CMC carboxymethyl cellulose

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	carboxymethyl cellulose	
IUPAC name	-	acetic acid; 2,3,4,5,6-pentahydroxyhexanal	
ACS name	-	cellulose, carboxymethyl ether	
Acronym	-	CMC	
CAS number	-	9000-11-7	
RTECS number	-	FJ5700000	
HISTORY			
Person to discover	-	Payen, A	
Date	-	1838	
Details	-	Payen determined elemental composition of carboxymethyl cellulose in 1838	
SYNTHESIS			
Monomer(s) structure	-	chloroacetic acid	
Monomer(s) CAS number(s)	-	79-11-8	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	94.50	
Degree of substitution	-	0.4-1.5 (theoretical maximum is 3 when all 3 groups in monomeric unit are substituted); 0.11-2.41	Yeasmin, S; Mondal, I H, Int. J. Biol. Macromol., 80, 725-31, 2015
Method of synthesis	-	carboxymethyl cellulose is obtained from reaction between cellulose and chloroacetic acid in the presence of alkalis which catalyze reaction	
Catalyst	-	alkalis	
Mass average molecular weight, M_w	dalton, g/mol, amu	80,000-560,000	
Polymerization degree (number of monomer units)	-	350-2,500	
STRUCTURE			
Crystallinity	%	80	Li, H; Wu, B; Mu, C; Lin, W, Carbohydrate Polym., 84, 881-86, 2011.
COMMERCIAL POLYMERS			
Some manufacturers	-	Dow	
Trade names	-	Walocel	
PHYSICAL PROPERTIES			
Density at 20°C	g cm^{-3}	1.05	
Decomposition temperature	°C	140-150	
pH	-	6.8	Yeasmin, S; Mondal, I H, Int. J. Biol. Macromol., 80, 725-31, 2015
Permeability to water vapor, 25°C	g mm m^{-2} day^{-1} kPa^{-1}	1.8	Sayanjali, S; Ghanbarzadeh, B; Ghiassifar, S, LWT Food Sci. Technol., 44, 1133-38, 2011.

PARAMETER	UNIT	VALUE	REFERENCES
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	17.6-17.8	Sayanjali, S; Ghanbarzadeh, B; Ghiassifar, S, LWT Food Sci. Technol., 44, 1133-38, 2011.
Elastic modulus	MPa	1,350	Ghanbarzadeh, B; Almasi, H, Int. J. Biol. Macromol., 48, 44-49, 2011.
Young's modulus	MPa	1227	Su, J-F; Huang, Z; Yuan, X-Y; Wang, X-Y; Li, M, Carbohydrate Polym., 79, 145-53, 2010.
Water absorption, equilibrium in water at 23°C	%	6.5; 10 max.	
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	poor	
Alcohols	-	poor	
Alkalis	-	poor	
Aliphatic hydrocarbons	-	good	
Aromatic hydrocarbons	-	fair	
Esters	-	poor	
Greases & oils	-	fair	
Halogenated hydrocarbons	-	poor	
Ketones	-	poor	
Good solvent	-	alkalies, acetone, chloroform, esters, mixture of water and alcohols, pyridine, water	
FLAMMABILITY			
Autoignition temperature	°C	287-370	
BIODEGRADATION			
Typical biodegradants	-	bacteria which can produce cellulase	
Stabilizers	-	Carbosan; potassium sorbate	Sayanjali, S; Ghanbarzadeh, B; Ghiassifar, S, LWT Food Sci. Technol., 44, 1133-38, 2011.
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	0/2/0	
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
Oral rat, LD_{50}	mg kg^{-1}	>5,000	
Skin rabbit, LD_{50}	mg kg^{-1}	>5,000	
PROCESSING			
Typical processing methods	-	compounding	
Applications	-	ceramics, cosmetics, fabric finishing, food products, flotation, leather pasting, paints, paper, pharmaceuticals, textile sizing, thickener and emulsion stabilizer in coatings, toothpaste, washing powders and liquids, well drilling	

PARAMETER	UNIT	VALUE	REFERENCES
BLENDS			
Suitable polymers	-	PEO, PR, PAM, PANI, carrageenan, PVAl	Miao, J; Zhang, R; Bai, R, J. Membrane Sci., 493, 654-63, 2015.
ANALYSIS			
FTIR (wavenumber-assignment)	cm^{-1}/-	3420 - OH stretching, 2925 - CH and CO stretching, 1640 - H-O-H, C=C, 896 - glucosidic linkages	Yeasmin, S; Mondal, I H, Int. J. Biol. Macromol., 80, 725-31, 2015.