Emulsion Stabilization

Gelling

Thickening

Film Formation

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CELLOSIZE

Hydroxyethylcellulose

A complete range of Hydroxyethylcellulose grades with hundreds of personal care applications.

Amerchol

THE ELEGANCE ENGINEERS

CELLOSIZE HEC, the thickening agent that can do more in almost any system

INCI Name: Hydroxyethylcellulose

CELLOSIZE™ hydroxyethylcellulose (HEC) is a nonionic water soluble polymer that has wide application as a thickening agent in cosmetic and personal care formulations. It also has tolerance for dissolved electrolytes, is pseudoplastic, and acts to improve emulsion stability.

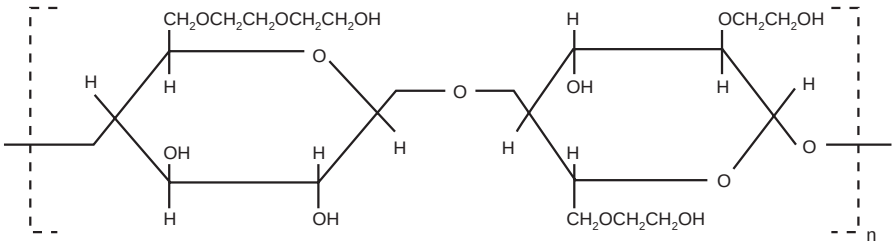
CELLOSIZE HEC is a free-flowing, granular powder that dissolves in water without heating, prolonged stirring or excessive agitation. Because of its nonionic character it exhibits a wide range of compatibility with other ingredients.

Why you should put CELLOSIZE HEC to work in your formulations:

- High product quality
- Offers a reproducible product
- Available in an easily handled physical form
- Available in a variety of viscosity grades
- Compatible with a wide range of surfactants
- Functions as a highly efficient thickener for aqueous solutions
- Demonstrates high tolerance for dissolved electrolytes
- Acts to improve emulsion stability
- Provides solutions that are pseudoplastic
- Forms clear, continuous, nontacky films
- Has low eye irritation

CELLOSIZE HEC chemistry

Idealized structure of CELLOSIZE HEC.



Viscosity grades of CELLOSIZE HEC

CELLOSIZE hydroxyethylcellulose is available in a variety of rapid dispersing viscosity grades (QP and PCG-10 types), which differ principally in their aqueous solution viscosities, ranging from about 100 to almost 20,000 centipoises at two percent concentration. This wide range permits a precise selection of material and superior reproducibility of the end product.

The table shows the standard grades and types available, and their respective viscosity ranges in aqueous solution.

Viscosity Ranges Of Aqueous Solutions of CELLOSIZE HEC

Product Type	Viscosity Grade	Concentration % by weight	Typical Viscosity† Range (cPs)	Spindle	RPM
QP	40	2	80-125	1	30
	300	2	300-400	2	60
	4400H	2	4800-6000	4	60
	15000H	1	1100-1500	3	30
	30000H	1	1500-2400	3	30
	52000H	1	2400-3000	3	30
PCG	10	1	4400-6000	4	30

†LVF Brookfield at 25 °C.

The wide range of available viscosity grades of CELLOSIZE HEC gives you added flexibility to select the grade most suitable to the final product and limits of the manufacturing process.

- Lower viscosity grades are easier to solubilize
- Higher viscosity grades are more efficient
- Variations during manufacture are easier to control with lower viscosity grades
- All solutions of CELLOSIZE HEC are non-Newtonian, and show pseudoplasticity dependent on the viscosity grade

Formulation advantages of CELLOSIZE HEC

In Hair Care Products

Hair Conditioners, Shampoos, and Rinses
CELLOSIZE HEC contributes body to a formulation while maintaining ease of pouring due to the pseudoplastic character of the solution. It can also improve the pearl of a product and the stability of the formulation. CELLOSIZE HEC is compatible with a wide range of surfactant systems and coupled with its excellent thickening efficiency, permits formulations varying in viscosity from liquid to gel.

High viscosity CELLOSIZE Polymer PCG-10 is recommended for conditioners and rinses. For shampoo systems, a mid-range viscosifying agent such as QP 4400H is suggested.

Hair Colors
CELLOSIZE HEC is compatible with a variety of dye types (oxidative, acid, disperse, etc.) and carrier systems, making it an ideal choice in hair color products. The use of a combination of low and medium range CELLOSIZE HEC is recommended. This combination will aid in the suspension of the dyes in a formulation, as well as facilitate and control the color product's application to specific locations on the hair.

Curling Lotions and Pre-softening Gels
The compatibility of CELLOSIZE HEC with salts and thioglycolic acid, and its ability to thicken under these highly alkaline conditions make it an excellent choice to incorporate into these systems. By adjusting the concentration and viscosifying grade, a formulator can increase the viscosity of a curling lotion slightly for improved ease of application, or produce a gel to soften "kinky" hair prior to rolling for a curly perm. A secondary property that can be extremely beneficial in permanent wave processing is the ability of CELLOSIZE HEC to hold onto water. Keeping hair moist during processing promotes an even curl pattern. This allows for ease of styling and a uniform look.

Hair Relaxers
In either alkali- or thioglycolate-based relaxer products, a cream or gel consistency is required to mat down or straighten the hair during processing. The pseudoplastic character of CELLOSIZE HEC allows the operator (salon or home) to work the hair while maintaining product viscosity during application. Medium to high viscosifying grades of CELLOSIZE HEC are recommended for these applications.

In Skin Care Products

Body Lotions and Moisturizers
CELLOSIZE HEC acts as a stabilizer in emulsion systems. The smoothness it imparts to the skin can also bring some cosmetic elegance to these products. Since CELLOSIZE HEC products are non-irritating to the skin, they are particularly useful in skin care products.

Facial Cleansers
Because of their low irritation potential and compatibility with mild surfactants CELLOSIZE HEC is often selected for use in facial cleansers. The film-forming property can aid in providing a protective layer to the skin.

Sun Care Lotions
CELLOSIZE HEC can help to stabilize sun care lotion emulsion systems. In addition, the film forming properties of CELLOSIZE HEC can promote the uniform deposition of UV absorbers.

In Cosmetic Preparations

Liquid Makeups
The ability of CELLOSIZE HEC to suspend solids in a water solution is ideal for liquid makeups, most notably in oil-free systems. Low to medium viscosity grades are suggested since maximum suspension properties are achieved without a large increase in the viscosity of the product. The addition of a feeling of smoothness imparted by the polymeric film provides formulations with excellent cosmetic characteristics. Because it's non-irritating to the skin, CELLOSIZE HEC is ideal for hypoallergenic products.

Powdered Makeups
CELLOSIZE HEC acts as a binder in these applications, and helps keep the powder on the skin. It also promotes uniform deposition of color.

Mascaras and Eyeliners
The binding ability of CELLOSIZE HEC also plays an important role in mascaras and eyeliners. Yet its ability to be washed off with water allows for easy removal when desired. A balanced formulation would withstand normal wear, humidity and tears, but still be removable with water.

Putting CELLOSIZE HEC to work in your formulations

Hair Care Products

CELLOSIZE HEC can be easily formulated into a number of hair care formulations, including shampoos, rinses, conditioners and hair colors. The following information is provided to assist in the the development of finished products containing this cellulosic thickener.

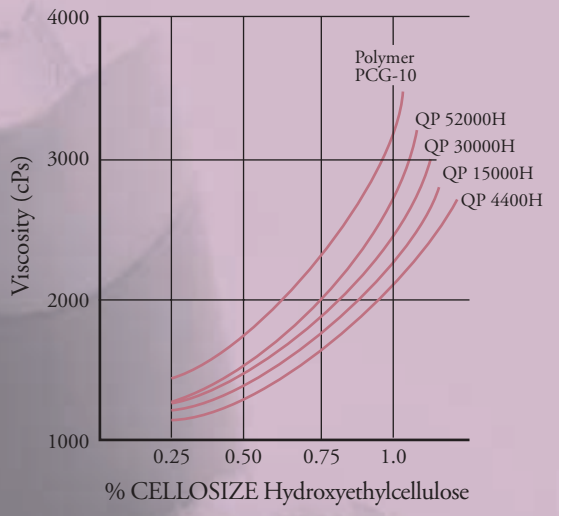
Conditioners and Rinses

Hair conditioners/rinses based on quaternary ammonium salts impart a soft feel to the hair and provide easier combability, better manageability, more gloss and less flyaway. Although clear products can be made, most commercial products on the market are emulsions, termed "crème." These crème rinses/conditioners give the appearance of rich products that soften hair. CELLOSIZE HEC contributes not only thickening to these emulsions, but delivers some pearlescence and improved stability.

Since CELLOSIZE HEC is available in various grades, a typical crème rinse formulation was prepared with the different grades and with varying concentrations of CELLOSIZE HEC.

Formulation	Percent by Weight
Stearalkonium Chloride *(25% Active)*	5.0%
Cetyl Alcohol	0.3
Glycerol Monostearate	0.5
CELLOSIZE *(Hydroxyethylcellulose)*	Varied
Preservative & Water	q.s.

Viscosity response in model crème rinse formulations



The results in the figure at the left with the model formulation above show how a desired viscosity can be achieved by the choice of particular grade of CELLOSIZE at a given concentration. The viscosity of the product is only one of the parameters to be considered in the selection of a particular viscosity grade. One other important consideration is the rheological response desired. Higher viscosity grades of CELLOSIZE HEC are more pseudoplastic and, therefore, exhibit more shear thinning than the lower viscosity grades.

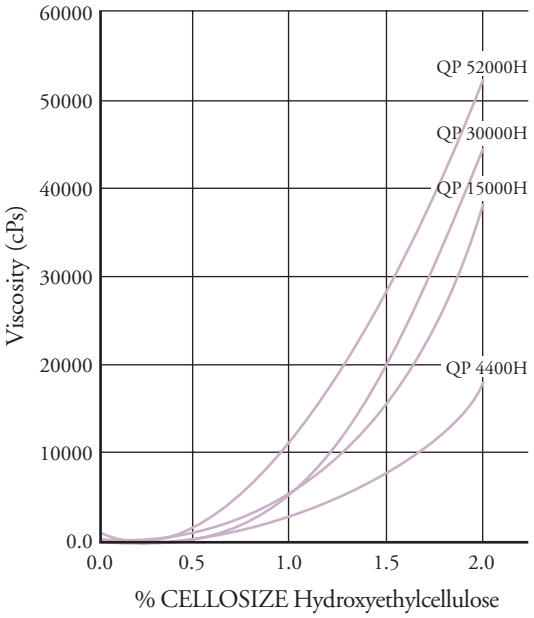
Shampoos
Because it is a nonionic polymer, CELLOSIZE HEC is compatible with a wide range of surfactant systems. This, coupled with the number of viscosity grades available, permits the formulator to derive clear shampoos varying in viscosity from liquid to gel.

To illustrate the range of shampoo viscosities possible, a model shampoo formulation was prepared with the indicated grades and concentrations of CELLOSIZE HEC shown below. The resulting viscosity profiles are shown in the figure to the right.

Formulation	Percent by Weight
Ammonium Lauryl Sulfate *(28% Active)*	43.0%
Cocamide MEA	2.0
CELLOSIZE HEC *(Hydroxyethylcellulose)*	Varied
Preservative & Water	q.s.

As with conditioners and rinses, the final viscosity of the product is not the only consideration in the selection of the appropriate viscosity grade of CELLOSIZE HEC. The desired rheological properties also influence the choice of viscosity grade.

Viscosity response in model formulations
(Ammonium Lauryl Sulfate (28%) and Cocamide MEA (2%))



Formulating facts on CELLOSIZE HEC

Preparations of solutions

Aqueous solutions of the QP- and PCG- type CELLOSIZE HEC products are prepared by dispersing the polymer in mildly agitated water maintained at 20-25 °C, (68-77 °F). When the polymer is thoroughly wetted, the solution process can be accelerated by heating to 60-70 °C, (140-158 °F). This temperature also assists in the control of bacterial growth. Making the solution slightly alkaline will also shorten the dissolving rate. Normally, about an hour is sufficient to complete the solubilization by adjusting temperature, pH and/or rate of stirring. If the final product is to be acidic, pH adjustments are preferably made on the final product.

Temperature effects
Increasing the temperature of a solution of CELLOSIZE HEC reduces the solution viscosity. Cooling the solution to the original temperature restores original viscosity. Solutions may be subjected to freeze-thaw conditions, stored at high temperatures, or boiled without precipitation or gelling problems.

pH effects
Variations in pH between 2 and 12 have little effect on the initial viscosity of solutions of CELLOSIZE HEC. Solutions are less stable below pH 5 because of hydrolysis. Oxidation may occur at high pH. Such reactions are characteristic of many polysaccharides.

Suggested formulations with CELLOSIZE HEC

Conditioning and Shine Gel — T99-95-4

UCARE™ Polymer JR 30M provides not only substantive conditioning but assists in forming a non-carbomer-based gel system together with CELLOSIZE Polymer PCG-10. GLUCAM™ E-20 moisturizes and plasticizes the hair while GLUCAM P-20 adds shine and gloss.

Viscosity: 20,000 cPs (20 °C, TC, 10 rpm)
pH: 5.9

Ingredients	Percentages
Deionized Water	q.s.
CELLOSIZE Polymer PCG-10 (Hydroxyethylcellulose)	1.50
UCARE Polymer JR 30M (Polyquaternium-10)	0.05
GLUCAM E-20 (Methyl Gluceth-20)	0.10
DMDM Hydantoin	0.40
GLUCAM P-20 (PPG-20 Methyl Glucose Ether)	0.20

Procedure: Add GLUCAM E-20, GLUCAM P-20 and the preservative into room temperature water. Slowly sprinkle the combination of CELLOSIZE Polymer PCG-10 and UCARE Polymer JR 30M into the room temperature water with adequate agitation. Once all the water soluble polymers are uniformly dispersed, heat to 60 °C to fully hydrate.

Shaving Gel T55-5-1

Description: This shaving gel is thickened to its gel consistency with CELLOSIZE Polymer PCG-10. It contains TEA-Palmitate soap for foaming and AMEROXOL™ OE-20 for foam stability. POLYOX™ WSR-205 Water-Soluble Resin is added to provide lubrication between the skin and the razor blade.

Formula

Water	q.s.
CELLOSIZE Polymer PCG-10 (Hydroxyethylcellulose)	1.25%
POLYOX WSR-205 (PEG-14M)	0.10
Water	3.23
Palmitic Acid	6.00
Triethanolamine (99%)	5.00
AMEROXOL OE-20 (Oleth-20)	2.00
Glycerin	2.00
Isopentane	6.00
Fragrance, Preservative, Color	q.s.

Procedure: Add CELLOSIZE Polymer PCG-10 to water at room temperature with rapid stirring. When well dispersed heat to 75 °C. Make a 3% solution using 0.1% of POLYOX Water-Soluble Resin added to 3.23% water. Add to the CELLOSIZE HEC dispersion as it is heating to 75 °C. When the batch is 75 °C and a clear gel has formed add palmitic acid, triethanolamine, AMEROXOL OE-20, glycerin and the preservative system to the batch individually waiting for each ingredient to dissolve before adding the next one. When the batch is uniform, cool to room temperature and add fragrance and color. Allow air to escape from the mixture. Cool isopentane and shave gel to 15 °C. Add isopentane slowly to batch with gentle stirring to avoid introducing foam. Package in sepro-type aerosol cans with A-40 propellant.

Crème Rinse T55-45-1

Description: A basic formula with excellent body and conditioning properties. Easy to pour because of the pseudoplastic property of CELLOSIZE HEC, yet thick and concentrated in appearance. Opalescent.

Formula

Stearalkonium Chloride	1.5%
Cetyl Alcohol	3.0
Glyceryl Monostearate	0.5
Polysorbate 80	0.5
CELLOSIZE QP 52000H (Hydroxyethylcellulose)	1.0
Preservative, Perfume	q.s.
Water	q.s.

Procedure: Add the CELLOSIZE QP 52000H HEC to the water at room temperature while stirring. When hydration is complete, heat to 70-75 °C. Add the stearalkonium chloride and the Polysorbate 80. Heat the glycerol monostearate and the cetyl alcohol to 70-75 °C. Add this mixture to the solution while stirring vigorously. Remove the heat, and continue stirring until temperature reaches 35-40 °C. Add preservative and perfume.

Curling Gel with Conditioner T55-93-1

This formula provides conditioning to the hair during the permanent wave process. The CELLOSIZE Polymer PCG-10 forms a clear and stable gel in the chemically active system. UCARE Polymer JR 30M is substantive to hair providing conditioning properties.

Formula

Ammonium Thioglycolate (60%)	15.0%
Ammonium Hydroxide (28%)	2.0
Triethanolamine (99%)	12.0
Pentasodium Pentetate	0.1
CELLOSIZE Polymer PCG-10 (Hydroxyethylcellulose)	1.0
UCARE Polymer JR 30M (Polyquaternium-10)	0.5
Propylene Glycol	4.0
Preservative, Fragrance, Color	q.s.
Water	q.s.

Procedure: Add ammonium thioglycolate, ammonium hydroxide, triethanolamine, pentasodium pentetate and preservative to rapidly stirring water in sequence so that the preceding ingredient is dissolved before adding the next. In a separate container, add CELLOSIZE Polymer PCG-10 and UCARE Polymer JR 30M to propylene glycol and mix to form a slurry. Add slurry to batch and mix until a uniform clear gel forms.

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For more information, complete literature, and product samples, you can reach a Dow representative at the following numbers:

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