Sodium Carboxymethylcellulose

The ideal hydrocolloid for beverages
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**ADDVALUE line**

**TOP QUALITY FOR BETTER PRODUCTS PLUS ONE-TO-ONE APPLICATIONS ADVICE**
Dow Wolff Cellulosics has been producing cellulose ethers for more than forty years. The company’s experience and state-of-the-art production facilities make Dow Wolff Cellulosics one of the leading suppliers of cellulose derivatives in the world. On this basis, Dow Wolff Cellulosics develops and manufactures products that contribute to the success of their customers’ businesses.

Key areas of Wolff Cellulosics’ expertise include the development, production and marketing of cellulose derivatives.

- The high-purity cellulose derivatives carboxymethylcellulose (CMC), hydroxy-propyl methylcellulose (HPMC), methyl cellulose (MC) and ethyl cellulose (EC) are used in foodstuffs, cosmetics and pharmaceuticals. In its pilot plants, Dow Wolff Cellulosics develops new products and technologies for the production and processing of derivatives of the renewable raw material cellulose.

- Thanks to continued investments in systems, products and methods, the production plants of Dow Wolff Cellulosics are among the most technologically advanced worldwide. They ensure a reliable supply of top-quality products.

- Dow Wolff Cellulosics carries out intensive research and development and therefore offers state-of-the-art products and informed technical consulting services.

- Our team will use its extensive technical and commercial marketing skills to work closely with you to boost the success of your business.

- Dow Wolff Cellulosics’ global logistics network will provide you with reliable and flexible supply.

- Quality management is a top priority at Dow Wolff Cellulosics. In-house test laboratories monitor the manufacturing processes 24 hours a day and laboratory technicians cooperate closely with production staff to ensure optimal product quality. Dow Wolff Cellulosics meets the ISO 9001:2000 standards.

For more information on Dow Wolff Cellulosics, visit our website at www.dowwolffcellulosics.com or contact our customer services team on +49 (0)5161 44 3443.
Sodium carboxymethylcellulose is produced through etherification of cellulose from renewable raw materials (timber). The hydroxyl groups of the β-D-glucose chain are partially replaced by carboxymethyl groups to create a water-soluble polymer (cellulose ether) with defined properties.

Degree of polymerization
(length of the cellulose chain)

The degree of polymerization influences the viscosity development of the CMC.

WALOCEL™ C grades cover a broad spectrum of viscosity – the consistency of a 1% CMC solution ranges from water-thin to paste-like. Low-viscosity CMC grades with only stabilizing properties are used in beverages, as are medium- and high-viscosity CMC grades, which have the added effect of boosting viscosity.

Granulometry

WALOCEL™ C products are available in various particle sizes (distributions). CMC granules (G), powdery materials (P) or ultra-fine powder (PP) are preferred, depending on the application/formulation.

Chemical structure of CMC

Figure 1: CMC molecule (polyanionic structure)
Influence of CMC concentration on viscosity

Rule of thumb:
Doubling the CMC volume increases viscosity by a factor of 10.

Effect of shear forces on CMC, reversible shear dilution

Mechanical forces such as stirring and homogenization influence viscosity. Shear load reduces the viscosity (pseudoplasticity). This effect is completely reversible over a wide pH value range. After an idle phase, the initial viscosity is restored (thixotropy).

Effect of heat on CMC

- When temperature increases, the viscosity of a CMC solution decreases (reversible process)
- All CMC grades have a low viscosity at temperatures above 90 °C
- Reversible behavior of CMC:
  If the temperature of the CMC solution is reduced, the initial viscosity is completely restored
- No destruction/decomposition of the CMC through boiling in acid systems (pH > 3.5)
- No heat gelation, no coagulation

Reversible heat dilution enables heat to be transferred rapidly and effectively during pasteurization/sterilization. Beverages and sensitive substances are treated mildly.
WaloCel™ C Properties
Effect of the pH on CMC

- Good stability over a wide pH range – best effect of WALOCEL™ C of pH 3.8 - 7.0.
- WALOCEL™ C functionality is still intact below pH 3.8, but is somewhat reduced.
- In addition, our products from the clear+stable range show particularly good results in terms of complete solubility and viscosity and also remain stable in highly acidic applications (pH under 3.0).

Influence of Ca²⁺ ions on CMC

- Divalent and trivalent metal ions can support CMC gelation. A very high concentration of these metal ions can also lead to coagulation of the anionic CMC molecule.
- The natural calcium ion concentration in milk (1.2 g/l) is not critical for the function of CMC. To achieve gelation effects, much higher Ca²⁺ volumes are required.
- For pH neutral dairy products, CMC is not recommendable to use as a single hydrocolloid due to its Ca²⁺ affinity.

Effect of CMC on proteins

- The anionic nature of CMC results in interactions with a large number of proteins, forming soluble and stable complexes.
- CMC creates a lasting stabilizing effect without increasing viscosity. Stabilization is not caused by gelation.
- CMC solubilizes proteins in their isoelectric pH range and protects proteins against the effects of heat (reduced coagulation through electrostatic forces of attraction).

Acid-stable CMC Cellulose Gums
CMC and alcohol (EtOH)

- CMC shows high compatibility and solubility levels in alcohol (ethanol).
- The cellulose derivative is clear and transparently soluble in alcoholic solutions with up to 40% ethanol.
- CMC can also be dissolved in solutions with more than 40% alcohol (up to 60%)—although this is accompanied by slight clouding (opaque appearance) and reduced viscosity.
- In pure alcohol, CMC can only be dispersed.

Surface activity

- Cellulose derivatives can influence surface tension in liquid systems, which means they can be surface active.
- CMC only shows minimal effects on surface tension but it acts as a foam stabilizer. Therefore, if a beverage stabilized with CMC is to foam, a foaming agent (e.g., a protein) is incorporated into the formulation.
- Hydroxypropyl methylcellulose (HPMC such as WALOCEL™ HIM-FG) lowers surface tension. It is an excellent foaming agent.
Figure 7: How CMC is used to stabilize acidic milk proteins

pH 3.8

CMC molecules with negatively charged carboxymethyl groups

electrostatic attraction

protein molecule
Unique performance of CMC

Interactions of CMC with proteins – behavior as a protective colloid

As polymers of amino acids, proteins show high sensitivity to heat treatment and pH changes. The protein’s origin is of secondary importance. Polymers of animal origin, such as milk proteins (casein, whey proteins), meat proteins and vegetable substances such as soy and wheat proteins, react if heated by coagulating. Denaturation can lead to hardening of a high-viscosity system or to coagulation in low-viscosity media. Proteins also show an isoelectric point (IEP). This specifies the pH at which solubility is minimal and the net charge is zero. When manufacturing/using sour products, visible complexes can be created from dissolved protein molecules through steric repulsive forces.

The addition of anionic sodium carboxymethylcellulose to acidic protein-containing formulations (pH = 3.0 - 5.5) can lead to interactions between CMC and proteins. Soluble complexes that are resistant to storage and heat are formed. Without the addition of CMC, proteins in this pH range normally sediment. The cellulose derivative solubilizes proteins in their isoelectric range.

CMC moves the proteins’ IEP to a lower pH so that the proteins are kept in a soluble state at their natural IEP by using CMC.

The interactions of water-soluble proteins with CMC are largely based on ionic mechanisms. Hydrogen bonds, steric effects and Van der Waals forces also influence the system.

In addition, CMC also protects acidic proteins from the effects of heat. These properties are used for example in stabilizing products that contain yogurt, whey, buttermilk, kefir or soy elements (milk-mixed drinks, milk substitute products, health drinks).

The solubilizing effect and behavior as a protective colloid for proteins give CMC a performance profile that is unique among other hydrocolloids such as guar, locust bean gum, carrageenan grades and starches (which are traditionally used in many foodstuffs) do not exhibit this heat resistance. The stabilizing function of these hydrocolloids is not caused by ionic mechanisms and electrostatic forces but is based solely on the influence of viscosity through gel formation and development of an inner network structure. This explains why these types of stabilized products can lose their high performance levels if concentrated products are heated or diluted. These hydrocolloids are not suitable for low-viscosity applications either.

How acidic proteins are stabilized

Proteins are polymers of amino acids. Amino acids fall into two characteristic functional groups – the NH₂ amino group and the COOH carboxyl group. In aqueous solutions, amino acids take the form of ions – depending on the pH, they have a positive, neutral or negative net charge (cationic/anionic structure or zwitterion). For pH values under 5.5, the proteins’ amino groups are protonated.

Electrostatic forces of attraction, which keep the proteins complexed in a soluble state and thus stabilize the system, occur between the CMC’s negatively charged carboxyl groups and the positively charged amino groups. clear+stable demonstrates its unique performance in this area of application.
Comparison of CMC with other hydrocolloids in acidic systems

Figure 8 shows the stabilizing effect of acidic milk proteins with CMC compared to other hydrocolloids. The buttermilk test provides an indication of the stabilization mechanism of each hydrocolloid while also measuring the resulting viscosity. The hydrocolloids can then be divided into two groups:

One group stabilizes using ionic mechanisms, electrostatic attraction and Van der Waals forces. CMC belongs to this group. The second group stabilizes food-stuff systems by increasing viscosity. It prevents the sedimentation of solids by forming a kind of gel network. This real or apparent gelling effect also “protects” sensitive ingredients. However, the use of this kind of stabilization is limited in heating processes and in the dilution of concentrates. A certain volume of low-viscosity CMC molecules is required to stabilize sour milk drinks to produce soluble complexes.

This explains the course of the line graph: Compared to guar and locust bean gum, a higher concentration of CMC is required to produce a stable beverage. These two hydrocolloids display an earlier point of “zero separation”. At low doses, they have a greater effect on the viscosity and prevent particle sedimentation by means of high viscosity. This thickening renders hydrocolloids with this effect unsuitable for low-viscosity applications.

The key argument in favor of CMC over other hydrocolloids is its effect as a protective colloid for proteins against acid and heat. The highly sensitive acidic milk proteins remain functional and in a soluble state under product and process conditions under which they would naturally coagulate into visible complexes.

Test method

1. Produce milk drink from:
   490 g butter milk + “x” g hydrocolloid
   + 101 ml water
2. Set the pH of the solution with citric acid (1 : 1) to pH 4.0
3. Homogenize at 250 bar
4. Centrifuge (30 min., 5,000 rpm)
5. Measure the volume of whey that is sedimented
Effect of hydrocolloids on whey separation in sour milk drinks

Figure 8: Effect of different hydrocolloids on whey separation in sour milk drinks
WALOCEL™ C offers unique characteristics and is therefore the ideal hydrocolloid for beverages

- Controls the rheology and viscosity of aqueous food systems
- High water-binding properties (reduced syneresis)
- Soluble in cold and hot water
- Excellent freeze-thaw stability (crystallization control)
- Good stabilizer
- Protective colloid for proteins
- Film former (barrier function, improved texture)
- Compatible with other hydrocolloids
- Odorless and tasteless
- Solutions are fiber-free with smooth flow properties
- No calories
- clear+stable – excellent stability even with low pH value

Acid stable CMC
Cellulose Gums
Deep frozen and half-frozen products

CMC controls crystallization. It lowers the crystallization speed and reduces the crystal size. The CMC retains its effectiveness through freeze-thaw cycles. This avoids a sandy texture in half-frozen products such as milk shakes or fruit punches.

Aerated dairy products

It ability to stabilize foams without affecting surface tension makes CMC suitable for fixing aerated products. The volume and density of the foam is kept stable (prolonged stand-up).

Dietary food and drinks

CMC is free of all known allergens and calories. It is an indigestible carbohydrate and acts as soluble fiber. The substitution of sugar and lactose and the replacement of fats and oils opens up new possibilities.

Nutraceuticals, functional and vegetarian foods

Fiber-enriched products can be produced by adding cellulose derivatives. The cellulose chain of CMC cannot be resorbed or metabolized in the human body. CMC is of plant origin (timber) and is an excellent choice in the development of 100 % vegetarian drinks.

Low- and medium-viscosity products

CMC thickens and provides texture by increasing the viscosity of aqueous systems. It prevents phase separation and syneresis during storage. Milk (native or fermented) and alcoholic systems can also be used as a basis for drinks. CMC improves texture and the body of the products thanks to its film-forming and thickening properties.

Protein-containing drinks

CMC has excellent stabilization functions. It can be used to partially replace traditional emulsifiers. CMC keeps proteins in solution in their isoelectric pH region and protects cationic proteins against the effects of heat (prevents co-agulation caused by steric repulsion). Potential applications are sour milk-mixed drinks, soy drinks and liqueurs that contain milk or egg. It is possible to combine CMC with other gel-forming hydrocolloids. This makes liquid gels tolerant to pH changes and keeps them stable during heating.
With its specific properties, WALOCYL™ C enhances almost all kinds of beverages – low-viscosity end products and medium-viscosity precursors such as concentrates and emulsions:

- Milk-mixed drinks such as yogurt, whey, butter milk or cocoa drinks and milk shakes
- Milk-free drinks made of fruit concentrates, products with natural or artificial flavors and soy drinks

**CMC is multifunctional and can be used regardless of the type of beverage:**

- Ready-made beverage products
- Beverage concentrates (basic substances)
- Powders for instant drinks

There is potential for various recipes:

- Sweet products such as soft drinks
- Spicy products that contain vegetable juices
- Acidic products such as fermented milk-mixed drinks or fruit juices

**Easy application of WALOCYL™ C**

- Use an aqueous CMC stock solution
- Add CMC granules directly to the drink
- Produce a dry mixture of CMC powder and other powdery ingredients such as sugar, pigments etc. and introduce the dry mixture into the liquid
- Add CMC-containing concentrates to the milk-free or milk-containing precursors (after fermentation)
- Add CMC as a dispersion to oil or, after moistening, with alcohol
Recommended applications
### Application of CMC in protein-containing drinks

<table>
<thead>
<tr>
<th>Applications</th>
<th>WALOCER™ CRT / clear+stable (c+s)</th>
<th>Concentration (in end product)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter milk and yogurt-drinks, other milk-based sour drinks</td>
<td>2000 / 20000 GA/PA (07) / c+s 2000 PA</td>
<td>0.2 – 0.5 %</td>
<td>Thickening</td>
</tr>
<tr>
<td></td>
<td>100 GA/PA / c+s 100 PA / c+s 2000 PA</td>
<td>Mind. 1 %</td>
<td>Protein protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 – 0.8 %</td>
<td></td>
</tr>
<tr>
<td>Whey drinks (pH 3.8 – 4.3)</td>
<td>30 / 100 GA/PA / c+s 100 PA / c+s 30 / 2000 GA/PA / c+s 2000 PA</td>
<td>1.5 – 2 %</td>
<td>Stabilization, Protein protection, mouthfeel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 – 1.5 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 – 0.8 %</td>
<td></td>
</tr>
<tr>
<td>Soya drinks (pH &lt; 5)</td>
<td>2000 / 20000 GA/PA (07) + 100 GA / PA</td>
<td>0.3 + 0.5 %</td>
<td>Stabilization, Protein protection, mouthfeel</td>
</tr>
<tr>
<td>Milk shakes (1.5 % fat)</td>
<td>100 GA/PA (07)</td>
<td>0.1 – 0.3 %</td>
<td>Thickening, crystallization control</td>
</tr>
<tr>
<td>Cocoa drinks (1.5 % fat)</td>
<td>100 GA/PA</td>
<td>1 % +</td>
<td>Stabilization, Protein protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.04 % K-carrageenan (refined)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9: Guidelines for WALOCER™ C grades and concentrations in protein drinks

### Application of CMC in basic substances and concentrates

<table>
<thead>
<tr>
<th>Applications</th>
<th>WALOCER™ CRT / clear+stable (c+s)</th>
<th>Concentration (in end product)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrates for fruit containing soft drinks (50 °Brix, pH 3.8, 1 – 2 % acid)</td>
<td>30 GA/PA / c+s 30 PA</td>
<td>1.5 – 2.5 %</td>
<td>Stabilization, mouthfeel</td>
</tr>
<tr>
<td>Basic substances for light (sugar-free) drinks</td>
<td>100 GA/PA / c+s 100 PA</td>
<td>1.5 – 2.5 %</td>
<td>Stabilization, mouthfeel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 – 2.5 %</td>
<td></td>
</tr>
<tr>
<td>Sport drinks</td>
<td>100 GA/PA / c+s 30 PA</td>
<td>1 %</td>
<td>Stabilization, mouthfeel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 %</td>
<td></td>
</tr>
<tr>
<td>Fruit juices</td>
<td>30000 / 40000 PA / c+s 30000 PA</td>
<td>0.05 – 0.25 %</td>
<td>Thickening, stabilization, mouthfeel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05 – 0.25 %</td>
<td></td>
</tr>
</tbody>
</table>

Figure 10: Guidelines for WALOCER™ C grades and concentrations in basic substances and drinks concentrates

### Application of CMC in instant drinks (powder mixtures)

<table>
<thead>
<tr>
<th>Applications</th>
<th>WALOCER™ CRT</th>
<th>Concentration* (in end product)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit-based instant drinks (cold or hot)</td>
<td>15000 PPA / 30000 PA</td>
<td>0.1 – 0.4 % (Powder: 0.5 – 1.5 % CMC, Drink: 15 – 20 % powder)</td>
<td>Thickening, stabilization, mouthfeel</td>
</tr>
<tr>
<td>Coffee drinks (hot preparation)</td>
<td>2000 / 10000 / 20000 PA</td>
<td>0.25 – 0.5 %</td>
<td>Thickening, stabilization, mouthfeel</td>
</tr>
<tr>
<td>Cold, coffee/tea-based instant drinks</td>
<td>100 PA</td>
<td>0.5 – 1 %</td>
<td>Stabilization, mouthfeel</td>
</tr>
</tbody>
</table>

Figure 11: Guidelines for WALOCER™ C grades and concentrations in instant drinks based on coffee or teas

### Application of CMC in alcoholic drinks

<table>
<thead>
<tr>
<th>Applications</th>
<th>WALOCER™ CRT</th>
<th>Concentration* (in end product)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liqueurs, transparent (without cream), with to 40 % alcohol</td>
<td>100 PA</td>
<td>0.5 – 2 %</td>
<td>Stabilization, mouthfeel</td>
</tr>
<tr>
<td></td>
<td>1000 / 2000 / 10000 PA</td>
<td>0.1 – 1 %</td>
<td>Thickenning, stabilization, mouthfeel</td>
</tr>
<tr>
<td>Cream liqueur generally (3 – 20 % alcohol)</td>
<td>1000 / 2000 / 10000 PA</td>
<td>0.1 – 1 %</td>
<td>Protein protection, stabilization, thickening, mouthfeel</td>
</tr>
<tr>
<td>Cream liqueur with milk proteins (10 – 15 % alcohol)</td>
<td>1000 PA</td>
<td>0.1 % +</td>
<td>Protein protection, stabilization, thickening, mouthfeel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1 % K-carrageenan (refined)</td>
<td></td>
</tr>
<tr>
<td>Egg liqueur</td>
<td>1000 PA</td>
<td>0.1 – 0.5 %</td>
<td>Protein protection, stabilization, thickening</td>
</tr>
</tbody>
</table>

Figure 12: Guidelines for WALOCER™ C grades and concentrations in alcoholic products

*based on application recommendations online at www.addvalueline.com
Cocoa
sour milk-mixed drinks and fruit preparations

Cocoa drinks

Low-viscosity CMC grades stabilize ready-made drinks with high solids contents.

Advantages

► Viscosity control
► Stabilization of cocoa particles at cold and hot temperatures, reduction of syneresis and sedimentation
► Enhanced texture
► Low-fat applications with a full taste
► Combination of CMC with kappa-carrageen maximizes stability

Sour milk-mixed drinks with fruit flavor

Low-viscosity WALOCEL™ C grades increase the quality of low-viscosity milk products.

CMC offers advantages such as

► Consistency control, with minimal effect on viscosity
► Stabilization of solids (fruit particles and milk proteins), no separation
► Enhanced texture

Fruit preparations for low- and medium-viscosity mixed-milk drinks

Add CMC via the fruit preparation.
The WALOCEL™ C grade determines the end viscosity and the type of stabilization of the milk drink (via the electrostatic attraction forces and also possibly by increasing viscosity). Low-viscosity CMC with only a stabilizing effect is used for water-thin drinks (recommendation: WALOCEL™ CRT 30 or 100 GA / PA, concentration in ready-made beverage is at least 1.5 % CMC). If more viscosity and body is required, medium-viscosity CMC is the best choice (WALOCEL™ CRT 2000 PA (07), dose of approx. 0.15-0.3 % in the end product).
Formulation of low-viscosity cocoa drinks

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (1.5 %)</td>
<td>90.46 %</td>
</tr>
<tr>
<td>Sugar</td>
<td>4.50 %</td>
</tr>
<tr>
<td>Glucose</td>
<td>2.00 %</td>
</tr>
<tr>
<td>Cocoa powder (de-oiled)</td>
<td>2.00 %</td>
</tr>
<tr>
<td>WALOCEL™ CRT 100 PA</td>
<td>1.00 %</td>
</tr>
<tr>
<td>K-carrageenan (refined)</td>
<td>0.04 %</td>
</tr>
</tbody>
</table>

Alternatives

Medium-viscosity cocoa drink made from low-fat milk (0.1 % fat content) with 0.3 % WALOCEL™ CRT 2000 PA 07

Formulation of sour mixed-milk drinks with fruit flavor

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet whey, fermented</td>
<td>74.0 %</td>
</tr>
<tr>
<td>Fruit juice (+ sugar)</td>
<td>24.5 %</td>
</tr>
<tr>
<td>clear+stable 30 / 100 PA</td>
<td>1.5 %</td>
</tr>
</tbody>
</table>

Alternatives

- a) Whey (50 %), water (33 %), sugar (9.5 %), fruit concentrate (6 %) + CMC (1.5 %)
- b) Replace the whey (74 %) with:
  - Unskimmed yogurt (30 - 40 %)
  - Water (34 - 44 %)

Formulation of (~40 ° Brix) fruit preparations for low- and medium-viscosity mixed-milk drinks

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pureed fruits</td>
<td>50.0 %</td>
</tr>
<tr>
<td>Sugar</td>
<td>35.0 %</td>
</tr>
<tr>
<td>Water</td>
<td>10 – 14 %</td>
</tr>
<tr>
<td>Citric acid (1:1) – for setting the pH 3.9 ± 0.2</td>
<td>(quantum satis)</td>
</tr>
<tr>
<td>WALOCEL™ CRT 30 / 100 GA</td>
<td>min. 5 %</td>
</tr>
<tr>
<td>WALOCEL™ CRT 2000 PA (07)</td>
<td>0.6 – 2 %</td>
</tr>
<tr>
<td>Dose of fruit preparation:</td>
<td>15 – 25 %</td>
</tr>
</tbody>
</table>
Isogetränke
Basic substances and concentrates for drinks

Isotonic electrolytic drinks

Sports drinks have a low viscosity and are highly enriched with mineral substances and vitamins. They are stabilized through the addition of low-viscosity CMC – e.g. 1 % WALOCEL™ CRT 100 PA. The functionality of the CMC is optimized by producing a highly concentrated stock solution and subsequently diluting it with the electrolytic system.

Basic substances and concentrates for drinks

Basic substances have a high concentration of sugars and acids. Colorings, flavors, proteins, vitamins, trace elements and buffer salts may also be present in the recipe. The stabilization of these highly loaded systems represents a real challenge for the hydrocolloids. The stabilization also has to be able to withstand dilution with water or preparation for the end product and other process steps such as pasteurization and carbonization.

Example:

Peach/passion fruit basic substance (50 °Brix with pH 3.8 and 1.3 % total acid) can be stabilized with 1.8 % WALOCEL™ CRT 30 PA. The lack of “sugar viscosity” in the production of light drinks can be compensated by the use of the higher-viscosity WALOCEL™ CRT 100 PA.
Coffee drinks

Fruit-based instant drinks

Alcoholic drinks

Coffee drinks (instant)

Medium-viscosity CMC grades are used in the production of instant drinks with a coffee flavor.

Advantages

► Stabilization of solids, protein protection

► Viscosity control

► Foam stabilization

► Creamy texture

Fruit-based instant drinks

Medium- and high-viscosity CMC grades are used to stabilize and thicken powder mixtures for instant drinks with solid fruit extracts.

Advantages

► Thickening and correct flow behavior

► Soluble and stable in cold and hot water

► No sedimentation of solids, no phase separation

► Enhanced texture

Alcoholic drinks

Medium-viscosity CMC grades are used in creamy liqueurs.

Advantages

► Viscosity enhancement, texture and consistency control

► Soluble in alcoholic systems

► Stabilizes and prevents phase separation

► Prevents coagulation of proteins (protein protection)

► Emulsification

► Excellent foam stabilization, foams are freeze-thaw stable

► Enhanced taste and texture
### Formulation: Coffee drinks (instant)
#### Composition of the dry power mixture

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>50.5 - 50.75 %</td>
</tr>
<tr>
<td>Coffee whitener (vegetable)</td>
<td>37 %</td>
</tr>
<tr>
<td>Instant coffee</td>
<td>12 %</td>
</tr>
<tr>
<td>Flavor + colorant optional</td>
<td></td>
</tr>
<tr>
<td>Walocel™ CRT 2000 / 10000 / 20000 Pa</td>
<td>0.25 - 0.5 %</td>
</tr>
</tbody>
</table>

Preparation of the beverage

Dilute 30 g powder mix (15 %)
in 170 g hot water

1 Phosphates are also required as a means of protein protection when milk powder is used.

### Formulation: Instant fruit drinks
#### Composition of the dry powder mix

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>77 - 78 %</td>
</tr>
<tr>
<td>Fruit powder</td>
<td>20 %</td>
</tr>
<tr>
<td>Citric acid</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Flavor optional</td>
<td></td>
</tr>
<tr>
<td>Walocel™ CRT 15000 PPa/30000 PPa</td>
<td>0.5 - 1.5 %</td>
</tr>
</tbody>
</table>

Preparation of the drink

- Powder mixture a) 15 – 20 %
- Water (cold or hot) 80 – 85 %

**Alternatives**

Vitamin mixtures and mineral substances can also be used.

### Formulation: Alcoholic drinks
#### (50 – 55 % dry matter)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>33.8 %</td>
</tr>
<tr>
<td>Fat</td>
<td>30 %</td>
</tr>
<tr>
<td>Sugar</td>
<td>20 %</td>
</tr>
<tr>
<td>Alcohol</td>
<td>13 %</td>
</tr>
<tr>
<td>Milk proteins</td>
<td>3 %</td>
</tr>
<tr>
<td>Flavor + colorant optional</td>
<td></td>
</tr>
<tr>
<td>K–carrageenan</td>
<td>0.1 %</td>
</tr>
<tr>
<td>WALOCCEL™ CRT 1000 PA</td>
<td>0.1 %</td>
</tr>
</tbody>
</table>

2 Addition as cream with 30 – 50 % fat content
Product range

Nomenclature of the grades

<table>
<thead>
<tr>
<th>WALOCHEL™ C</th>
<th>clear+stable</th>
<th>Trade name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT 2000</td>
<td>P A 07</td>
<td>Degree of substitution</td>
</tr>
<tr>
<td>Sodium carboxy methyl cellulose</td>
<td>Guide value for the viscosity</td>
<td></td>
</tr>
<tr>
<td>Cellulose gum or cellulose rubber</td>
<td>Granulometry</td>
<td></td>
</tr>
<tr>
<td>E 466</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WALOCHEL™ C and clear+stable are produced from high-purity timber-based cellulose in line with GMP

Our CMC is manufactured from high-purity wood cellulose in compliance with GMC. In codes and regulations it is known as:

- Sodium carboxy methyl cellulose
- CMC or Na-CMC
- Cellulose gum or cellulose rubber
- E 466

WALOCHEL™ C and clear+stable grades may be used as technological additives without specification of a maximum volume ("quantum satis") in any food application.

All products meet the following requirements

- Code of the U.S. Food and Drug Administration
  - FDA 21 CFR 182 1745 (GRAS)
- Food Chemical Code (FCC)
- Latest version of the EU Directive relating to E466

All WALOCHEL™ C and clear+stable grades for beverages are

- Kosher/Halal
- Gluten free
- Vegetarian origin
- BSE/TSE-free
- GMO-free

According to the European Directive 2003/114/EC of December 22, 2003 the product may be labelled on food packages as „Na-CMC“ or „Cellulose Gum“. The „E“ number may be omitted.
WALOCEL

EL Trade name

in carboxy methyl cellulose

guide for the viscosity

Granulometry

high-purity CMC (min)

Degree of substitution
WaloCel™ C and clear+stable are a stable material, but like all hydrocolloids, they are hygroscopic. Burst bags should be stored in well sealed containers and stored in a cool and dry place.

Packaging

WaloCel™ C and clear+stable are packed on pallets in 25 kg (net weight) paper bags with a PE barrier layer and wrapped in stretch foil.

Storage

WaloCel™ C and clear+stable are a stable material, but like all hydrocolloids, they are hygroscopic. Burst bags should be stored in well sealed containers and stored in a cool and dry place.
# Viscosity

## WALOCEL™ C-Viscosity levels for beverages

<table>
<thead>
<tr>
<th>Grade</th>
<th>Degree of Substitution</th>
<th>Particle size</th>
<th>Conc. (%)</th>
<th>Brookfield viscosity LVT at 25 °C (mPa·s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT 30 A</td>
<td>09</td>
<td>G, P</td>
<td>2</td>
<td>25 – 35</td>
</tr>
<tr>
<td>CRT 100 A</td>
<td>09</td>
<td>G, P</td>
<td>2</td>
<td>110 – 160</td>
</tr>
<tr>
<td>CRT 1000 A</td>
<td>09</td>
<td>G, P</td>
<td>2</td>
<td>550 – 800</td>
</tr>
<tr>
<td>CRT 2000 A</td>
<td>07 / 09</td>
<td>G, P</td>
<td>2</td>
<td>1900 – 2800</td>
</tr>
<tr>
<td>CRT 10000 A</td>
<td>09</td>
<td>G, P</td>
<td>1</td>
<td>900 – 1500</td>
</tr>
<tr>
<td>CRT 15000 A</td>
<td>09</td>
<td>P</td>
<td>1</td>
<td>1900 – 2600</td>
</tr>
<tr>
<td>CRT 30000 A</td>
<td>09</td>
<td>G, P</td>
<td>1</td>
<td>3000 – 4000</td>
</tr>
<tr>
<td>CRT 40000 A</td>
<td>09</td>
<td>G, P</td>
<td>1</td>
<td>4000 – 5000</td>
</tr>
</tbody>
</table>

*1 purity: 99.5 % pure Na-CMC, maximum 0.5 % salt (sodium chloride, sodium glycolate)

*2 G = granules; P = powder; PP = ultra-fine powder

---

## Viscosity levels for beverages

<table>
<thead>
<tr>
<th>Grade</th>
<th>Degree of Substitution</th>
<th>Particle size</th>
<th>Conc. (%)</th>
<th>Brookfield viscosity LVT at 25 °C (mPa·s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c+s 30 A</td>
<td>09</td>
<td>P</td>
<td>2</td>
<td>25 – 40</td>
</tr>
<tr>
<td>c+s 100 A</td>
<td>09</td>
<td>P</td>
<td>2</td>
<td>80 – 200</td>
</tr>
<tr>
<td>c+s 2000 A</td>
<td>09</td>
<td>P</td>
<td>2</td>
<td>1900 – 2800</td>
</tr>
<tr>
<td>c+s 30000 A</td>
<td>09</td>
<td>P</td>
<td>1</td>
<td>2700 – 4900</td>
</tr>
</tbody>
</table>

*1 purity: 99.5 % pure Na-CMC, maximum 0.5 % salt (sodium chloride, sodium glycolate)

*2 P = powder
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