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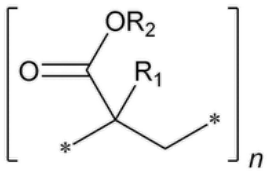
Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer



$R_1 = CH_3$; R_2 = H or

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R_1 = H; $R_2 = C_2H_5$

Partially-neutralized poly(methacrylic acid, ethyl acrylate);
Partially-neutralized methacrylic acid–ethyl acrylate copolymer
CAS RN®: 25212-88-8.

DEFINITION

Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer consists of methacrylic acid and ethyl acrylate monomers arranged in a random distribution, some units of methacrylic acid in the copolymer are neutralized by sodium hydroxide. The non-neutralized methacrylic acid units in the partially-neutralized methacrylic acid and ethyl acrylate copolymer are NLT 43.2% and NMT 47.6%, calculated on the dried basis. It may contain suitable emulsifiers.

IDENTIFICATION

- **A. Infrared Absorption**

Sample: 100 mg of Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer

Analysis: Dissolve the *Sample* in 1 mL of dehydrated alcohol, and place 2 drops of the solution on a sodium chloride (or potassium bromide) plate. Dry to evaporate the solvent and allow to form a film and cover with another sodium chloride (or potassium bromide) plate.

Acceptance criteria: The IR absorption spectrum of Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer exhibits maxima corresponding to the same wavelengths as that of a similar preparation of USP Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer (1:1) RS, treated in the same manner.

- **B.** It meets the requirements of the *Assay*.

ASSAY

- **Procedure**

Sample: 1 g, calculated on the dried basis

Analysis: Dissolve the *Sample* in 40 mL of water and 60 mL of 2-propanol, and titrate with 0.1 N sodium hydroxide VS, determining the endpoint potentiometrically (see *Titrimetry* ⟨541⟩). Each mL of 0.1 N sodium hydroxide is equivalent to 8.609 mg of methacrylic acid ($C_4H_6O_2$) units.

Acceptance criteria: 43.2%–47.6% for Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer

IMPURITIES

Inorganic Impurities

- **Residue on Ignition ⟨281⟩:** 2.0%–3.5%

Organic Impurities

- **Procedure: Limit of Methacrylic Acid and Ethyl Acrylate**

Phosphoric acid solution: 0.1% phosphoric acid prepared from phosphoric acid

Mobile phase: Methanol and *Phosphoric acid solution* (3:7)

Standard solution: 1.0 µg/mL each of methacrylic acid and ethyl acrylate in methanol

Sample solution: Transfer 0.5 g of Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer to a 25-mL volumetric flask, and dissolve in 20 mL of methanol. Add *Phosphoric acid solution* dropwise to precipitate the polymer while continuously stirring until the volume of 25 mL is reached. [NOTE—Stir with a magnetic stirrer for 10 min. Any volume deviation caused by the precipitation is negligible for contents in the ppm range. Use a magnetic stirrer of appropriate size to avoid a large variance from the final volume of the *Sample solution*.] As soon as the solid matter has settled, pass the supernatant through a filter of 0.45-µm pore size. [NOTE—Solution that cannot be filtered is centrifuged at NLT 20,000 × *g* for NLT 30 min.] Use the clear supernatant.

Chromatographic system

(See *Chromatography ⟨621⟩, System Suitability*.)

Mode: LC

Detector: UV 205 nm

Column: 4.0-mm × 12.5-cm analytical column, 5-µm packing L1 or 4.6-mm × 15.0-cm analytical column, 5-µm packing L1

Flow rate: 1.2 mL/min

Injection size: 20 µL

[NOTE—Where appropriate, the volume must be adapted to the sensitivity of the detector.]

[NOTE—Column switching system may be used for extension of column lifetime.]

System suitability

Sample: *Standard solution*

[NOTE—The relative retention times for methacrylic acid and ethyl acrylate are 1.0 and 2.2, respectively.]

Suitability requirements

Resolution: NLT 5.0 between methacrylic acid and ethyl acrylate

Relative standard deviation: NMT 5.0%

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of each monomer (methacrylic acid or ethyl acrylate) in the portion of Methacrylic Acid and Ethyl Acrylate Copolymer taken:

$$\text{Result} = (r_U/r_S) \times (C_S/W) \times V_F \times F \times 100$$

r_U = peak response from the *Sample solution*

r_S = peak response from the *Standard solution*

C_S = concentration of the *Standard solution* (µg/mL)

W = weight of Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer taken to prepare the *Sample solution* (g)

V_F = final volume of the *Sample solution*, 25 mL

F = conversion factor, 10^{-6} g/µg

Acceptance criteria: NMT 0.01% for the total amount of monomers

SPECIFIC TESTS

• **Loss on Drying ⟨731⟩:** Dry a sample at 110° for 6 h: it loses NMT 5.0% of its weight.

• **Viscosity—Rotational Methods ⟨912⟩:** Weigh 400 g of water into a short form, 600-mL beaker (internal diameter about 80 mm and height 120 mm). After determining the *Loss on Drying*, weigh a quantity of undried Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer, equivalent to 100 g on the dried basis. Transfer the sample to the beaker very slowly while effectively stirring (avoid lumps). Ensure that the stirring is very effective at the beginning and that the powder is immersed very slowly at the same time. Once the powder is dispersed and no lumps are visible, gentle stirring is then sufficient. Ensure a colloidal dispersion (milky white liquid) by stirring at room temperature for 3 h and taking care to avoid mixing in excess air. Afterwards allow the container to stand for 1 h, control the temperature to 23 ± 0.1°, and let the entrapped air dissipate. [NOTE—Ensure that the concentration of this solution is 20% (w/w).] Determine the viscosity of this solution at 23 ± 0.1° using a suitable rotational viscometer with a cylindrical spindle 1.9 cm in diameter and 6.5 cm high, attached to a shaft 0.3 cm in diameter.[1] The spindle rotates at 50 rpm at an immersion depth of 8.1 cm. Follow the instrument manufacturer's directions to measure the apparent viscosity.

Acceptance criteria: 20–100 mPa · s

ADDITIONAL REQUIREMENTS

• **Packaging and Storage:** Preserve in tight containers, and store at controlled room temperature.

• **Labeling:** Label it to indicate the range of non-neutralized methacrylic acid units. The labeling also indicates the name and quantity of any emulsifier if the content is 0.10% or greater.

• **USP Reference Standards** ⟨11⟩

USP Partially-Neutralized Methacrylic Acid and Ethyl Acrylate Copolymer (1:1) RS

[1] A suitable spindle is available from Brookfield as an LV1 spindle, or the equivalent.

Auxiliary Information - Please check for your question in the FAQs before contacting USP.

Topic/Question	Contact	Expert Committee
PARTIALLY-NEUTRALIZED METHACRYLIC ACID AND ETHYL ACRYLATE COPOLYMER	Documentary Standards Support	CE2020 Complex Excipients
REFERENCE STANDARD SUPPORT	RS Technical Services RSTECH@usp.org	CE2020 Complex Excipients

Chromatographic Database Information: Chromatographic Database

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