

HEC hydroxyethyl cellulose

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	hydroxyethyl cellulose	
CAS name	-	cellulose, 2-hydroxyethyl ether	
Acronym	-	HEC	
CAS number	-	9004-62-0	
HISTORY			
Person to discover	-	Hagedorn, M; Ziese, W; Reyle, B; Bauer, R	Hagedorn, M; Ziese, W; Reyle, B; Bauer, R; US Patent 1,876,920, IG Farben, Sept. 13, 1932.
Date	-	1932 (first application 1929)	
Details	-	patent for production of HEC	
SYNTHESIS			
Monomer(s) structure	-	cellulose, ethylene oxide	
Monomer(s) CAS number(s)	-	9004-34-6; 75-21-8	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	160,000-560,000; 44.06	
Method of synthesis	-	cellulose is reacted with ethylene oxide in the presence of sodium hydroxide	
Catalyst	-	NaOH	
Typical additives	%	1 (fumed silica as a flow aid)	
Mass average molecular weight, M_w	dalton, g/mol, amu	100,000-230,000	
Radius of gyration	nm	47	Nilsson, S; Sundelof, L-O; Porsch, Carbohydrate Polym., 28, 265-75, 1995.
COMMERCIAL POLYMERS			
Some manufacturers	-	Ashland, DOW	
Trade names	-	Natrosol, Cellosize	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	1.3-1.4	
Bulk density at 20°C	g cm ⁻³	0.3-0.6	
Color	-	white to cream	
Refractive index, 20°C	-	1.5	
Odor	-	odorless	
Softening point	°C	135-140	
Decomposition temperature	°C	205-210	
Glass transition temperature	°C	120-125	
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	36-76	
Tensile modulus	MPa	30	
Elongation	%	6-7	
Elastic modulus	MPa	590	
Charpy impact strength, unnotched, 23°C	kJ m ⁻²	15-99	

HEC hydroxyethyl cellulose

PARAMETER	UNIT	VALUE	REFERENCES
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	non-resistant	
Alcohols	-	insoluble	
Aromatic hydrocarbons	-	insoluble	
Esters	-	insoluble	
Greases & oils	-	insoluble	
Halogenated hydrocarbons	-	insoluble	
Ketones	-	insoluble	
Good solvent		water	
FLAMMABILITY			
Ignition temperature	°C	400	
Autoignition temperature	°C	420	
Volatile products of combustion	-	CO, CO ₂ , hydrocarbons	
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	2/1/0	
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
Mutagenic effect	-	not known	
Teratogenic effect	-	not known	
Reproductive toxicity	-	not known	
Oral rat, LD ₅₀	mg kg ⁻¹	>8,700	
ENVIRONMENTAL IMPACT			
Aquatic toxicity, <i>Daphnia magna</i> , LC ₅₀ , 48 h	mg l ⁻¹	>100	
Aquatic toxicity, <i>Bluegill sunfish</i> , LC ₅₀ , 48 h	mg l ⁻¹	>100	
Aquatic toxicity, <i>Fathead minnow</i> , LC ₅₀ , 48 h	mg l ⁻¹	>100	
Aquatic toxicity, <i>Rainbow trout</i> , LC ₅₀ , 48 h	mg l ⁻¹	>100	
Chemical oxygen demand	mg O ₂ /mg	1.41	
PROCESSING			
Additives used in final products	-	graphene oxide (drug delivery)	Mianehrow, H; Mogadam, M H M; Sharif, F; Mazinani, S, Int. J. Pharm., 484, 1-2, 276-82, 2015.
Applications	-	agriculture (pesticides), building materials (retarder in gypsum and cement formulations), cosmetics, detergents, light-emitting diodes, paper (film forming), polymerization, sizing agent (textiles), thickener of paints and coatings	Wu, C-L; Chen, Y, Org. Electronics, 25, 156-64, 2015.
Outstanding properties	-	thickening, pseudoplasticity, film forming	