



Pharmaceutical Polymers

Typical Properties and Specifications

Typical Properties of Carbopol® Polymers and Pemulen™ Pharmaceutical-Grade Polymers

	Powder Grades	Granular Grade (Carbopol® 71G NF polymers)
Description	White, light, fluffy, acidic, hygroscopic powders	White, free flowing, acidic, hygroscopic granules
Particle Size	Flocculated powders have a median diameter of 2–7 microns (Coulter counter)	Typical size range (min 85%) is 150–425 microns (sieve analysis)
Bulk Density	~0.2 g/cm ³	0.325–0.400 g/cm ³ (Carbopol 71G NF polymer)
Tapped Density	~0.3 g/cm ³	0.400–0.465 g/cm ³ (Carbopol 71G NF polymer)
True Density (pycnometry)	1.40 g/cm ³	
BET Surface Area	12 – 14m ² /g	
Solubility/Swelling Properties	The polymers are not soluble due to their crosslinked nature and high molecular weight. The polymers swell in water and some polar solvents (neutralization may be required in some systems), producing viscous dispersions.	
Equivalent Weight	76 ± 4	
Dissociation Constant	pKa = 6.0 ± 0.5	
Chemical Stability	Chemically very stable under normal storage conditions; no significant changes of the chemical parameters or detected impurities for a period of minimum 5 years.	
Physical Stability	The polymers are hygroscopic. They are supplied with a loss on drying specification of 2% maximum. Lubrizol recommends to retest polymers for loss on drying two years after the date of manufacture.	
Equilibrium Moisture Content (25°C and 50% H)	8–10% w/w	
Glass Transition Temperature	~105°C. Glass transition temperature significantly decreases in the presence of moisture.	
Thermal Stability	Thermally stable under normal conditions. When exposed to excessive temperatures, above the glass transition temperature, the polymers become sintered. The products may become discolored depending on the temperature and exposure time. Complete decomposition occurs within 30 minutes when heated at 260°C.	
Recommended Storage	In airtight containers, protected from moisture and excessive temperature.	

The differences between Carbopol 971P NF polymer and Carbopol 71G NF polymer are particle size and density.



Carbopol 971P NF polymer (powder form)



Carbopol 71G NF polymer (granular form)

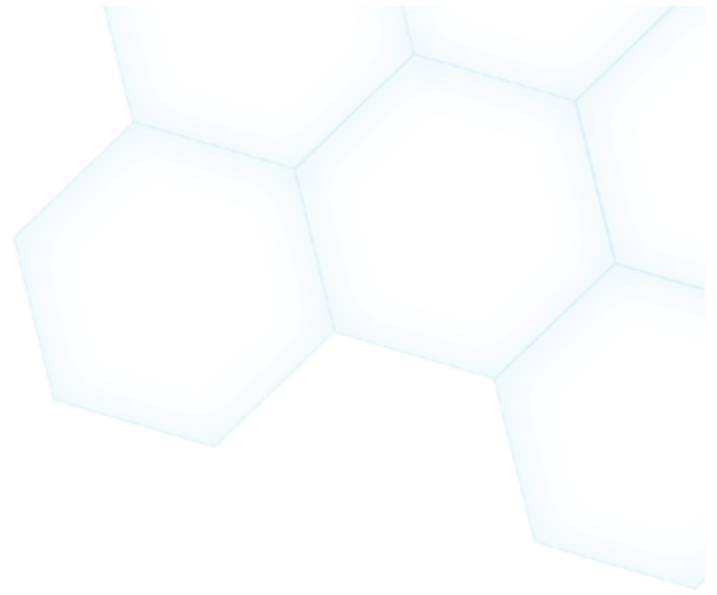
Summary of Lubrizol Product Specifications for Pharmaceutical Grade Carbopol® Polymers, Pemulen™ Polymers and Noveon® Polycarbophil

- Lubrizol pharmaceutical-grade polymers are produced and tested according to current good manufacturing practices (cGMP).
 - Method and testing frequency are indicated in the product specification sheet for each product (www.lubrizol.com/Pharmaceutical/Literature/ProductSpecifications.html).
 - When considering multiple polymers for pharmaceutical development, please refer to product specifications for method details and evaluate key performance properties of the final products.
 - Based on customer request, Lubrizol certifies select lots of product against the JPE Carboxyvinyl Polymer monograph.

Trade Name	Carbopol® Polymers							
	71G NF	971P NF	974P NF	980 NF	981 NF	5984 EP	ETD 2020 NF	Ultrez 10 NF
Identification								
Gel Formation	•	•	•	•	•	•	•	•
Colorimetric	•	•	•	•	•	•	—	—
Infrared Spectrum	•	•	•	•	•	•	•	•
Precipitate Formation	•	•	•	•	•	•	—	—
Foam on Dispersion	—	—	—	—	—	—	—	—
Wet-Out Test (60 minutes)	—	—	—	—	—	—	•	•
Emulsion Test Stability								
Carboxylic Acid Content (%)	56.0–68.0	56.0–68.0	56.0–68.0	56.0–68.0	56.0–68.0	56.0–68.0	52.0–62.0	52.0–62.0
Absorbing Power (g/g)	—	—	—	—	—	—	—	—
Viscosity (cP)								
0.2% w/w	—	—	—	13,000-30,000	1,000-6,000	—	—	—
0.5% w/w	4,000-11,000	4,000-11,000	29,400-39,400	40,000-60,000	4,000-10,000	30,500-39,400	—	45,000-65,000
1.0% w/w	—	—	—	—	—	—	47,000-77,000	—
1.0% w/w with 1% w/w salt	—	—	—	—	—	—	4,000-10,000	—
0.2% w/w emulsion	—	—	—	—	—	—	—	—
Clarity (% transmission)	—	—	—	85 min	—	—	—	—
Loss on Drying (%)	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max
Heavy Metals (ppm)								
Total Heavy Metals, as Pb	20 max	20 max	20 max	20 max	20 max	20 max	20 max	20 max
Specific Metals: Hg, Pb, As, Sb	10 max	10 max	10 max	10 max	10 max	10 max	10 max	10 max
Ethyl Acetate (%)	0.50 max	0.50 max	0.50 max	0.30 max	0.30 max	0.30 max	0.35 max	0.35 max
Cyclohexane (%)	—	—	—	0.30 max	0.30 max	0.30 max	0.15 max	0.15 max
Benzene (ppm)	0.50 max	0.50 max	0.50 max	0.50 max	0.50 max	0.50 max	0.50 max	0.50 max
Free Acrylic Acid (ppm)	1,000 max	1,000 max	1,000 max	2,500 max	2,500 max	2,500 max	2,500 max	2,500 max
Sulfated Ash (residue on ignition) (%)	2.5 max	2.5 max	2.5 max	2.5 max	2.5 max	2.5 max	—	—
Particle Size (%)								
Pass Through 40 Mesh (425 microns)	95 min	—	—	—	—	—	—	—
Pass Through 100 Mesh (150 microns)	10 max	—	—	—	—	—	—	—
pH								
1.0% Dispersion	—	—	—	—	—	—	—	—

• Designates "Pass" — Designates "Not Applicable"

Trade Name	Carbopol® Polymers					Pemulen™ Polymers		Noveon® Polycarbophil
	934 NF	934P NF	940 NF	941 NF	1342 NF	TR-1 NF	TR-2 NF	AA-1 USP
Identification								
Gel Formation	•	•	•	•	•	—	—	•
Colorimetric	•	•	•	•	•	—	—	•
Infrared Spectrum	—	—	—	—	—	•	•	—
Precipitate Formation	—	—	—	—	—	—	—	—
Foam on Dispersion	—	—	—	—	—	•	•	—
Wet-Out Test (60 minutes)	—	—	—	—	—	—	—	—
Emulsion Test Stability								
Carboxylic Acid Content (%)	56.0–68.0	56.0–68.0	56.0–68.0	56.0–68.0	52.0–62.0	52.0–62.0	52.0–62.0	—
Absorbing Power (g/g)	—	—	—	—	—	—	—	62 min
Viscosity (cP)								
0.2% w/w	2,050-5,450	2,050-5,450	—	—	—	—	—	2,000-12,000
0.5% w/w	30,500-39,400	29,400-39,400	40,000-60,000	4,000-10,000	—	—	—	—
1.0% w/w	—	—	—	—	9,500-26,500	10,000-26,500	4,500-13,500	—
1.0% w/w with 1% w/w salt	—	—	—	—	5,500-15,000	—	—	—
0.2% w/w emulsion	—	—	—	—	—	6,500-15,500	1,700-4,500	—
Clarity (% transmission)	—	—	85 min	—	—	—	—	—
Loss on Drying (%)	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	2.0 max	1.5 max
Heavy Metals (ppm)								
Total Heavy Metals, as Pb	20 max	20 max	20 max	20 max	20 max	20 max	20 max	—
Specific Metals: Hg, Pb, As, Sb	10 max	10 max	10 max	10 max	10 max	10 max	10 max	—
Ethyl Acetate (%)	—	—	—	—	—	—	0.30 max	0.45 max
Cyclohexane (%)	—	—	—	—	—	—	0.30 max	—
Benzene (ppm)	1,000 max	100 max	1,000 max	1,000 max	1,000 max	0.50 max	0.50 max	0.50 max
Free Acrylic Acid (ppm)	2,500 max	1,000 max	2,500 max	2,500 max	2,500 max	2,500 max	2,500 max	3,000 max
Sulfated Ash (residue on ignition) (%)	—	—	—	—	—	—	—	4.0 max
Particle Size (%)								
Pass Through 40 Mesh (425 microns)	—	—	—	—	—	—	—	—
Pass through 100 mesh (150 microns)	—	—	—	—	—	—	—	—
pH								
1.0% dispersion	—	—	—	—	—	—	—	4.0 max



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