Sodium Cetostearyl Sulfate

» Sodium Cetostearyl Sulfate is a mixture of sodium cetyl sulfate and sodium stearyl sulfate. It contains not less than 40.0 percent of sodium cetyl sulfate ($C_{16}H_{33}NaSO_4$), and the sum of the sodium cetyl sulfate content and sodium stearyl sulfate ($C_{18}H_{37}NaSO_4$) content is not less than 90.0 percent (both contents calculated on the anhydrous basis). It may contain a suitable buffer.

Packaging and storage— Preserve in well-closed containers. No storage requirements specified.

Labeling— Label it to indicate the name and concentration of any added buffer.

USP Reference standards ⟨ 11 ⟩ **—** *USP Cetyl Alcohol RS*. *USP Stearyl Alcohol RS*.

Identification—

A: The retention times of the two major peaks in the chromatogram of *Assay preparation C* correspond to those in the chromatogram of the *Resolution solution,* as obtained in the *Assay.*

B: It meets the requirements of the flame test for *Sodium* ⟨ 191 ⟩.

C: Mix 10 mg with 10 mL of ethanol, and heat to boiling on a water bath, shaking frequently. Filter immediately, and evaporate to dryness. Dissolve the residue in 7 mL of water, add 3 mL of diluted hydrochloric acid, and evaporate the solution to half its volume. Allow to cool, and filter. To the filtrate, add 1 mL of barium chloride solution (6 in 100): a white crystalline precipitate is formed.

Acidity or alkalinity— Dissolve 500 mg with heating in a mixture of 10 mL of water and 15 mL of 90% alcohol. Add 0.1 mL of phenolphthalein TS: the solution is colorless. Add 0.1 mL of 0.1 N sodium hydroxide: the solution becomes red.

Water, *Method I* ⟨ 921 ⟩ **:** not more than 1.5%.

Limit of sodium chloride and sodium sulfate—

Dichloroacetic acid solution— Dilute 67 mL of dichloroacetic acid with water to 300 mL, and neutralize to blue litmus paper using ammonia TS. Cool, add 33 mL of dichloroacetic acid, and dilute with water to 600 mL.

Sodium chloride— Dissolve about 5 g of Sodium Cetostearyl Sulfate, accurately weighed, in 50 mL of water, and add diluted nitric acid dropwise until the solution is neutral to blue litmus paper. Add 1 mL of potassium chromate TS, and titrate with 0.1 N silver nitrate VS, determining the endpoint potentiometrically. Calculate the percentage of sodium chloride (NaCl) in the Sodium Cetostearyl Sulfate taken by the formula:

$$5.844VN/W,$$

in which 5.844 is the equivalence factor for sodium chloride; V is the volume, in mL, of silver nitrate solution; N is the normality of silver nitrate; and W is the weight, in g, of the Sodium Cetostearyl Sulfate taken.

Sodium sulfate— Dissolve 0.5 g of Sodium Cetostearyl Sulfate, accurately weighed, in 20 mL of water, warming gently if necessary, and add 1 mL of a solution containing 0.5 g per L of dithizone in acetone. If the solution is red, add 1 N nitric acid dropwise until a bluish-green color is obtained. Add 2.0 mL of *Dichloroacetic acid solution* and 80 mL of acetone, and titrate with 0.01 M lead nitrate VS until a persistent orange-red color is obtained. Calculate the percentage of sodium sulfate (Na_2SO_4) in the Sodium Cetostearyl Sulfate taken by the formula:

$$14.20VM/W,$$

in which 14.20 is the equivalence factor for sodium sulfate; V is the volume, in mL, of lead nitrate solution; M is the molarity of lead nitrate; and W is the weight, in g, of the Sodium Cetostearyl Sulfate taken. The sum of the percentages of sodium chloride and sodium sulfate is not more than 8.0%.

Limit of free cetostearyl alcohol— Examine the chromatogram of *Assay preparation A,* obtained as directed in the *Assay*. Calculate the percentage of free cetostearyl alcohol in the Sodium Cetostearyl Sulfate taken using the formula:

$$100(A_a + B_a) \times W_{ah} / (S_{a(corr)} \times W_a),$$

in which $(A_a + B_a)$ is the sum of the areas of the cetyl alcohol and stearyl alcohol peaks in the chromatogram of *Assay preparation A;* $S_{a\ (corr)}$ is defined under *Assay;* W_{ah} is the weight of the internal standard, in mg, added in the preparation of *Assay preparation A;* and W_a is the weight, in mg, of Sodium Cetostearyl Sulfate taken to prepare *Assay preparation A:* not more than 4.0% is found.

Residual solvents ⟨ 467 ⟩ **:** meets the requirements.
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Assay—

Resolution solution— Dissolve accurately weighed quantities of *USP Cetyl Alcohol RS* and *USP Stearyl Alcohol RS* in alcohol to obtain a solution having a known concentration of about 5 mg of each per mL.

Internal standard solution— Prepare a solution of 1-heptadecanol in alcohol having a concentration of about 4 mg per mL.

Assay preparation A— Dissolve 300 mg of Sodium Cetostearyl Sulfate in 50 mL of alcohol, and add 2 mL of the *Internal standard solution* and 48 mL of water. Extract the solution with four 25-mL portions of pentane, adding 10–15 mL of saturated sodium chloride solution, if necessary, to facilitate the separation of the layers. Combine the organic layers, and reserve the hydro-alcoholic layers for the preparation of *Assay preparations C* and *D.* Wash the organic layer with two 30-mL portions of water, dry over anhydrous sodium sulfate, and filter.

Assay preparation B— Dissolve 300 mg of Sodium Cetostearyl Sulfate in 50 mL of alcohol, and add 50 mL of water. Extract the solution with four 25-mL portions of pentane, adding 10 to 15 mL of saturated sodium chloride solution, if necessary, to facilitate the separation of the layers. Combine the organic layers, wash with two 30-mL portions of water, dry over anhydrous sodium sulfate, and filter.

Assay preparation C— Transfer 25 mL of the hydro-alcoholic solution obtained in the preparation of *Assay preparation A* to a 200-mL flask that can be fitted with a reflux condenser. Add 20 mL of hydrochloric acid and 10 mL of the *Internal standard solution,* and boil under reflux for 2 hours. Allow to cool. Extract with four 20-mL portions of pentane. Wash the combined organic layer with two 20-mL portions of water, dry over anhydrous sodium sulfate, and filter.

Assay preparation D— Transfer 25 mL of the hydro-alcoholic solution obtained in the preparation of *Assay preparation A* to a 200-mL flask that can be fitted with a reflux condenser. Add 20 mL of hydrochloric acid and 10 mL of alcohol, and boil under reflux for 2 hours. Allow to cool. Extract with four 20-mL portions of pentane. Wash the combined organic layer with two 20-mL portions of water, dry over anhydrous sodium sulfate, and filter.

Chromatographic system (see *Chromatography* ⟨ 621 ⟩)— The gas chromatograph is equipped with a flame-ionization detector, a 0.25-mm × 25-m fused silica capillary column that contains phase G2, and a split injection system with a split ratio of about 1:100. The carrier gas is nitrogen, flowing at a rate of 1 mL per minute. The column temperature is maintained at 150° at the time of injection, then programmed to increase at

a rate of 5° per minute to 250°, and maintained at 250° for the duration of the analysis. The injection port and detector temperatures are maintained at about 250°. Chromatograph the *Resolution solution,* and record the peak responses as directed for *Procedure:* the resolution, *R,* between cetyl alcohol and stearyl alcohol is not less than 4.0; and the relative standard deviation for replicate injections is not more than 1.5%.

Correction for interference— Inject about 1 µL of each of *Assay preparations A* and *B* into the chromatograph, record the chromatograms, and measure the areas for the major peaks. If the chromatogram of *Assay preparation B* shows a peak at the same retention time as the internal standard peak in the chromatogram of *Assay preparation A,* calculate the ratio, *r:*

$$r = S_{cb} / S_i,$$

in which S_{cb} is the area of the cetyl alcohol peak; and S_i is the area of the peak with the same retention time as the internal standard, respectively, in the chromatogram of *Assay preparation B.* If *r* is less than 300, calculate the corrected area, $S_{a(corr)}$, of the peak corresponding to the internal standard in the chromatogram of the *Assay preparation A:*

$$S_{a(corr)} = S_{ha} – (S_i \times S_{ca} / S_{cb}),$$

in which S_{ha} and S_{ca} are the areas of the internal standard peak and the cetyl alcohol peak, respectively, in the chromatogram of *Assay preparation A.*

Inject about 1 µL of each of *Assay preparations C* and *D* into the chromatograph, record the chromatograms, and measure the areas for the major peaks. Carry out the correction for interference in the same manner as for *Assay preparation A,* and calculate the corrected area, $S_{c(corr)}$, of the peak corresponding to the internal standard in the chromatogram of *Assay preparation C.*

Procedure— Inject equal volumes of the *Resolution solution* and *Assay preparations C* and *D* into the chromatograph, record the chromatograms, and measure the areas for the major peaks. The substances are eluted in the following order: cetyl alcohol, 1-heptadecanol (internal standard), and stearyl alcohol. Identify the cetyl alcohol and stearyl alcohol peaks in the chromatograms of the *Assay preparations* by comparison with the *Resolution solution.* Calculate the percentage of sodium cetyl sulfate in the portion of Sodium Cetostearyl Sulfate taken by the formula:

$$100A_c \times 1.421 \times W_{ch} /(S_{c(corr)} \times W_c),$$

in which A_c is the area of the cetyl alcohol peak in the chromatogram of *Assay preparation C;* W_{ch} is the weight of the internal standard, in mg, added in the preparation of *Assay preparation C;* and W_c is the weight, in mg, of Sodium Cetostearyl Sulfate taken to prepare *Assay preparation C,* calculated on the anhydrous basis.

Calculate the percentage of sodium stearyl sulfate in the portion of Sodium Cetostearyl Sulfate taken by the formula:

$$100\ B_c \times 1.377 \times W_{ch} /(S_{c(corr)} \times W_c),$$

in which B_c is the area of the stearyl alcohol peak in the chromatogram of *Assay preparation C;* and the other terms are as defined above.

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