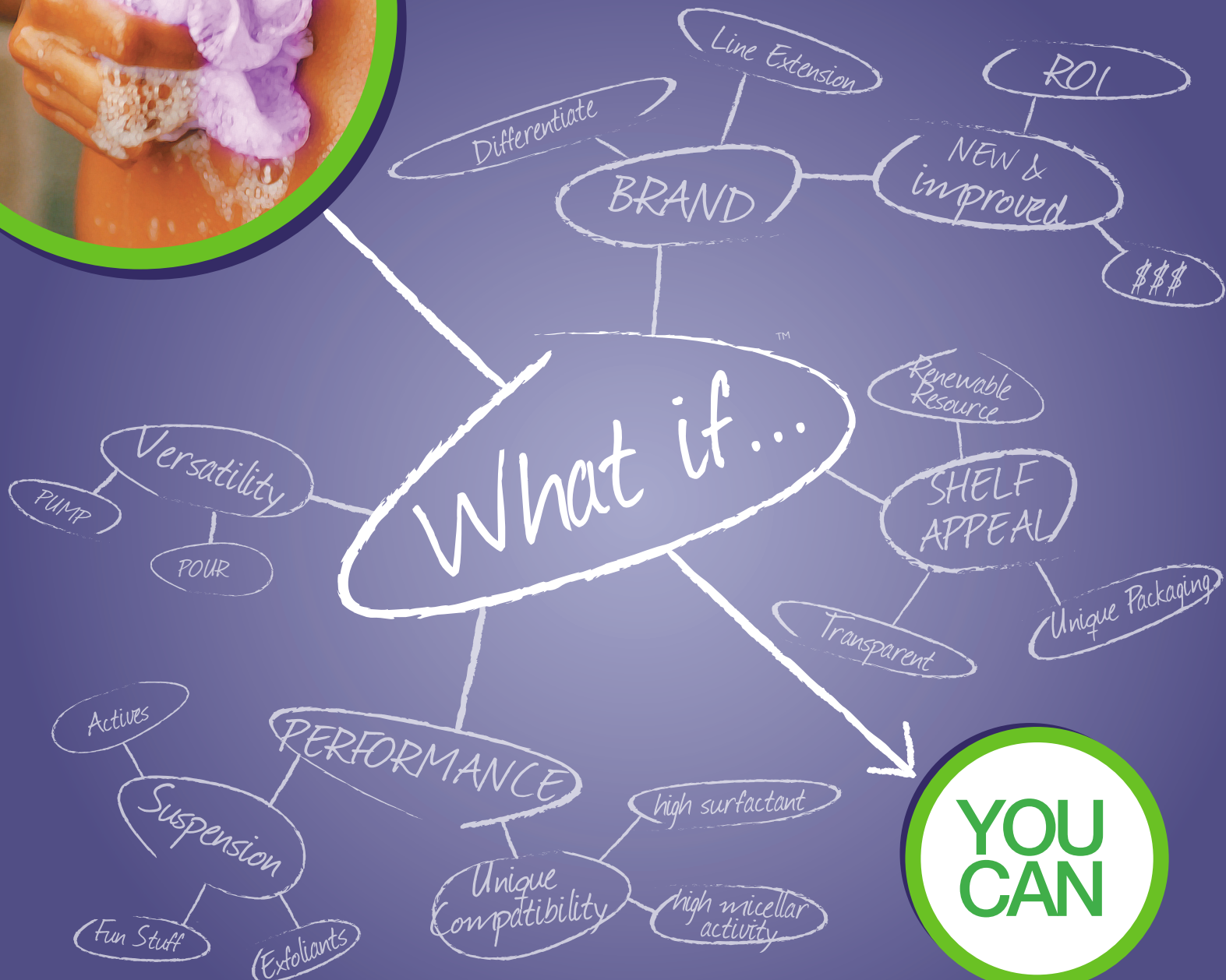


AxCel[®] CG PX

MICROFIBROUS CELLULOSE TECHNOLOGY



AxCel[®] CG PX

MICROFIBROUS CELLULOSE TECHNOLOGY

Sustainable Suspension

Personal care companies face a myriad of challenges attempting to capture and keep the attention of consumers. These include short product lifecycles, fast-evolving trends, regulatory scrutiny, competition for market share, and the high costs for complex chemistries and scientifically based innovations. The ability to succeed, in fact to survive depends on formulating for and providing new attributes to differentiate products in a crowded marketplace.

The creation of products with an eye-catching look and unique functional properties implies higher value to the consumer, grabs their attention, and prompts a purchase decision.

Suspending actives and other functional ingredients – moisturizers, vitamin droplets, ribbons, exfoliating particles, antioxidant encapsulates – can improve the product's consumer attractiveness. These actives, coupled with the appropriate visual cues and packaging, improve the overall product experience.

However, creating a system with consumer friendly appeal that reliably suspends and uniformly distributes these components has historically proven difficult, if not impossible.

Rheology-modifying polymers are typically required to suspend these inclusions in personal care formulations. Nonetheless, use of these polymers in bath and shower gel formulations can be difficult due to high surfactant levels or high micelle development (i.e. high surfactant-based viscosity). These more extreme environments can lead to polymer compatibility issues, particularly with soluble rheology modifiers like xanthan gum and cellulose-ether polymers. Synthetic rheology modifiers deemed "compatible" in these conditions tend to have pH limitations, hazing issues, and require high use levels (also known as high cost).

CP Kelco's AxCel[®] CG PX microfibrinous cellulose technology has been created to overcome these technical hurdles, allowing reliable suspension of actives, entrained air or a variety of decorative materials. The suspended inclusions may provide a functional or active benefit, a visual cue, or both. This tool offers synthetic performance in a biodegradable format.

Suspension By A Different Mechanism

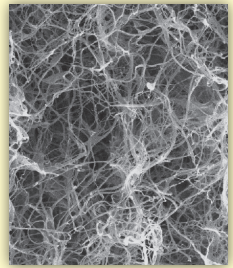
While suspension in personal care products is not new, AxCel CG PX's method is.

To suspend particles, formulators have traditionally increased product viscosity by structuring (thickening) the surfactant or by simply increasing product viscosity by adding rheology modifiers. This means that suspension is governed by Stokes' Law.

Surfactants alone are not designed for suspension. They provide Newtonian viscosity at low shear rates. Attempting to suspend with surfactants can negatively impact the flow of a finished product.

Rather than relying on structuring the surfactant or liquid phases of the formula, or increasing overall product viscosity, AxCel CG PX forms an invisible, translucent three-dimensional network in the fluid.

This suspension happens *independently* of viscosity, surfactant type and level and ionic strength. It also happens without adversely affecting the final viscosity of the finished product. This 'decoupling' of viscosity and suspension gives the formulator new flexibility without hindering the consumer experience.



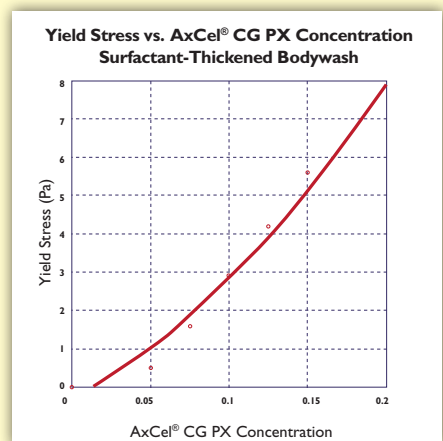
Activated AxCel CG PX solution. The fibers form an invisible 3-dimensional network.

How? Creating Yield Stress

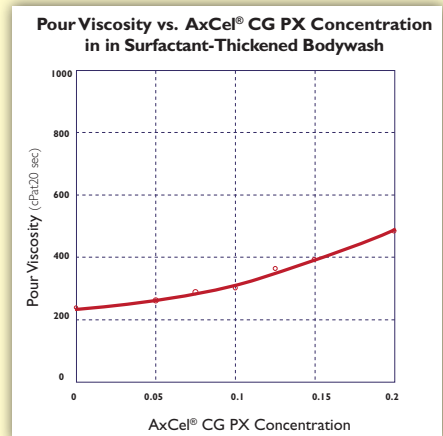
The microscopic three-dimensional network provided by AxCel CG PX structures the fluid, leading to a measurable yield stress, which is defined as the minimum stress (or force per unit area) that must be applied to induce flow.

Particles or inclusions remain suspended by the AxCel CG PX network as long as the particles do not exceed the fluid's yield stress. Structuring power can be controlled by adjusting the concentration of AxCel CG PX, providing the necessary yield stress to suspend a wide range of particles of various sizes and densities.

Formulators who rely on surfactant micelle development to provide base viscosity will find AxCel CG PX's provision of yield stress excellent for suspension. AxCel CG PX builds yield stress via forming a colloidal network in association with the surfactant system. This network creates a high degree of stability in these systems as well as in high surfactant systems where traditional rheology modifiers fail to perform.



This graph shows that yield stress is dependent upon AxCel CG PX concentration. Surfactant base provides zero Pa yield stress.



As shown by the graph, increasing concentrations of AxCel CG PX have a minimal impact on pour viscosity.

...you can

The Clear Alternative

Through its unique functionality, AxCel CG PX overcomes hurdles associated with more common means of suspension, particularly in high surfactant systems.

A common approach to developing suspension is to match the density of the fluid to the particle being suspended. This not only limits what can be suspended but can also lead to phase separation, hazing and layering due to incompatibility issues or exceeding the density.

Other means of creating suspension, such as acrylates or other polymers, may "collapse" and become incapable of providing the utility expected. Fluids may phase separate or suspended items sink or float, damaging aesthetic appeal.

Additionally acrylate co-polymers can have compatibility limitations with surfactants and pH as well as hazing issues.

AxCel CG PX provides suspension without hazing or phase separation, even in highly concentrated surfactant formulations or systems with low pH.

AxCel CG PX is effective in a wide range of formulations. Its very low use level enables creation of clear to translucent systems. Typical use rates are 0.05% to 0.2% w/w.

AxCel CG PX stabilized systems are tolerant of a broad pH range (4.0-12.0) and perform well in high salt environments. Despite the robustness conferred to the formula, these products will be readily dispersible and will dilute quickly with water.



0.05% AxCel CG PX (no separation/uniform suspension) 0.25% Xanthan Gum (phase separation/product failure)
In a high-surfactant body wash

Uniqueness of AxCel® CG PX

- The ability to suspend inclusions without negatively impacting the finished product viscosity
- Being able to do so in the presence of high concentrations of surfactant
- Being inherently biodegradable and produced from renewable resources

A Material Friendly to The Environment

Renewable. AxCel CG PX is based on microfibrillar cellulose (MFC). MFC is produced using a patented microbial fermentation process.

Biodegradable. Being cellulose-based, AxCel CG PX is inherently biodegradable, unlike petroleum-based technologies such as polyacrylates and acrylate co-polymers.

Low Use Levels. The fibers in MFC are much finer than those found in other cellulose sources, and as such, on a weight-to-weight basis, MFC offers greater surface area and therefore produces a highly efficient structure-forming polymer. This greater surface area allows it to cost-effectively substitute for polyacrylates and other non-renewable thickening components, significantly reducing the level of VOC-causing ingredients and contribution to wastewater.

*Why Settle for Anything Less?
Try it right way!*

At very low inclusion levels, AxCel CG PX not only stabilizes and suspends inclusions; it does so without adding excessive viscosity.

Prototype Body Wash Formulation With AxCel CG PX:

Ingredients	% by Weight	Functionality
Deionized Water	46	Solvent, Carrier
HALLSTAR PEG 6000 DS	1.5	Thickener
BIO-TERGE AS-40	25.0	1° Surfactant
AMPHOSOL CS-50	6.0	2° Surfactant
Glycerin	1.0	Humectant
DL-Panthenol	0.05	Additive
AxCel CG PX	0.05-0.2	Suspension aid
Sodium Chloride	1.5	Viscosity Adjuster
Citric Acid	q.s.	pH adjuster
Sodium Hydroxide	q.s.	pH adjuster

PROCEDURE:

PART A:

1. Prepare a 1% solution of AxCel CG PX in water by first adding the powder slowly to the vortex of a strongly mixing beaker. Ensure that the powder has been fully dispersed.
2. Activate this 1% solution of AxCel CG PX by mixing at 10,000 rpm on a Silverson Homogenizing mixer for 10 minutes. There is no risk of overshearing AxCel CG PX.

PART B:

1. Into a suitable vessel equipped with mixing and heating capabilities combine: Deionized Water, HALLSTAR PEG 6000 DS, BIO-TERGE AS-40, AMPHOSOL CS-50, Glycerin, and DL-Panthenol.
2. Heat to 60-65°C. Mix until solution is clear. Cool the batch to 25°C.

PART C:

1. Add the components from Part B slowly and carefully to premeasured AxCel CG PX dose.
2. Add remaining water at the end and adjust pH to ~ 6 to 6.5 with Citric Acid or Sodium Hydroxide and viscosity with Sodium Chloride, if necessary.

Benefits to Processors and Consumers

Divided into four squares, the benefits of AxCel CG PX can be seen across the manufacturing and consumer interface.

Personal Care Systems with AxCel® CG PX

(4-Square Value Determination Plan)

SQUARE 1: Ingredient Costs	SQUARE 2: Preparation	SQUARE 3: Productivity	SQUARE 4: Quality
<i>Raw Materials</i>	<i>Formulation / Batch Prep / Ingredient Combination</i>	<i>Filling Operation, Equipment Runnability and Performance</i>	<i>Finished Product</i>
<ul style="list-style-type: none"> • Functions at low use levels (typically 0.05 to 0.20%) => low in use cost • Price stability of non-petroleum-based material • 100% active ingredient 	<ul style="list-style-type: none"> • AxCel has large surface area, therefore a more efficient structure-forming polymer • Compatibility with high surfactant systems and high micelle development • Excellent temperature, salt and pH stability • Activated with high shear • No heating required for activation 	<ul style="list-style-type: none"> • No phase separation, flocculation or hazing • AxCel CG PX's dispersed fiber network provides even particle distribution, eliminating rejects due to separation • Easy rework (if necessary) due to uniform suspension of particles during filling 	<ul style="list-style-type: none"> • Ability to suspend insoluble ingredients with pourable viscosity • Improved aesthetics. Particulates remain in suspension on shelf, improving consumer attractiveness and packaging options • Can create transparent fluids • Works with foaming head dispensers
Ready for Combination	Combined Intermediate Batch	Processing and Filling	Finished Product Sale
Purchaser benefit from low cost vs. alternatives	Processors receive yield improvements		Branders benefit from improved end-product quality

VALUE DELIVERY

BELGIUM
 CP Kelco Belgium b.v.b.a.
 Industrieweg 150
 3538 Beringen
 Belgium
 Tel: +32 11 45 86 56
 Fax: +32 11 42 03 61

DENMARK
 CP Kelco ApS
 Ved Banen 16
 DK 4623 Lille Skensved
 Denmark
 Tel: +45 56 16 56 16
 Fax: +45 56 16 94 46

FINLAND
 CP Kelco Oy
 Kuhnamentie 2
 PL 500
 FIN-44101 Äänekoski
 Finland
 Tel: +358 14 518-3000
 Fax: +358 14 518-3003

FRANCE
 CP Kelco France S.A.R.L.
 22-26, rue de Bitche
 92400 Courbevoie
 France
 Tel: +33 (0) 1 49 03 78 00
 Fax: +33 (0) 1 49 03 78 29

GERMANY
 CP Kelco Germany GmbH
 Pomosin-Werk 5
 23775 Großbrode
 Geschäftsführer: Thomas Klink
 HRB 346 OL Amtsgericht Lübeck
 Germany
 Tel: +49 4367 715 0
 Fax: +49 4367 715 111

THE NETHERLANDS
 CP Kelco B.V.
 Winselingseweg 12
 6541 AK Nijmegen
 The Netherlands
 Tel: +31 24 371 9900
 Fax: +31 24 371 9999

POLAND
 CP Kelco Poland Sp. z o.o.
 Ul. Marcelinska 90
 60-324 Poznan, Poland
 Tel: +48 61 860 20 96
 Fax: +48 61 860 20 95

RUSSIA
 CP Kelco (Moscow Rep. Office)
 32/2, building 4,
 Kadashevskaya emb.
 Business Center
 "Kadashevskaya Sloboda"
 115035 Moscow
 Russia
 Tel: +7 495 937 36 47/48
 Fax: +7 495 937 36 27

UNITED KINGDOM
 CP Kelco UK, Ltd.
 Cleeve Court, Cleeve Road
 Leatherhead
 Surrey KT22 7UD
 United Kingdom
 Tel: +44 (0) 1327 369 400
 Fax: +44 (0) 1327 369 401

www.cpkelco.com

E-mail: solutions@cpkelco.com

Technical Inquiries: +44 (0) 1372 369 400

The information contained herein is, to our best knowledge, true and accurate. All recommendations or suggestions are made without guarantee, since we can neither anticipate nor control the different conditions under which this information and our products are used. There are no implied or express warranties of fitness for purpose. Each manufacturer is solely responsible for ensuring the final products comply with any and all applicable federal, state and local regulations. Further, CP Kelco disclaims all liability with regard to customers' infringement of third party intellectual property including, but not limited to, patents. CP Kelco recommends that our customers apply for licenses under any relevant patents.