Ethylcellulose

1 Nonproprietary Names

BP: Ethylcellulose

PhEur: Ethylcellulose

USP–NF: Ethylcellulose

2 Synonyms

Aquacoat ECD; *Aqualon*; *Ashacel*;*BonuCel*; E462; *Ethocel*; ethylcellulosum; *Fetocel*; *Surelease*.

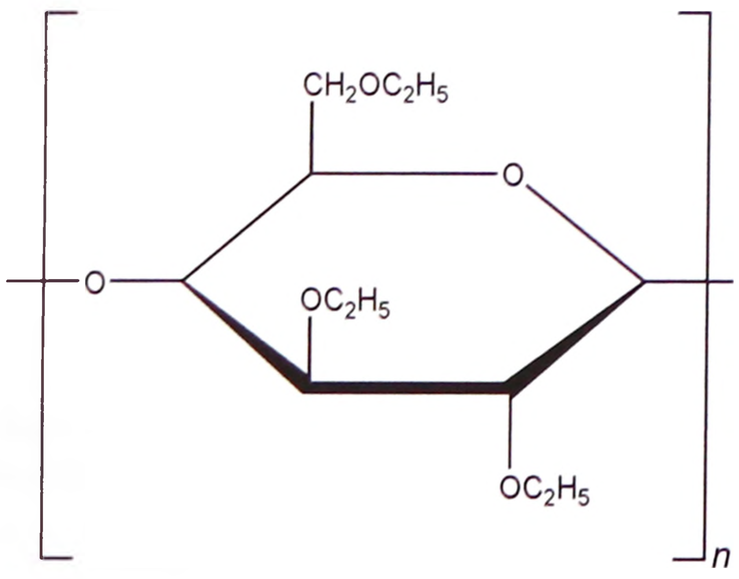
3 Chemical Name and CAS Registry Number

Cellulose ethyl ether [9004-57-3]

4 Empirical Formula and Molecular Weight

Ethylcellulose is partially ethoxylated. Ethylcellulose with complete ethoxyl substitution (DS = 3) is $C_{12}H_{23}O_6(C_{12}H_{22}O_5)_nC_{12}H_{23}O_5$ where *n* can vary to provide a wide variety of molecular weights. Ethylcellulose, an ethyl ether of cellulose, is a long-chain polymer of β-anhydroglucose units joined together by acetal linkages.

5 Structural Formula



6 Functional Category

Coating agent; microencapsulating agent; tablet and capsule binder; tablet and capsule diluent; taste-masking agent; viscosity-increasing agent.

7 Applications in Pharmaceutical Formulation or Technology

Ethylcellulose is widely used in oral and topical pharmaceutical formulations; *see* Table I.

The main use of ethylcellulose in oral formulations is as a hydrophobic coating agent for tablets and granules.[1–8] Ethylcellulose coatings are used to modify the release of a drug,[7–10] to mask an unpleasant taste,[11,12] or to improve the stability of a formulation; for example, where granules are coated with ethylcellulose to inhibit oxidation. Modified-release tablet formulations may also be produced using ethylcellulose as a matrix former.[13–16]

Ethylcellulose, dissolved in an organic solvent or solvent mixture, can be used on its own to produce water-insoluble films. Higher-viscosity ethylcellulose grades tend to produce stronger and more durable films. Ethylcellulose films may be modified to alter their solubility[17] by the addition of hypromellose[18] or a plasticizer;[19–21] *see* Section 18. An aqueous polymer dispersion (or latex) of ethylcellulose such as *Aquacoat ECD* (FMC Biopolymer) or *Surelease* (Colorcon) may also be used to produce ethylcellulose films without the need for organic solvents.

Drug release through ethylcellulose-coated dosage forms can be controlled by diffusion through the film coating. This can be a slow process unless a large surface area (e.g. pellets or granules compared with tablets) is utilized. In those instances, aqueous ethylcellulose dispersions are generally used to coat granules or pellets. Ethylcellulose-coated beads and granules have also demonstrated the ability to absorb pressure and hence protect the coating from fracture during compression.[21]

High-viscosity grades of ethylcellulose are used in drug microencapsulation.[10,22–24]

Release of a drug from an ethylcellulose microcapsule is a function of the microcapsule wall thickness and surface area.

In tablet formulations, ethylcellulose may additionally be employed as a binder, the ethylcellulose being blended dry or wet-granulated with a solvent such as ethanol (95%). Ethylcellulose produces hard tablets with low friability, although they may demonstrate poor dissolution.

Ethylcellulose has also been used as an agent for delivering therapeutic agents from oral (e.g. dental) appliances.[25]

In topical formulations, ethylcellulose is used as a thickening agent in creams, lotions, or gels, provided an appropriate solvent is used.[26] Ethylcellulose has been studied as a stabilizer for emulsions.[27]

Ethylcellulose is additionally used in cosmetics and food products.

Table I: Uses of ethylcellulose.

Use	Concentration (%)
Microencapsulation	10.0–20.0
Sustained-release tablet coating	3.0–20.0
Tablet coating	1.0–3.0
Tablet granulation	1.0–3.0
Taste-masking	5.0-50.0

8 Description

Ethylcellulose is a tasteless, free-flowing, white to light tan-colored powder.

9 Pharmacopeial Specifications

The pharmacopeial specifications for ethylcellulose have undergone harmonization of many attributes for PhEur, and USP–NF.

See Table II. *See also* Section 18.

10 Typical Properties

Density (bulk) 0.4 g/cm^3

Glass transition temperature 129–133°C[28]

Moisture content Ethylcellulose absorbs very little water from humid air or during immersion, and that small amount evaporates readily.[29,30]

See also Figure 1.

Particle size distribution *see* Table III; *see also* Figures 2 and 3.

Solubility Ethylcellulose is practically insoluble in glycerin, propylene glycol, and water. Ethylcellulose that contains less than 46.5% of ethoxyl groups is freely soluble in chloroform, methyl acetate, and tetrahydrofuran, and in mixtures of aromatic hydrocarbons with ethanol (95%). Ethylcellulose