Carbomer

1 Nonproprietary Names

BP: Carbomers

PhEur: Carbomers

USP–NF: Carbomer

2 Synonyms

Acrypol; *Acritamer*; acrylic acid polymer; carbomera; *Carbopol*; carboxy polymethylene; carboxyvinyl polymer; *Pemulen*; polyacrylic acid; *Tego Carbomer*.

3 Chemical Name and CAS Registry Number

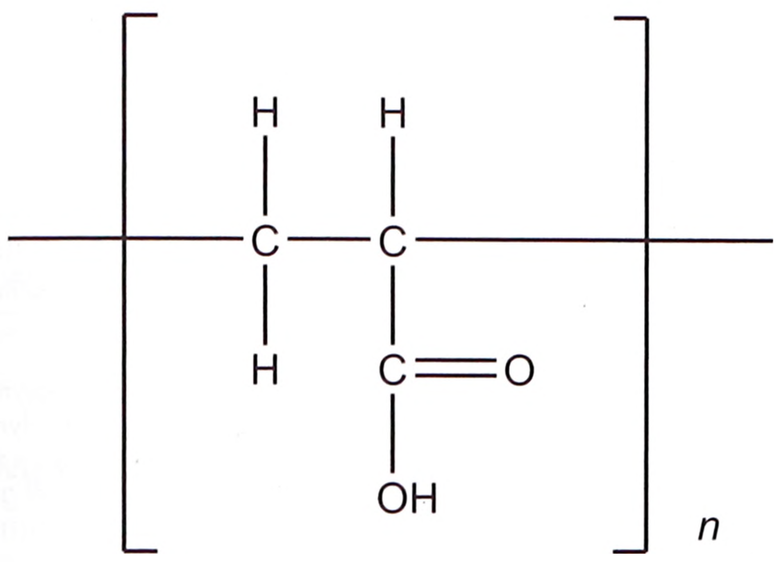
Carbomer [9003-01-4]

Note that alternative CAS registry numbers have been used: carbomer 934 [9007-16-3]; carbomer 940 and carbomer homopolymer Type C [9007-17-4]; and 941 [9062-04-08]. The CAS registry number [9007-20-9] has also been used for carbomer (carboxypolymethylene).

4 Empirical Formula and Molecular Weight

Carbomers are synthetic high-molecular-weight polymers of acrylic acid that are crosslinked with either allyl sucrose or allyl ethers of pentaerythritol. They contain between 52% and 68% of carboxylic acid (COOH) groups calculated on the dry basis. The BP 2017 and PhEur 9.2 have a single monograph describing carbomer; the USP 40–NF 35 S1 contains several monographs describing individual carbomer grades that vary in aqueous viscosity, polymer type, and polymerization solvent. The molecular weight of carbomer is theoretically estimated at 7×10^5 to 4×10^9.

5 Structural Formula



Acrylic acid monomer unit in carbomer polymers.

Carbomer polymers are formed from repeating units of acrylic acid. The monomer unit is shown above. The polymer chains are crosslinked with allyl sucrose or allyl pentaerythritol. *See also* Section 4.

6 Functional Category

Bioadhesive material; emulsifying agent; emulsion stabilizing agent; modified-release agent; suspending agent; viscosity-increasing agent.

7 Applications in Pharmaceutical Formulation or Technology

Carbomers are used in liquid or semisolid pharmaceutical and cosmetic formulations as rheology modifiers and emulsifying agents in the preparation of oil-in-water emulsions for external administration. Formulations include creams, gels, lotions and ointments for use in ophthalmic,[1–3] rectal,[4–6] topical[7–12] and vaginal[13–16] preparations; *see* Table I.

In tablet formulations, carbomers are used as controlled-release agents either alone[17–26] or in combination with other polymers such as hypromellose and polyvinyl acetate phthalate.[27–29] In contrast to linear polymers, higher viscosity does not result in slower drug release with carbomers. Lightly crosslinked carbomers (lower viscosity) are generally more efficient in controlling drug release than highly crosslinked carbomers (higher viscosity).

Carbomers are also used as binders in wet granulation using water, organic solvents, or their mixtures as the granulating fluid.

Carbomer polymers have also been studied in the preparation of multiparticulate systems for oral delivery[30–34] and in oral mucoadhesive controlled drug delivery systems.[35–39]

Table I: Uses of carbomers.

Use	Typical concentration (%)
Emulsifying agent	0.1–0.5
Gelling agent	0.5–2.0
Suspending agent	0.5–1.0
Tablet binder	0.75–3.0
Controlled-release agent	5.0–30.0

8 Description

Carbomers are white-colored, 'fluffy', acidic, hygroscopic powders with a characteristic slight odor. A granular carbomer is also available (*Carbopol 71G*).

9 Pharmacopeial Specifications

The USP–NF has several monographs for different carbomer grades, while the BP and PhEur have only a single monograph.

The USP–NF lists three umbrella monographs, carbomer copolymer, carbomer homopolymer and carbomer interpolymer, which separate carbomer products based on polymer structure and apply to products not polymerized in benzene. The differentiation within each umbrella monograph is based on viscosity characteristics (Type A, Type B and Type C).

The USP–NF also lists monographs for carbomer 934, 934P, 940 and 941, which are manufactured using benzene. Effective since January 1 2011, products manufactured without the use of benzene are officially titled Carbomer Homopolymer provided they comply with the carbomer homopolymer monograph. The USP–NF also includes carbomer 1342, which applies to carbomer copolymers manufactured using benzene.

Carbomer polymers are also covered either individually or together in other pharmacopeias.

See Table II. *See also* Section 18.

10 Typical Properties

Acidity/alkalinity

pH = 2.5–4.0 for a 0.2% w/v aqueous dispersion