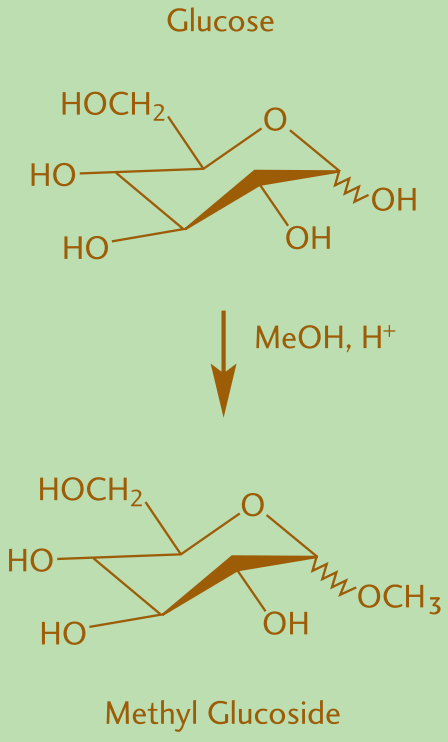
Glucamate™ THICKENERS

Naturally Derived, Mild, Safe and Functional

Formulate With Confidence™

Lubrizol

METHYL GLUCOSIDE BASIC CHEMISTRY



NATURALLY DERIVED, MILD, SAFE AND FUNCTIONAL

Methyl glucoside is a unique building block based on the stabilization of glucose via methylation. It was developed to overcome the inherent problems associated with other sugar backbones, such as instability with regard to reactivity and a tendency toward carbonization and anhydrization.

In the process of methylating a simple monosaccharide such as glucose, anhydrization is limited to only one oxygen bridge. In addition, by introducing a methyl group on the terminal carbonyl, there is guaranteed retention of the free hydroxyl groups, thus enabling further derivatization.

The remaining hydroxyl groups have excellent hydrophilic properties in the subsequent derivatives.

This stabilized methyl glucoside backbone, based on a readily renewable and natural resource, as well as the availability of several reactive sites in the form of hydroxyl groups, allows development of numerous multifunctional derivatives, meeting the requirements of being naturally derived, mild, safe and functional.

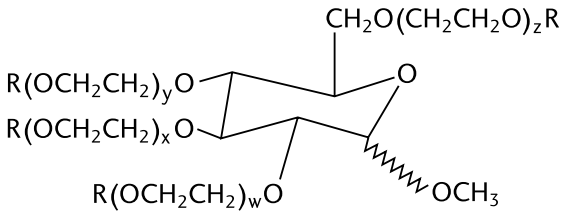
Glucamate™ Natural Thickeners: Discover new options for thickening personal care products. Versatile, nonionic thickeners derived from renewable resources, methyl glucoside derivatives feature excellent safety and mildness profiles, along with broad compatibility with other formulation ingredients. Experience enhanced elegance and cost-effective performance, naturally.

STRUCTURE OF GLUCAMATE™ THICKENERS

Glucamate™ thickeners can be classified as Gemini surfactants. Gemini surfactants are surfactant molecules possessing more than one hydrophobic tail and hydrophilic head group. These surfactants typically have better surface-active properties than corresponding conventional surfactants of equal chain length.

Above is the schematic representation of a Gemini surfactant. For the Glucamate thickeners, the spacer represents the methyl glucoside portion of the molecule, the ion is the ethylene oxide group, and the tail is the oleic group.

Structure of Glucamate™ Thickeners



Where R=H or $C_{17}H_{33}CO$, w+x+y+z=120

Glucamate™ DOE-120 Thickener
INCI Name: PEG-120 Methyl Glucose Dioleate

Glucamate™ LT Thickener
INCI Name: PEG-120 Methyl Glucose Trioleate (and) Propylene Glycol (and) Water

Glucamate™ VLT Thickener
INCI Name: PEG-120 Methyl Glucose Trioleate (and) Propanediol

FEATURES AND BENEFITS OF GLUCAMATE™ THICKENERS

- Derived from Natural, Renewable Resources
- Reduces Surfactant Irritation
- Efficient Thickening at Low Use Levels
- Synergistic Thickening with Salt and Betaines
- Light Emollient Afterfeel

SUGGESTED APPLICATIONS FOR GLUCAMATE™ THICKENERS

- Body Washes/Shower Gels
- Mild Shampoos (such as Baby and Color-treated)
- Facial Cleansers
- Facial Scrubs
- Foaming Hand Cleansers
- Liquid Hand Soaps
- Hair Mousse
- Feminine Hygiene Products

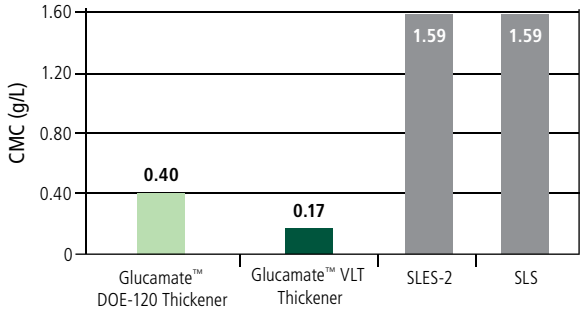
MILDNESS

Critical micelle concentration (CMC) is the concentration above which monomeric surfactant molecules aggregate to form micelles. Hydrophobic interaction opposed by electrostatic repulsion among the ionic head groups drives the process of micellization. The value of a surfactant's CMC decreases with an increase in the hydrophobic chain length of the molecule.

Irritation is caused by adsorption of free monomer (surfactant molecules in solution). Therefore, the lower the CMC, the milder the surfactant.

Glucamate thickeners have remarkably low CMC values. As shown in Figure 1, Glucamate™ DOE-120 thickener has a CMC value of 0.4 g/L and Glucamate™ VLT thickener has a CMC value of 0.17 g/L. This is compared to harsh surfactants such as sodium lauryl sulfate (SLS) and sodium laureth sulfate (SLES, 2-mole), which both have CMC values of 1.59 g/L.

FIGURE 1: Critical Micelle Concentration of Glucamate™ Thickeners vs. Surfactants



Glucamate thickeners also lower the CMC of surfactant systems. When added to a formulation containing surfactant, Glucamate™ thickeners efficiently associate with free surfactant molecules, decreasing the surfactant concentration required to form micelles. By lowering the CMC of a surfactant system, Glucamate thickeners decrease the irritancy of the system, reducing the skin and eye irritation caused by these surfactants. This makes Glucamate thickeners ideal for shampoo and body wash formulations. Figure 2 shows the results of independent laboratory testing* of a basic SLES/SLS/Cocamidopropyl Betaine (CAPB) surfactant system containing Glucamate DOE-120 thickener. The horizontal red line on the graph indicates the point where a surfactant system is considered an "irritant." As the figure shows, Glucamate DOE-120 thickener is able to reduce the irritation of the surfactant system, making it non-irritating to the skin, both upon initial application as well as throughout the dilution and rinsing process.

FIGURE 2: Glucamate™ DOE-120 Thickener Reduces Irritation of Surfactant Systems

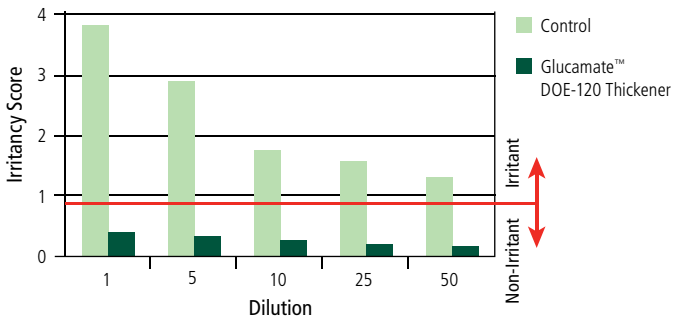
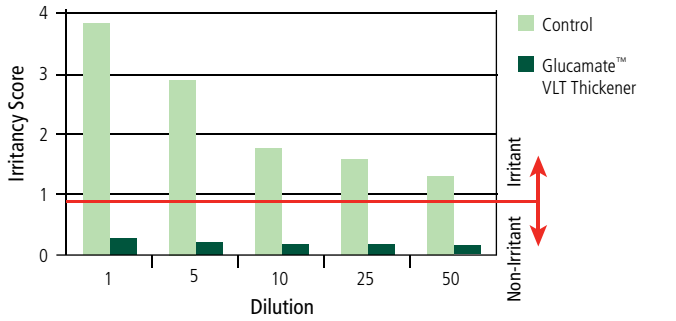


Figure 3 below shows the same formulation thickened with Glucamate VLT thickener and tested by an independent laboratory* for irritancy. As the graph shows, Glucamate VLT thickener is exceptional as an irritation mitigation agent in surfactant systems.

FIGURE 3: Glucamate™ VLT Thickener Reduces Irritation of Surfactant Systems



Glucamate thickeners significantly reduce the irritancy score of common surfactant systems, meaning Glucamate thickeners not only provide efficient, consistent and elegant rheology, but also enhanced mildness for sensitive personal care formulations.

EFFICIENT THICKENING AT LOW USE LEVELS

Current cleansing formulations are frequently based on three or more surfactants, used to deliver the most desirable consumer properties such as rich lather, improved mildness, and superior sensory benefits.

Experiments were conducted to evaluate the performance of Glucamate thickeners in both sulfate and sulfate-free cleansing formulations (Tables I, II). In these formulations, even at low thickener concentrations, viscosity is easily achieved (Figures 4, 5).

* In Vitro Irritection Assay performed by In Vitro International

TABLE I: Sulfate Formula

Ingredient	Weight % (as is)
Deionized Water	q.s.
Sodium Laureth Sulfate (2-mole, 28% active)	40.00
Cocamidopropyl Betaine (35% TS, 30% active minimum)	11.50
Thickener	q.s.

TABLE II: Sulfate-Free Formula

Ingredient	Weight % (as is)
Deionized Water	q.s.
Disodium Laureth Sulfosuccinate (40% TS)	40.00
Cocamidopropyl Betaine (35% TS, 30% active minimum)	11.50
Ammonium Cocoyl Isethionate (30% TS)	4.76
Thickener	q.s.

FIGURE 4: Thickening Efficiency of Glucamate™ Thickeners in Sulfate Formulation

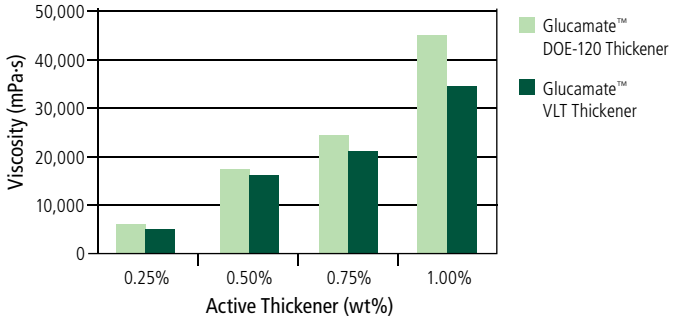
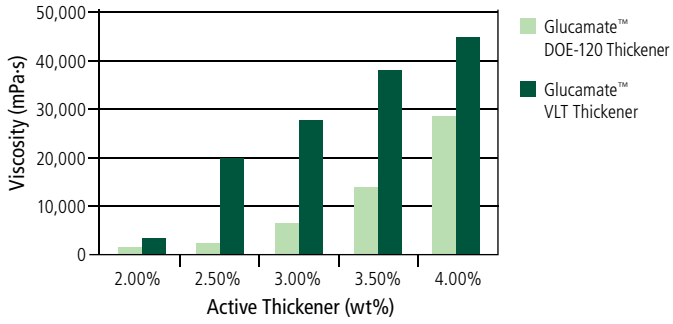


FIGURE 5: Thickening Efficiency of Glucamate™ Thickeners in Sulfate-Free Formulation



The three oleate moieties of Glucamate™ LT and Glucamate VLT thickeners interact with surfactants to form a mesh-like, complex network that synergistically builds viscosity and offers additional thickening efficiency when compared to other di-substituted associative thickeners.

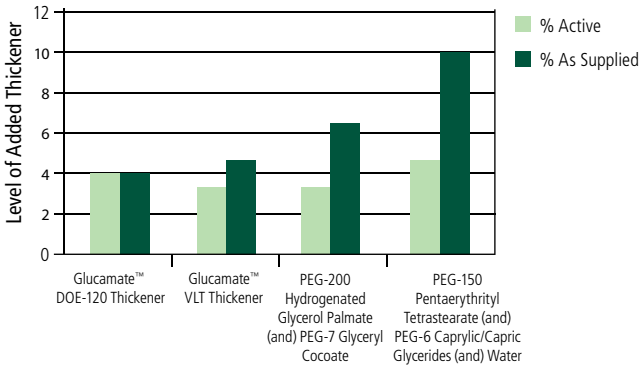
Figure 6 shows the performance of Glucamate thickeners in a cleansing formulation (Table III) containing sodium laureth sulfate (2-mole), sodium lauryl sulfate and cocamidopropyl betaine with a target viscosity of 10,000 – 12,000 mPa·s.

TABLE III: Cleansing Formulation

Ingredient	Weight % (as is)
Deionized Water	q.s.
Sodium Laureth Sulfate (2-mole, 28% active)	25.00
Sodium Lauryl Sulfate (30% active)	20.00
Cocamidopropyl Betaine (35% TS, 30% active minimum)	10.00
Thickener	q.s.

Glucamate thickeners demonstrate improved thickening performance at lower concentration than other commercial thickeners.

FIGURE 6: Thickening Performance of Various Commercial Thickeners to Reach Viscosity 10,000–12,000 mPa·s



SYNERGISTIC THICKENING WITH SALT

Sodium chloride is used extensively in cleansing formulations, often as the primary thickener or in combination with other thickeners. Drawbacks of using high levels of salt include increased risk of irritation as well as the risk of "crashing" the system by overshooting the salt curve.

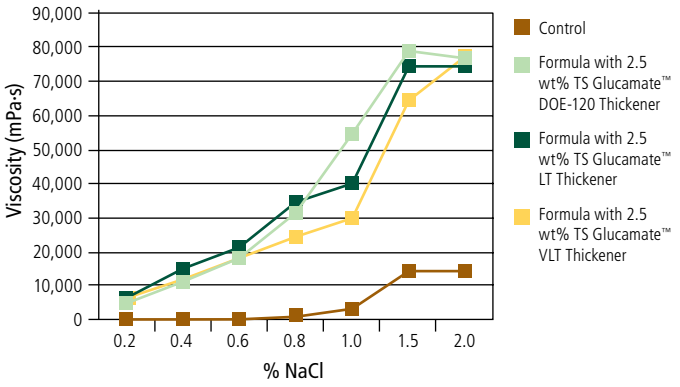
Glucamate thickeners, when used in combination with salt, provide a synergistic viscosity response, thus making them cost-effective thickeners while at the same time improving formulation mildness. Table IV shows a basic surfactant formulation. A salt curve using Glucamate thickeners was created using this basic formulation chassis.

TABLE IV: Salt Synergy in a Simple Cleansing Formulation

Ingredient	Weight % (as is)
Deionized Water	q.s.
Sodium Laureth Sulfate (2-mole, 28% active)	40.00
Cocamidopropyl Betaine (35% TS, 30% active minimum)	6.57
Glucamate™ Thickener	q.s.
Thickener	q.s.

Figure 7 depicts the effect of various salt concentrations on the viscosity of the surfactant system in Table IV with and without 2.5 wt% TS Glucamate thickener. The synergistic effect on viscosity is readily apparent.

FIGURE 7: Salt Curve With and Without Glucamate™ Thickeners



SYNERGISTIC THICKENING WITH BETAINES

Betaines are commonly used in cleansing applications for their foam enhancing properties. Glucamate DOE-120 thickener also shows a synergistic viscosity response when used in combination with cocamidopropyl betaine (CAPB) (Figure 8).

FIGURE 8: Glucamate™ DOE-120 Thickener: Synergy with Betaine

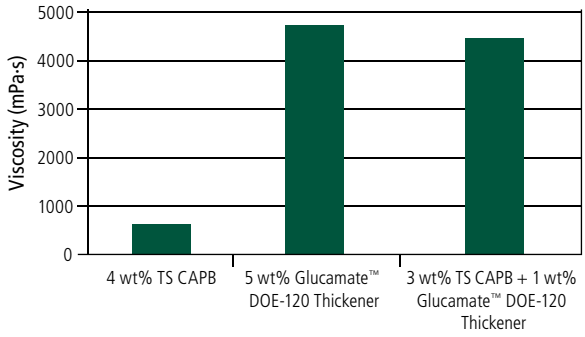


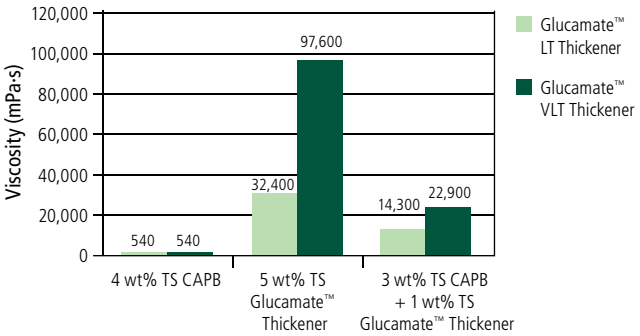
TABLE V: Synergistic Thickening with Betaines in a Cleansing Formulation

Ingredient	Weight % (as is)
Deionized Water	q.s.
Sodium Laureth Sulfate (2-mole, 28% active)	53.60
Cocamidopropyl Betaine (35% TS, 30% active minimum)	6.57
Thickener	q.s.

In the system above (Table V), using 1 wt% TS Glucamate DOE-120 thickener increased the viscosity more than 8 times vs. using betaine alone (Figure 8).

Glucamate LT and Glucamate VLT thickeners demonstrated an even higher thickening synergy with betaines vs. using betaines alone (Figure 9).

FIGURE 9: Glucamate™ LT and VLT Thickeners: Synergy with Betaine



Cost-Efficiency and More: With high thickening efficiency, Glucamate thickeners are cost-effective and provide additional benefits such as a reduction in the irritation associated with surfactants and broad compatibility. They also contribute to luxurious sensory properties through the retention of foaming properties and a light, emollient afterfeel.

SAFE AND EASY TO USE

Glucamate thickeners are nontoxic and have a low potential for eye and skin irritation. Their chemical structures preclude the possibility of nitrosamine contamination and they are not considered to be nitrosamine potentiators.

Glucamate DOE-120 thickener can readily be dissolved in the aqueous portion of a surfactant-based formulation. For best results, Glucamate DOE-120 thickener should be dissolved at 70°C.

Glucamate LT and VLT thickeners are liquid products which are cold processable, meaning that no heat or additional energy is required to dissolve the material or create the association needed for thickening. However, for optimal performance and shorter mixing times, Glucamate LT and VLT thickener can be added at 70°C.

LIGHT, EMOLLIENT AFTERFEEL

Incorporating Glucamate thickeners results in products with improved sensory benefits. The natural, oleate chemistry of Glucamate thickeners enhances application, improves product spreadability and provides an emollient afterfeel.

Further, the three-dimensional structure of Glucamate LT and VLT thickeners interacts with surfactants to form a complex network that actually contains less water and "breaks" easily during rub in. This phenomenon improves the feel of liquid soaps, body washes, shower gels and other liquid cleansers.

CONCLUSION

In today's crowded and highly competitive personal care market, it is differentiated performance and claims that set products apart. The proliferation of product choices is not only limited to the consumer. Cosmetic chemists have also been exposed to a multitude of products.

Today's formulator must have the justification for any ingredient based on true functionality and overall value added to the formulation.

Glucamate thickeners are multifunctional products which support the important consumer claims of safety, inherent mildness, and elegance in use. They contribute to luxurious sensory properties through the retention of lather and a light, emollient afterfeel. Further, Glucamate thickeners are perfect choices for satisfying the trend towards the use of materials derived from natural, renewable resources.

Additionally, ease of use, thickening efficiency and synergistic behavior with surfactants and salt enables a cost-effective formulating solution, making Glucamate thickeners the natural choice.

For product details, more information, samples and starting formulations visit www.lubrizol.com/personalcare

Formulate With Confidence™

North America
Lubrizol Advanced Materials, Inc.
9911 Brecksville Road
Cleveland, OH 44141-3247
TEL: 216.447.5000
TEL: 800.379.5389
FAX: 216.447.5250

Mexico
Lubrizol de Mexico Comerical S. de. R.L. de C.V.
Montes Urales #215
Col. Lomas de Chapultepec
Deleg. Miguel Hidalgo
México, D.F. c.p. 11000
TEL: 52.55.3067.0860
FAX: 52.55.5870.8956

Brazil
Lubrizol do Brasil Aditivos, Ltda.
Av. Fagundes Filho
134 - Cj. 101, 10th Floor
Edificio Victoria Office Center
São Judas, 04304-010 São Paulo
TEL: 55.11.4082.1330
FAX: 55.11.4082.1345

Europe
Lubrizol Advanced Materials Europe BVBA
Chaussée de Wavre, 1945
B-1160 Brussels,
Belgium
TEL: 32.2.678.19.11
FAX: 32.(0)2.678.1990

Asia Pacific
Lubrizol Specialty Chemicals (Shanghai) Co., Limited
10F, Park Centre International,
No. 1088 Fang Dian Road,
Shanghai 201204, PR China
TEL: 86.21.3866.0366
FAX: 86.21.5887.6977

India
Lubrizol Advanced Materials India Private Limited
Application & Business Center, 6th & 7th Floor
Jaswanti Landmark, Mehra Industrial Estate
LBS Marg, Vikhroli (W)
Mumbai 400079 India
Telephone : 91.22.6602.7800
FAX: 91.22.6602.7888

www.lubrizol.com/personalcare

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