



AQUALON[®]

Sodium Carboxymethylcellulose

Physical and Chemical Properties

HERCULES

AQUALON® CMC

An Anionic Water-Soluble Polymer

CONTENTS	PAGE
AQUALON CMC — AN ANIONIC WATER-SOLUBLE POLYMER	2
APPLICATIONS	3
CHEMISTRY	5
GRADES AND TYPES	6
Grades	6
Degree of Substitution	6
Viscosity	7
Particle Size	7
Product Coding	7
PROPERTIES	8
Moisture Absorption	8
Physiological Properties	8
DISPERSION AND DISSOLUTION OF CMC	9
Solvent	9
Type of CMC	9
Shear Rate	9
Dispersion Methods	9
Theory of Polymer Dissolution	11
PROPERTIES OF CMC SOLUTIONS	13
Viscosity	13
Effect of Concentration	13
Effect of Blending	13
Blending Chart	13
Effect of Shear	16
Pseudoplasticity	16
Thixotropy	17
Effect of Temperature	20
Effect of pH	20
Effect of Mixed Solvents	20
Stability	21
Microbiological Attack	21
Chemical Degradation	21
Compatibility	22
Effect With Salts	22
Monovalent Cations	22
Polyvalent Cations	23
Gelation of Solutions	23
Effect With Water-Soluble Nonionic Gums	23
PROPERTIES OF CMC FILMS	24
PACKAGING AND SHIPPING	25
MICROBIOLOGICAL INFORMATION AND REGULATORY STATUS FOR USE IN FOODS, DRUGS, COSMETICS, AND TOILETRIES	25
Microbiological Information	25
Food Status	25
Food Labeling	26
Pharmaceutical Use	26
Cosmetics and Toiletries	26
APPENDIX—METHODS OF ANALYSIS	27
Viscosity of Solution	27
Moisture Determination	27
Solution Preparation	27
Viscosity Measurement	28

AQUALON® CMC

AN ANIONIC WATER-SOLUBLE POLYMER

Aqualon® sodium carboxymethylcellulose (CMC) has a minimum purity of 99.5%. An anionic water-soluble polymer derived from cellulose, it has the following functions and properties:

- It acts as a thickener, binder, stabilizer, protective colloid, suspending agent, and rheology, or flow control agent.
- It forms films that are resistant to oils, greases, and organic solvents.
- It dissolves rapidly in cold or hot water.
- It is suitable for use in food systems.
- It is physiologically inert.
- It is an anionic polyelectrolyte.

These properties and functions make it suitable for use in a broad range of applications in the food, pharmaceutical, cosmetic, paper, and other industries. To serve these diverse industries, the polymer is available in three grades: food, pharmaceutical, and standard, and in many types based on carboxymethyl substitution, viscosity, particle size, and other parameters.

This booklet describes basic chemical and physical properties of Aqualon CMC in all its forms. The wide variety of types produced and the typical uses for this versatile polymer are also discussed. The contents page will guide the reader to subjects of special interest.

Technical or semi-refined grades of sodium carboxymethylcellulose are also available and are described in Booklet 250-3, available from Aqualon by request.

APPLICATIONS

Since its commercial introduction in the United States by Hercules Incorporated in 1946, sodium carboxymethylcellulose has found use in an ever-increasing number of applications. The many important functions provided by this polymer make it a preferred thickener, suspending aid, stabilizer, binder, and film-former in a wide variety of uses.

The wide range of viscosity and substitution types available from Aqualon for the highly purified grades and the less highly purified technical grades of CMC continues to expand the uses for this product line.

A representative listing of the many applications for sodium carboxymethylcellulose is given below and on the following page. Many of these applications do not require the use of the highly purified grade, and a *technical* grade of CMC is available for certain applications. Aqualon's chemists and engineers continue to tailor-make various grades and types to meet the needs of specific customers and industries requiring water-soluble polymers.

APPLICATIONS FOR PURIFIED CMC⁽¹⁾

Types of Uses	Specific Applications	Properties Utilized
Cosmetics	Toothpaste	Thickener; flavor stabilizer; suspending aid; binder
	Shampoos; foamed products	Suspending aid; thickener; foam stabilizer; high water-binding capacity
	Creams; lotions	Emulsion stabilizer; film-former; thickener
	Gelled products	Thickener; gelling agent; film-former
	Denture adhesives	Wet tack; long-lasting adhesion
Foods	Frozen desserts; soft-serve	Controls ice crystal growth; improves mouthfeel, body, and texture
	Pet food	Water binder; gravy thickener; extrusion aid; binder of fines
	Protein foods	Retains water; improves mouthfeel
	Baked goods	Batter viscosifier; improves moisture retention and texture
	Beverages	Suspending aid; rapid viscosifier; improves mouthfeel and body; protein stabilizer in acidified drinks
	Desserts; icings; toppings	Odorless and tasteless; thickens; controls sugar crystal size; improves texture; inhibits syneresis
	Low-calorie foods	No caloric value ⁽²⁾ ; thickens; imparts body and mouthfeel
	Syrups	Clear; thickens; imparts favorable mouthfeel and body
	Dressings; sauces	Thickener and suspending aid; imparts mouthfeel
	Animal feed; extrusion products	Lubricant; binder; film-former
Pharmaceuticals	Ointments; creams; lotions	Stabilizer; thickener; film-former
	Jellies; salves	Thickener; gelling agent; protective colloid, film-former
	Tablet binder; granulation aid	High-strength binder
	Bulk laxatives	Physiologically inert; high water-binding capacity
	Syrups	Thickener
	Suspensions	Thickener; suspending aid

⁽¹⁾For these applications, food grades (designated "F") or pharmaceutical grades (designated "PH") are used.

APPLICATIONS FOR STANDARD GRADE OF CMC

Types of Uses	Specific Applications	Properties Utilized
Adhesives	Wallpaper paste	Water-binding aid; adhesion; good open time; nonstaining
	Starch-corrugating adhesive	Thickener; water-binding and -suspending aid
	Latex adhesives	Thickener; water-binding aid
Aerial-drop fluids	Insecticides	Thickener; binder; suspending aid
	Drift-control agent	Thickener
Ceramics	Glazes Porcelain slips Vitreous enamels Refractory mortars	Binder for green strength; thickener; suspending aid
	Welding rod coatings	Binder; thickener; lubricant
Coatings	Foundry core wash	Binder; thickener; suspending aid
	Latex paints; paper coatings	Rheology control; suspending aid; protective colloid
Detergents	Laundry	Whiteness retention through soil suspension
Lithography	Fountain and gumming solutions	Hydrophilic protective film
	Water-based inks	Binder; rheology control; suspending aid
Paper and paper products	Internal addition	High-strength binder; improves dry strength of paper
	Surface addition	High-strength binder; oil-resistant film-former; provides control of curl and porosity and resistance to oils and greases
	Pigmented coatings	Thickener; rheology control; water-retention aid
Textiles	Laundry and fabric sizes	Film-former
	Latex adhesives; backing compounds	Rheology control; thickener; water binding and holdout
	Printing pastes and dyes	
	Warp sizing	High film strength; good adhesion to fiber; low BOD value
Tobacco	Cigar and cigarette adhesive	Good wet tack; high film strength
	Reconstituted sheet	High-strength binder and suspending aid

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.