply form) in water solution

![Figure 13: Thickening efficiency](image)

Emulsion stabilization
STRUCTURE ZEA starch provides good stabilization in emulsion systems over a period of 12 weeks.

![Figure 14: Stability of emulsion over 12 weeks at 45°C](image)

Suggested Applications
- Hair treatment products
- Natural creams
- Lotions
- Powdered bleach
- Powdered hair dyes

Formulation Used in the Study

<table>
<thead>
<tr>
<th>Curl Control and Hydrating Cream (14590-33.E) pH 6.5-7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCI Name</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td><strong>Phase A</strong></td>
</tr>
<tr>
<td>Deionized Water</td>
</tr>
<tr>
<td>Hydroxypropyl Starch Phosphate, STRUCTURE® ZEA starch</td>
</tr>
<tr>
<td>Polyurethane-14 (and) AWP-Acrylates Copolymer (and) Water, DynamX® H2O (25% Solids)</td>
</tr>
<tr>
<td><strong>Phase B</strong></td>
</tr>
<tr>
<td>Cetearyl Alcohol</td>
</tr>
<tr>
<td>Ceteareth-20</td>
</tr>
<tr>
<td>Behentrimonium Methosulfate (and) Cetearyl Alcohol</td>
</tr>
<tr>
<td><strong>Phase C</strong></td>
</tr>
<tr>
<td>Cetrimonium Chloride (and) Water, ARQUAD® PC 16-29 (29% active)</td>
</tr>
<tr>
<td><strong>Phase D</strong></td>
</tr>
<tr>
<td>Dimethicone (and) Laureth-4 (and) Laureth-23 (and) Water</td>
</tr>
<tr>
<td>DMDM Hydantoin (and) Water</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Viscosity measured at 25°C, Brookfield RV, 10 rpm

Viscosity, mPa.s

0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
4,200
4,400
4,600
4,800
5,000
5,200
5,400
5,600
6,000

Viscosity measured at 25°C, Brookfield RV, 10 rpm
STRUCTURE® SOLANACE™ starch
INCI Name: Potato Starch Modified

Ideal for low pH skin care emulsion systems, STRUCTURE SOLANACE starch is an effective thickener and emulsion stabilizer. Derived from potato (non-GM) and biodegradable, it enables naturally derived skin and hair care formulations with a light, creamy texture.

Key Benefits
- Formulation pH range: 3.5-11
- Optimal viscosity stability in emulsion systems at pH 4
- Ideal for low pH skin care emulsions
- Effective thickener and emulsion stabilizer
- No neutralization required
- Naturally derived and biodegradable
- Non-GM agriculturally derived product
- Extremely shear thinning
- Suitable for emulsion in spray or pump delivery
- Typical usage: 2% to 6% (above 3% the starch will yield more gel-like rheological properties)
- Available globally
- Approved in China

Texture
STRUCTURE SOLANACE starch provides formulations with a light, creamy texture, when compared to competitive products.

Figure 15: Simple cream base formulated with STRUCTURE SOLANACE starch at pH 4.5

Stability in emulsion systems
Study shows simple cream base pH 4.5 with STRUCTURE SOLANACE starch is the most stable after four weeks under 50°C.

Figure 16: Four week stability test results

Stability in emulsion systems
One of the important properties of the STRUCTURE SOLANACE starch is its effect on emulsion stability. The starch functions to reduce the particle size of an emulsion and increase the stability of a formulation. Figure 18a shows the particle size of a TEA/Stearate emulsion evaluated by microscopy analysis. With no starch, the formula exhibits a large particle size, about 50 microns, and poor shelf stability. As the amount of starch is increased, the particle size of the emulsion decreases and the formulation stability increases. Figure 18b shows the same emulsion containing 2% STRUCTURE SOLANACE starch. The particle size is <<10 microns, but more importantly the formula exhibits excellent stability under ambient and accelerated aging conditions of the starch.

Figure 18: STRUCTURE SOLANACE starch functions to reduce the particle size of an emulsion and increase the stability of a formulation

Suggested Applications
- Creams and lotions
- Sun care products
- Color cosmetics (liquid makeup)
- Low surfactant emulsifier systems
- Aerosol shave foams or skin mousses
**STRUCTURE® 2001 and 3001 polymers**

**INCI Name: Acrylates/Steareth-20 Itaconate Copolymer (STRUCTURE 2001)**

**INCI Name: Acrylates/Ceteth-20 Itaconate Copolymer (STRUCTURE 3001)**

Easy-to-use, aqueous-based emulsion polymers designed for use in highly alkaline and hard-to-thicken formulations in a broad pH range (6.5-12). Both provide long-term viscosity stability over time even at 50°C. STRUCTURE 3001 polymer has stronger salt tolerance than 2001, while STRUCTURE 2001 has provide superior thickening effect.

**Key Benefits**

- Ideal for highly alkaline and hard-to-thicken formulations
- High viscosities at low use levels
- Extremely user-friendly; can simply be added to water, neutralized and easily mixed
- Can be neutralized by most commonly-used counter ions
- Stable over time in the presence of heat and high pH; stable to hydrogen peroxide
- Shear-thinning; formulation can be easily squeezed from an applicator, or mixed in a bowl, but will set up readily on the hair.
- Can also be used in one-component, pre-neutralized formulations such as hair dyes, gels and relaxers.
- With just water, product will easily rinse from the hair.
- Solvent tolerant
- STRUCTURE 2001 and 3001 polymers can be blended to optimize the performance attributes of both (thickening + salt tolerance)
- Typical usage: Aqueous gels, Hair treatment and Relaxers: 1.0% to 3.0%; Hair dye: 2.0% to 4.0%
- Available globally
- Approved in China

**Viscosity**

At low use levels, STRUCTURE 2001 gives very high viscosity. The relationship between polymer solids and viscosity is logarithmic, not linear, meaning that small increases in solids produce large boosts in viscosity.

**Suggested Applications**

**STRUCTURE 2001:**
- Hair color/dyes
- Hair treatment
- Hair relaxers
- Specialty hair gels and depilatories

**STRUCTURE 3001:**
- Hair color/dyes
- Depilatories
STRUCTURE® PLUS polymer
INCI Name: Acrylates/Aminoacrylates/C10-30 Alkyl PEG-20 Itaconate Copolymer

Designed for low-pH (3-6) systems, STRUCTURE PLUS polymer thickens suspends and stabilizes surfactant-based formulations. Its cationic compatibility, coupled with surfactant thickening synergies, makes it ideal for conditioning gels, two-in-one shampoos and body washes.

Key Benefits
- Multifunctional: Thickens, stabilizes and suspends
- Enables low-pH formulations (3-6)
- Also thickens in the neutral pH region when used with surfactants
- Compatible with functional cationics
- Sheer thinning, minimal flow at rest with good workability
- Clear formulations
- Salt tolerance
- Its acid-swelling nature makes it ideal for low pH gels, lotions and creams and pH balanced cleansing systems
- Typical usage: Cleansers: 0.75% to 2.0%; Clear gels: 2.5% to 3.0%; Emulsions: 0.2% to 1.0%
- Available in NA

Viscosity in surfactant systems
Because personal care surfactant systems are rarely composed of a single surfactant type, it is important to understand how surfactant blends interact with the STRUCTURE PLUS polymer. We find the interactions are not simply additive. For example, the combination of the STRUCTURE PLUS polymer and a binary blend of 10% ALES and 5% CAPB yields a viscosity over 30,000 cps, and further addition of 5% CAA yields a system viscosity approaching 60,000 cps. These values are much higher than would be expected given the viscosities of the polymer in combination with the individual surfactants.

Studies also show that the STRUCTURE PLUS polymer can thicken in the neutral to alkaline region in the presence of surfactants, even without pre-swelling the polymer in an acid. This is unexpected because in higher pH environments the polymer is uncharged. However, surfactants can solubilize the hydrophobic portions of the STRUCTURE PLUS polymer, enabling the uncharged polymer to swell.

The presence of surfactants can improve the polymer’s thickening efficiency in the acid region as well.

Cationic compatibility
One of the most unique attributes of the STRUCTURE PLUS polymer is its ability to thicken in the presence of a variety of functional cationics. Formulators can create conditioning, shear-thinning gels as well as rich, creamy emulsions.

Suspension
This evaluation indicates the suspension property level of STRUCTURE PLUS polymer.

Formulation used in the study

| Cleanser base (pH 4.5) | | |
| 10% (active) Sodium Laureth-2 Sulfate | | |
| 3% (active) Cocamidopropyl Betaine | | |
| 1% (active) Thickening polymer | | |
### Our rheology modifiers at a glance

<table>
<thead>
<tr>
<th>Rheology Modifier</th>
<th>Type of Polymer</th>
<th>pH Range</th>
<th>Formulation Systems</th>
<th>Functionality</th>
<th>Compatibility</th>
<th>Salt Tolerance</th>
<th>Formulation</th>
<th>Clarity</th>
<th>Process</th>
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<tbody>
<tr>
<td><strong>AMAZE</strong>™ XT polymer</td>
<td>Bio-polymer</td>
<td>3-10</td>
<td>Water-base, surfactant, gel systems</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Surfactants and silicones</td>
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<td>Clear</td>
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<td><strong>BALANCE</strong>® RCFg polymer</td>
<td>Synthetic</td>
<td>6.5-12</td>
<td>Water-base, surfactant, sulfate-free, and gel systems</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Surfactants and cationics</td>
<td>Yes</td>
<td>Clear</td>
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<td><strong>ELFACOS</strong> GT 282S nonionic copolymer</td>
<td>Copolymer</td>
<td>2-12</td>
<td>Water-base and surfactant systems</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Anionic and amphoteric surfactants</td>
<td>Yes (low levels)</td>
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<td><strong>STRUCTURE</strong>® XL starch</td>
<td>Bio-polymer</td>
<td>3-9</td>
<td>Emulsions</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Oils, emollients, silicones, UV filters, AHA/BHA, surfactants</td>
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<td>Not Clear</td>
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<td><strong>STRUCTURE</strong>® ZEA starch</td>
<td>Bio-polymer</td>
<td>3-9</td>
<td>Emulsions</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Peroxide solutions, salts, powdered perborates, cationics</td>
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<td>Not Clear</td>
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<tr>
<td><strong>STRUCTURE</strong>® SOLANACE™ starch</td>
<td>Bio-polymer</td>
<td>3-11</td>
<td>Emulsions</td>
<td>Yes</td>
<td>Yes</td>
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<td><strong>STRUCTURE</strong>® 2001 and 3001 polymers</td>
<td>Synthetic</td>
<td>6.5-12</td>
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<td>Nonionic and anionic ingredients</td>
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<td>Clear</td>
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<td><strong>STRUCTURE</strong>® PLUS polymer</td>
<td>Synthetic</td>
<td>3-6</td>
<td>Water base and surfactant systems</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Surfactants and cationic polymers</td>
<td>Yes</td>
<td>Clear</td>
</tr>
</tbody>
</table>

**Salt tolerance**

STRUCTURE PLUS polymer provides stable viscosity above 2% salt addition.

**Figure 26: Viscosity of cleanser base with 1.0% STRUCTURE PLUS polymer and various levels of salt**

**FORMULATION USED IN THE STUDY**

<table>
<thead>
<tr>
<th>Cleanser base STRUCTURE PLUS (#1002-65)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCI Name</strong></td>
</tr>
<tr>
<td>Deionized Water</td>
</tr>
<tr>
<td>Sodium Laureth Sulfate</td>
</tr>
<tr>
<td>Cocamidopropyl Betaine</td>
</tr>
<tr>
<td>20% Sodium Hydroxide</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>STRUCTURE PLUS</td>
</tr>
<tr>
<td>Deionized Water</td>
</tr>
<tr>
<td>NaOH or Citric Acid</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Suggested Applications**
- Shampoos
- Body washes
- Creams and lotions
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