MC methylcellulose

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	methylcellulose	
Acronym	-	MC	
CAS number	-	9004-67-5	
EC number	-	232-674-9	
RTECS number	-	FJ5959000	
HISTORY			
Person to discover	-	Houghton, A A; Taylor, C M	Houghton, A A; Taylor, C M, US Patent 2,285,514, ICI, June 9, 1942.
Date	-	1942	
Details	-	low substituted methyl cellulose patented	
SYNTHESIS			
Monomer(s) structure	-	cellulose; methyl chloride	
Monomer(s) CAS number(s)	-	9004-34-6; 74-87-3	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	160,000-560,000; 50.49	
Degree of substitution	-	1.3-2.6 (3 is maximum), 1.6-1.9 (pharmaceutical formulations)	
Method of synthesis	-	cellulose is heated with sodium hydroxide solution and then reacted with methyl chloride	
Number average molecular weight, M_n	dalton, g/mol, amu	38,000-180,000	
Mass average molecular weight, M_w	dalton, g/mol, amu	70,000-290,000	Ye, D; Farriol, X, Ind. Crops Products, 26, 54-62, 2007.
Radius of gyration	nm	57	Nilsson, S; Sundelof, L-O; Porsch, Carbohydrate Polym., 28, 265-75, 1995.
STRUCTURE			
Chain width	nm	0.91 (cellulose 0.79)	Chandrasekaran, R, Adv. Food Nutrition Res., 42, 131-210, 1999.
COMMERCIAL POLYMERS			
Some manufacturers	-	DOW	
Trade names	-	Methocel	
PHYSICAL PROPERTIES			
Density at 20°C	g cm^{-3}	1.01	
Color	-	white to off-white	
Refractive index, 20°C	-	1.4970	
Transmittance	%	92.2	
Odor	-	odorless	
Melting temperature, DSC	°C	290-305	
Gelation temperature	°C	48	
Glass transition temperature	°C	150-165	
Surface tension	mN m^{-1}	47-59	

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Volume resistivity	ohm-m	2.6E+03	Xu, W; Xu, Q; Huang, Q; Tan, R; Shen, W; Song, W, Mater. Lett., 152, 173-6, 2015.
Permeability to water vapor, 25°C	g m^{-1} s^{-1} Pa^{-1} x 10^{11}	6.77	Pinotti, A; Garcia, M A; Martino, M N; Zaritzky, Food Hydrocolloids, 21, 66-72, 2007.
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	10-100	Turhan, K N; Sahbaz, F, J. Food Eng., 61, 3, 459-66, 2004; Xu, W; Xu, Q; Huang, Q; Tan, R; Shen, W; Song, W, Mater. Lett., 152, 173-6, 2015.
Elongation	%	14-97	Turhan, K N; Sahbaz, F, J. Food Eng., 61, 3, 459-66, 2004.
Young's modulus	MPa	3,200	Xu, W; Xu, Q; Huang, Q; Tan, R; Shen, W; Song, W, Mater. Lett., 152, 173-6, 2015.
Intrinsic viscosity, 25°C	ml g^{-1}	220-715	Ye, D; Farriol, X, Ind. Crops Products, 26, 54-62, 2007.
CHEMICAL RESISTANCE			
Alcohols	-	good	
Alkalis	-	poor	
Aliphatic hydrocarbons	-	poor	
Aromatic hydrocarbons	-	poor	
Esters	-	poor	
Halogenated hydrocarbons	-	good	
Ketones	-	poor	
Good solvent	-	alkalies, acetone, chloroform, cyclohexanone, esters, pyridine, water	
Non-solvent	-	diethyl ether, methanol, methylene chloride	
BIODEGRADATION			
Typical biodegradants	-	bacteria (e.g, *Escherichia, Pseudomonas, Staphylococcus, Lactobacillus, Bacillus*) and fungi (e.g., *Penicilium, Trichophyton*)	Tunc, S; Duman, O, LWT Food Sci. Technol., 44, 465-72, 2011.
Stabilizers	-	carvacrol	Tunc, S; Duman, O, LWT Food Sci. Technol., 44, 465-72, 2011.
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	0/0/0	
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
Oral rat, LD_{50}	mg kg^{-1}	>10,000	
ENVIRONMENTAL IMPACT			
Aquatic toxicity, *Fathead minnow*, LC_{50}, 48 h	mg l^{-1}	>1,000	

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PARAMETER	UNIT	VALUE	REFERENCES
PROCESSING			
Applications	-	artificial fiber (food supplement), artificial tears, food (emulsifier, thickener), glue, mortar, paper, pharmaceutical (controlled release, scaffolds, tablet coating, thickener)	Shen, H; Ma, Y; Luo, Y; Zhang, Z; Dai, J, Colloids Surf. B: Biointerfaces, 135, 332-8, 2015.
Outstanding properties	-	thickening, binding	
BLENDS			
Suitable polymers	-	chitosan, PEG, PPy, PVA, xanthan gum	
ANALYSIS			
FTIR (wavenumber-assignment)	cm^{-1}/-	ether group – 1066; C-O-C – 1100	Aziz, N A N; Idris, N K; Isa, M I N, Intl. J. Polym. Anal. Charact., 15, 319-327, 2010.
x-ray diffraction peaks	degree	20 (cellulose peak); 9 (modification)	Aziz, N A N; Idris, N K; Isa, M I N, Intl. J. Polym. Anal. Charact., 15, 319-327, 2010.