

EC ethyl cellulose

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	ethyl cellulose	
CAS name	-	cellulose, ethyl ether	
Acronym	-	EC	
CAS number	-	9007-57-3	
RTECS number	-	FJ5950500	
SYNTHESIS			
Monomer(s) structure	-	cellulose, CH ₃ CH ₂ Cl; NaOH	
Monomer(s) CAS number(s)	-	9004-34-6; 75-00-3; 1310-73-2	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	depends on source; 64.51; 40.00	
Ethoxy content	%	44.0-51.0	
Method of synthesis	-	cellulose is first reacted with sodium hydroxide solution, followed by reaction between alkali cellulose and chloroethylene	
Number average molecular weight, M _n	dalton, g/mol, amu	24,000-75,000	
Mass average molecular weight, M _w	dalton, g/mol, amu	18,300-82,000	
Polydispersity, M _w /M _n	-	1.09-2.8	Sanchez, R; Franco, J M; Delgado, M A; Valencia, C; Gallegos, C, Carbohydrate Polym., 83, 151-58, 2011; Marucci, M; andersson, H; Hjartstam, J; Stevenson, G; Bad-erstedt, J; Standing, A; Larsson, A; von Corswant, C, Int. J. Pharm., 458, 218-23, 2013.
Molar volume at 298K	cm ³ mol ⁻¹	calc.=220.5	
Van der Waals volume	cm ³ mol ⁻¹	141.28	
STRUCTURE			
Crystallinity	%	close to 0	
Cell type (lattice)	-	orthorhombic	Zugenmaier, P, J. Appl. Polym. Sci., Polym. Symp., 37, 223, 1983.
Cell dimensions	nm	a:b:c=1.56:2.71:1.50	Zugenmaier, P, J. Appl. Polym. Sci., Polym. Symp., 37, 223, 1983.
Number of chains per unit cell	-	6	Zugenmaier, P, J. Appl. Polym. Sci., Polym. Symp., 37, 223, 1983.
Chain conformation	-	3/2	
Entanglement molecular weight	dalton, g/mol, amu	calc.=9126	
COMMERCIAL POLYMERS			
Some manufacturers	-	DOW	
Trade names	-	Ethocel	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	1.07-1.18	
Bulk density at 20°C	g cm ⁻³	0.29	
Color	-	white to light tan	

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Refractive index, 20°C	-	calc.=1.4745-1.489; exp.=1.479	
Melting temperature, DSC	°C	240-255	
Softening point	°C	152-180	
Thermal expansion coefficient, 23-80°C	10 ⁻⁴ °C ⁻¹	1-2	
Thermal conductivity, melt	W m ⁻¹ K ⁻¹	calc.=0.1721; exp.=0.159-0.293	
Glass transition temperature	°C	43-142	
Heat deflection temperature at 1.8 MPa	°C	46-88	
Hansen solubility parameters, δ_D , δ_P , δ_H	MPa ^{0.5}	19.0, 5.6, 4.9	
Interaction radius		7.9	
Hildebrand solubility parameter	MPa ^{0.5}	20.4-21.1	
Surface tension	mN m ⁻¹	calc.=31.8-34.1	
Power factor	-	0.002-0.02	
Permeability to nitrogen, 25°C	cm ³ cm cm ⁻² s ⁻¹ Pa ⁻¹ x 10 ¹²	0.332	
Permeability to oxygen, 25°C	cm ³ cm cm ⁻² s ⁻¹ Pa ⁻¹ x 10 ¹²	1.1	
Permeability to water vapor, 25°C	cm ³ cm cm ⁻² s ⁻¹ Pa ⁻¹ x 10 ¹²	670	
Diffusion coefficient of nitrogen	cm ² s ⁻¹ x10 ⁶	0.233	
Diffusion coefficient of oxygen	cm ² s ⁻¹ x10 ⁶	0.639	
Diffusion coefficient of water vapor	cm ² s ⁻¹ x10 ⁶	0.0286	
Contact angle of water, 20°C	degree	84.5	
Surface free energy	mJ m ⁻²	30.3	
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	14-62	Rowe, R C; Roberts, R J, J. Mater. Sci. Lett., 14, 6, 420-21, 1995.
Tensile stress at yield	MPa	30-45	Rowe, R C; Roberts, R J, J. Mater. Sci. Lett., 14, 6, 420-21, 1995.
Elongation	%	5-40	
Flexural strength	MPa	28-83	
Young's modulus	MPa	860-1,800	Rowe, R C; Roberts, R J, J. Mater. Sci. Lett., 14, 6, 420-21, 1995; Lee, S; Ko, K-H; Shin, J; Kim, N-K; Kim, Y-W; Kim, J-S, 121, 284-94, 2015.
Izod impact strength, notched, 23°C	J m ⁻¹	20	
Poisson's ratio	-	calc.=0.374	

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Rockwell hardness	-	R50-115	
Shrinkage	%	0.5-0.9	
Water absorption, equilibrium in water at 23°C	%	0.8-1.8	
Moisture absorption, equilibrium 23°C/50% RH	%	2.0	
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	resistant/non-resistant	
Alcohols	-	non-resistant	
Alkalis	-	resistant	
Aromatic hydrocarbons	-	non-resistant	
Esters	-	non-resistant	
Halogenated hydrocarbons	-	non-resistant	
Ketones	-	non-resistant	
Good solvent	-	acetic acid, formic acid, pyridine	
Non-solvent	-	ethanol	
FLAMMABILITY			
Ignition temperature	°C	291	
Autoignition temperature	°C	296	
Minimum ignition energy	J	0.01	
Char at 500°C	%	0.4	
WEATHER STABILITY			
UV/VIS transmittance	%	56	Lee, S; Ko, K-H; Shin, J; Kim, N-K; Kim, Y-W; Kim, J-S, 121, 284-94, 2015.
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	1-2/1/0	
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	-	compression molding, sheet extrusion, injection molding	
Processing temperature	°C	121-199 (compression molding), 177-260 (injection molding)	
Processing pressure	MPa	55-220	
Additives used in final products	-	Release: fluorosilicone, silicone coating; Slip: silicone oil	
Applications	-	pharmaceutical (microencapsulation, sustained release, tablet coating, water insoluble films)	
Outstanding properties	-	adhesion, emulsifier	
BLENDS			
Suitable polymers	-	MC, PHB, PVP	