BULLETIN VC-5674

aqualon™ carboxymethylcellulose

nature-derived[1], vegan-suitable, COSMOS-validated, anionic, water-soluble thickener

formulator benefits

- thickens aqueous systems, enhances slip, modifies flow and texture
- provides shear-thinning rheology
- controls toothpaste syneresis (binds water)
- provides humidity resistance in hair styling products
- dissolves rapidly in cold or hot water
- multiple grades available, including food and pharmaceutical compliant grades
- stable in wide pH range (pH 4-12)
- nature-derived, 73-82% by ISO 16128-2:2017, depending on grade

formulation benefits

- gives smooth texture, good stand up; low stringiness and glossy surface to toothpaste bead
- brings initial hold to denture adhesives
- provides clear gels, adds some texture and improves playtime of water-based liquid
- improves formulation mildness in surfactant-based systems
- derived from sustainable[2] cellulose, a natural and renewable resource
- biodegradable[3] and COSMOS[4] validated -grades available
- vegan suitable[5]
- not a microplastic under current definitions
- no odor or taste

applications

hair styling; skin care gels, serums, and lubricants; skin toners, mists and micellar waters, bubble bath; oral care/toothpaste and denture adhesives; hydrocolloid wound care; ostomy products; liquid make up and mascara

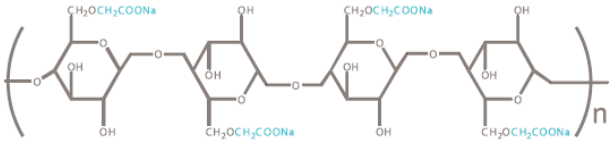
product forms anhydrous dispersons, powders, lean solvent systems, liquids, gels, suspensions

available formulations from Ashland oral care/toothpaste and denture adhesive pastes

1. nature-derived meets ISO 16128-2:2017 50-99% natural origin content
2. wood-based cellulose from Forest Stewardship Council (FSC)- and Program for the Endorsement of Forest Certification (PEFC)-certified suppliers with zero deforestation practices. Our cotton-based cellulose is sourced from recycled cotton and our suppliers have third party certifications that the cotton is composed of recycled content
3. has attained a sufficient level of biodegradation for "ready" or "inherent" according to OECD or related methods such as, 301, 302, or 306. Or product has been assessed based on a read-across to a chemical with similar structure.

4. the Cosmetic Organic Standard (COSMOS*)
5. meets Ashland's criteria for animal content, animal testing and manufacturing practices

chemistry



idealized structure of CMC (degree of substitution of 1.0)

sodium salt of carboxymethylcellulose (CMC)
INCI name: Cellulose Gum
not preserved

typical properties

appearance……free-flowing off-white powder
purity, CMC content on dry basis, %……99.5 min
water solubility……>2 g/L
loss on drying (as packed), % max……10
browning temperature, °F (°C)……441 (227)
charring temperature, °F (°C)……486 (252)
bulk density, g/mL……0.55-1.00
solution properties
pH, 1% solution……6.5-8.0
surface tension, 1% solution, dynes/cm……71
specific gravity, 2% solution……1.0068
typical particle size (microns by Malvern laser diffraction method)
regular…….. D(50%): 0-250
"X" grind (fine) ……D(90%): ≤ 140

grades

Aqualon™ CMC is produced in three levels of substitution, the approximate average value of which, multiplied by 10 is the first number of the product designation:

DS type	substitution range	sodium content, %[7]
7	0.65-0.90[6]	7.0-8.8
9	0.80-0.95	8.1-9.2
12	1.15-1.45	10.4– 12.0

6. the 7S and 7O types, the upper limit of substitution is 0.95
7. obtained by calculation

The following table lists common grades. Fine grind or X-grind grades are also available.

DS type 7	DS type 9	DS type 12	concentration (% w/w)	Brookfield viscosity range (mPa.s @ 25°C)	spindle number	speed (RPM)
7H4F	9H4F		1	2500-6000	4	30
7H3SF, 7HOF			1	1000-2800	3	30
7HF			1	1500-3000	3	30
		12M31P	2	800-3100	3	30
	9M31F		2	1500-3100	3	30
7MF	9M8F	12M8	2	400-800	2	30
7M8SF			2	200-800	2	30
7M2F			2	100-200	2	60
7LF			2	25-50	1	60
7L2			4	50-200	2	60

note: viscosity ranges in table are not necessarily current specifications.

formulation guidelines

recommended use levels	0.5-1.5% as toothpaste binder up to 35% in denture adhesive pastes, and up to 66% in powders 0.25-1.0 % hair styling gels, styling creams and lotions 0.05-0.3% skin care gels, mists and toners 0.1-1.0% bubble bath
temperature/mixing conditions	CMC particles swell and hydrate to solubilize. The state of disaggregation will affect viscosity of the solution. CMC disaggregation is promoted by increasing energy. Higher temperatures, shear rates and mixing times increase polymer hydration. A processing temperature of 25° to 40°C is typically sufficient to achieve optimum viscosity and stability. Do not add CMC to hot water; it may lump. Avoid direct addition to salt solutions. Add electrolytes after CMC is hydrated.
when to add	The preferred method for preparing solutions is to slurry the dry CMC powder into a non-solvent, glycols for instance, until fully dispersed, then add slurry to vortex of solvating media liquid and mix until fully dissolved. Alternatively, slowly sift CMC powder into vortex of well agitated solvating media or dry blend with other ingredients, then slowly sift into the vortex of well agitated solvating media. For laboratory preparation of toothpaste, add to non-solvating solvent such as glycerol, PEG, PG, under agitation, then add > 50% of the water as pure water, mixing under high agitation for 15-30 minutes. The soluble salts should be added, in solution form, using the remaining water and mixed under high agitation for approximately15 minutes.

tips from our technical solvers	For toothpaste, 9M31F or 9M31XF CMC are good starting points. A fine particle size (x-grind) is suggested for gel toothpastes. Toothpastes with low water and/or high electrolyte levels may require higher DS CMC grades (9 or 12 types.) For denture adhesive powders and creams, 7H3SXF CMC is suggested. For hair styling products, 9H4F CMC is a good starting point. For bubble bath, gels, serums, mists, toners, micellar waters and lubricants, 7H3SF CMC is suggested.

safety, handling, and storage

The product should be stored in its original packaging under dry and clean conditions and away from heat. The product is hygroscopic. Additional information concerning safety, handling and storage is supplied in the safety data sheet (SDS). Read and understand the SDS before using the product. A toxicology summary can also be made available on request.

The standard package is a 50 lb. (22.68 kg) bag supplied on pallets of 40 bags each.

regulatory

CAS No. 9004-32-4
CAS name Cellulose, carboxymethyl ether, sodium
In general, Aqualon™ CMC grades designated P or PH are compliant with current monograph requirements of USP/NF. Some grades may also meet European and Japanese monograph requirements. Specific compendial status is reflected on the certificate of analysis.
Grades designated with an F are compliant with the requirements of the U.S. Code of Federal Regulations, Title 21 section 182.1745, "Substances Generally Recognized as Safe" (GRAS) for use in foods and meets the monograph requirements set forth in the Food Chemicals Codex, current edition.
GMO and non-GMO grades are available
other regulatory information available on request.

keywords: easy-to-use, manufactured in Hopewell, VA, USA, purified, pseudoplastic, thixotropy, binder