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Polyoxyl Stearate

$R-CO-(OCH_2CH_2)_n-OH$ $R-CO-(OCH_2CH_2)_n-OOC-R$ $R = CH_3(CH_2)_{16}$ or $CH_3(CH_2)_{14}$ $n = 6-100$
Polyethylene glycol stearate;
Polyethylene glycol monostearate;
Poly(oxy-1,2-ethanediyl), α -hydro- ω -hydroxyoctadecanoate
CAS RN®: 9004-99-3.

DEFINITION

Polyoxyl Stearate is a mixture of monoesters and diesters of mainly stearic (octadecanoic) acid and/or palmitic (hexadecanoic) acid and polyethylene glycols. The fatty acids may be of vegetable, animal, or synthetic origin. Polyoxyl Stearate Type I or Type II differs in its content of stearic acid. It may contain free polyethylene glycols. The average polymer length is equivalent to 6–100 ethylene oxide units per molecule (nominal value).

IDENTIFICATION

Change to read:

- A. [▲ SPECTROSCOPIC IDENTIFICATION TESTS \(197\), Infrared Spectroscopy: 197A ▲](#) (CN 1-MAY-2020)
Sample: Use an undried specimen.
- B. It meets the requirements of the test for *Content of Stearic Acid and Palmitic Acid*.

ASSAY

- CONTENT OF STEARIC ACID AND PALMITIC ACID
Polyoxyl Stearate exhibits the composition profiles of fatty acids shown in [Table 1](#) below, as determined in [Fats and Fixed Oils \(401\), Fatty Acid Composition](#).

Table 1

	Content of Stearic Acid and Palmitic Acid
Polyoxyl Stearate Type I	Stearic Acid: 40.0%–60.0%; sum of Palmitic and Stearic acids: NLT 90.0%
Polyoxyl Stearate Type II	Stearic Acid: 90.0%–99.0%; sum of Palmitic and Stearic acids: NLT 96.0%

- CONTENT OF FREE POLYETHYLENE GLYCOLS

[NOTE—This test is for Polyoxyl 40 Stearate only.]

Sample: 6 g of Polyoxyl 40 Stearate

Analysis: Transfer the *Sample* to a 500-mL separator containing 50 mL of ethyl acetate. Dissolve completely, then add 50 mL of sodium chloride solution (29 in 100), shake vigorously for 2 min, and allow to separate for 15 min. If separation is incomplete, carefully insert the separator into the well of a steam bath for short time intervals. Repeat this technique as many times as necessary to ensure the complete separation of the two phases. Cool, and drain the lower, aqueous phase into a second 500-mL separator. Extract the upper layer with a second 50-mL portion of sodium chloride solution (29 in 100). Repeat the separation as before, including the steam bath technique, to facilitate complete separation.

To the combined aqueous layers add 50 mL of ethyl acetate, shake vigorously for 2 min, and allow to separate as before. Drain the lower, aqueous phase into a third 500-mL separator, and extract it with two 50-mL portions of chloroform, shaking for 2 min each time. Repeat the steam bath technique to ensure complete separation.

Evaporate the combined chloroform extracts in a 150-mL beaker on a steam bath, with the aid of a stream of nitrogen, to apparent dryness. Redissolve in about 15 mL of chloroform, and filter, collecting the filtrate in a weighed 150-mL beaker. Record the weight of the empty 150-mL beaker, W_1 , in g. Rinse the funnel with several small portions of chloroform, and evaporate the combined filtrate and rinsings, as described above, to remove chloroform or ethyl acetate.

Dry in vacuum at 60° for 1 h. Cool in a desiccator, and weigh. Record the weight, W_2 , in g.

Calculate the percentage of free polyethylene glycols in Polyoxyl 40 Stearate taken:

$$\text{Result} = [(W_2 - W_1)/W] \times 100$$

W = weight of Polyoxyl 40 Stearate (g)

Acceptance criteria: 17%–27% of free polyethylene glycols for Polyoxyl 40 Stearate only

IMPURITIES

- **ARTICLES OF BOTANICAL ORIGIN, Total Ash (561):** NMT 0.3%, determined on 1.0 g

- **LIMIT OF ETHYLENE OXIDE AND DIOXANE**

Analysis: Proceed as directed in [Ethylene Oxide and Dioxane \(228\), Method II](#).

Acceptance criteria

Ethylene oxide: 1 ppm

Dioxane: 380 ppm

SPECIFIC TESTS

- **ALKALINITY**

Phenol red solution: Dissolve 100 mg of phenolsulfonphthalein in a mixture of 2.82 mL of 0.1 M sodium hydroxide and 20 mL of alcohol, and dilute with water to 100 mL.

Sample solution: 2.0 g of Polyoxyl Stearate

Analysis: Dissolve the *Sample* in alcohol and dilute with alcohol to 20 mL. To 2 mL of this solution add 0.05 mL of *Phenol red solution*.

Acceptance criteria: The solution does not turn red.

- **FATS AND FIXED OILS, Acid Value (401):** NMT 6.0
- **FATS AND FIXED OILS, Hydroxyl Value (401):** Within the ranges specified in [Table 2](#)
- **FATS AND FIXED OILS, Iodine Value (401):** NMT 3.0
- **FATS AND FIXED OILS, Peroxide Value (401):** NMT 10.0
- **FATS AND FIXED OILS, Saponification Value (401):** Within the ranges specified in [Table 2](#)
- **MELTING RANGE OR TEMPERATURE (741)**

Sample: 10 g

Analysis: Melt the *Sample* at 80°–90°. Introduce a sufficient amount of the *Sample* into the tube by capillary action to form a column of the prescribed height in the tube. Allow to stand at 0° for 2 h.

Acceptance criteria: Within the ranges specified in [Table 2](#)

Table 2

Ethylene Oxide Units/ Molecule (Nominal Value)	Melting Range or Temperature (°)	Hydroxyl Value	Saponification Value
6	26–37	80–110	90–115
8	26–35	80–105	88–100
32	46–50	20–40	30–45

Ethylene Oxide Units/ Molecule (Nominal Value)	Melting Range or Temperature (°)	Hydroxyl Value	Saponification Value
40	Measure Congealing Temperature	25–40	25–35
75	53–59	15–35	8–25
100	48–60	15–30	5–20

- **CONGEALING TEMPERATURE (651):** 37°–47° for Polyoxyl 40 Stearate only
- **WATER DETERMINATION, Method I (921):** NMT 3.0%

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in tight containers, and store at room temperature. Protect from light and moisture.
- **LABELING:** Label it to indicate the number of ethylene oxide units/molecule (nominal value), and the type of Polyoxyl Stearate. Label it to indicate whether the fatty acids are derived from vegetable, animal, or synthetic sources.
- **USP REFERENCE STANDARDS (11).**
[USP Polyoxyl 6 Stearate RS](#)
[USP Polyoxyl 8 Stearate RS](#)
[USP Polyoxyl 32 Stearate RS](#)
[USP Polyoxyl 40 Stearate RS](#)
[USP Polyoxyl 75 Stearate RS](#)
[USP Polyoxyl 100 Stearate RS](#)

Auxiliary Information - Please [check for your question in the FAQs](#) before contacting USP.

Topic/Question	Contact	Expert Committee
POLYOXYL STEARATE	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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