Bentonite Magma

» Prepare Bentonite Magma as follows:

Bentonite	50 g
Purified Water, a sufficient quantity, to make	1000 g

Sprinkle the Bentonite, in portions, upon 800 g of hot purified water, allowing each portion to become thoroughly wetted without stirring. Allow it to stand with occasional stirring for 24 hours. Stir until a uniform magma is obtained, add Purified Water to make 1000 g, and mix.

The Magma may be prepared also by mechanical means such as by use of a blender, as follows. Place about 500 g of Purified Water in the blender, and while the machine is running, add the Bentonite. Add Purified Water to make up to about 1000 g or up to the operating capacity of the blender. Blend the mixture for 5 to 10 minutes, add Purified Water to make 1000 g, and mix.

Packaging and storage—Preserve in tight containers.

Microbial enumeration tests ⟨61⟩ **and Tests for specified microorganisms** ⟨62⟩**—**It meets the requirements of the test for absence of *Escherichia coli*.

Benzaldehyde

C_7H_6O 106.12
Benzaldehyde [100-52-7].

DEFINITION
Benzaldehyde contains NLT 98.0% and NMT 100.5% of C_7H_6O.

ASSAY
- **PROCEDURE**

Solution A: Dissolve 34.7 g of hydroxylamine hydrochloride in 160 mL of water, and dilute with alcohol to 1000 mL.

Sample solution: Transfer 1 mL of Benzaldehyde to a tared, glass-stoppered weighing bottle. Loosen the stopper, and transfer the weighing bottle and contents to a 250-mL conical flask containing 25 mL of *Solution A*. Rinse down the sides of the flask with 50 mL of *Solution A*. Allow to stand for 10 min, and add 1 mL of bromophenol blue TS.

Analysis: Titrate the liberated hydrochloric acid with 1 N sodium hydroxide VS to a light green endpoint. Perform a blank determination (see *Titrimetry, Residual Titrations* ⟨541⟩). Each mL of 1 N sodium hydroxide is equivalent to 106.1 mg of C_7H_6O.

Acceptance criteria: 98.0%–100.5%

IMPURITIES
- **LIMIT OF HYDROCYANIC ACID**

Sample solution: Shake 0.5 mL of Benzaldehyde with 5 mL of water, add 0.5 mL of 1 N sodium hydroxide and 0.1 mL of ferrous sulfate TS, and warm the mixture gently.

Acceptance criteria: Upon the addition of a slight excess of hydrochloric acid, no greenish-blue color or blue precipitate is produced within 15 min.

- **LIMIT OF NITROBENZENE**

Sample solution: Dissolve 1 mL of Benzaldehyde in 20 mL of alcohol, and mix with 10 mL of water.

Analysis: Add 1-g portions of zinc and 1-mL portions of 2 N sulfuric acid, as needed, to maintain a brisk evolution of hydrogen for 1 h. Filter, evaporate the liquid to 20 mL, and boil 10 mL of the concentrated liquid with 1 drop of potassium dichromate TS.

Acceptance criteria: No purplish color is produced.

- **CHLORINATED COMPOUNDS**

Analysis: Wind a strip of 20-mesh copper gauze 1.5-cm wide and 5-cm long around the end of a copper wire. Heat the gauze in the nonluminous flame of a Bunsen burner until it glows without coloring the flame green. Permit the gauze to cool, and heat several times until a thick coat of oxide has formed. With a medicine dropper, apply 2 drops of Benzaldehyde to the cooled gauze, ignite, and permit it to burn freely in the air. Again cool the gauze, add 2 more drops of Benzaldehyde, and burn as before. Repeat this process until a total of 6 drops have been added and ignited. Then hold the gauze in the outer edge of the Bunsen flame, adjusted to a height of 4 cm.

Acceptance criteria: Not even a transient green color is imparted to the flame.

SPECIFIC TESTS
- **SPECIFIC GRAVITY** ⟨841⟩**:** 1.041–1.046 at 25°
- **REFRACTIVE INDEX** ⟨831⟩**:** 1.544–1.546 at 20°

ADDITIONAL REQUIREMENTS
- **PACKAGING AND STORAGE:** Preserve in well-filled, tight, light-resistant containers.

Compound Benzaldehyde Elixir

» Compound Benzaldehyde Elixir contains 0.05 percent Benzaldehyde in a suitably flavored and sweetened hydroalcoholic vehicle.

Packaging and storage—Preserve in tight, light-resistant containers.

Alcohol content, *Method I* ⟨611⟩: between 3.0% and 5.0% of C_2H_5OH.

Benzalkonium Chloride

Ammonium, alkyldimethyl(phenylmethyl)-, chloride; Alkylbenzyldimethylammonium chloride [8001-54-5].

DEFINITION
Benzalkonium Chloride is a mixture of alkylbenzyldimethylammonium chlorides of the general formula:

$$[C_6H_5CH_2N(CH_3)_2R]Cl$$

in which R represents a mixture of alkyls, including all or some of the group beginning with n-C_8H_{17} and extending through higher homologs, with n-$C_{12}H_{25}$, n-$C_{14}H_{29}$, and n-$C_{16}H_{33}$ composing the major portion. On the anhydrous basis, the content of the n-$C_{12}H_{25}$ homolog is NLT 40.0%, and the content of the n-$C_{14}H_{29}$ homolog is NLT 20.0% of the total alkylbenzyldimethylammonium chloride content. The amount of the n-$C_{12}H_{25}$ and n-$C_{14}H_{29}$ homolog components together is NLT 70.0% of the total alkylbenzyldimethylammonium chloride content. The total alkylbenzyldimethylammonium chloride content, calculated on the anhydrous basis, with allowance

made for the amount of residue on ignition, is NLT 97.0% and NMT 103.0% of $[C_6H_5CH_2N(CH_3)_2R]Cl$.

IDENTIFICATION

- **A. PROCEDURE**

Analysis: To 2 mL of a solution (1 in 100) add 1 mL of 2 N nitric acid.

Acceptance criteria: A white precipitate is formed, and it is dissolved after adding 5 mL of alcohol.

- **B. PROCEDURE**

Analysis: Dissolve 200 mg in 1 mL of sulfuric acid, add 100 mg of sodium nitrate, and heat on a steam bath for 5 min. Cool, dilute with water to 10 mL, add 500 mg of zinc dust, and warm for 5 min on a steam bath. To 2 mL of the clear supernatant, add 1 mL of sodium nitrite solution (1 in 20), cool in ice water, and then add 3 mL of a solution of 500 mg of 2-naphthol in 10 mL of 6 N ammonium hydroxide.

Acceptance criteria: An orange-red color is produced.

- **C. IDENTIFICATION TESTS—GENERAL,** *Chloride* ⟨**191**⟩**:** The solution in a mixture of equal volumes of water and alcohol meets the requirements of the tests.
- **D.** The retention times of the major peaks for benzalkonium chloride in the *Sample solution* correspond to those of the *Standard solution*, as obtained in the test for *Ratio of Alkyl Components*.

ASSAY

- **RATIO OF ALKYL COMPONENTS**

Solution A: Adjust a 0.1 M solution of sodium acetate with glacial acetic acid to a pH of 5.0.

Mobile phase: Acetonitrile and *Solution A* (9:11). Acetonitrile and *Solution A* may be adjusted from (2:3) to (3:2) to meet system suitability requirements.

Standard solution: 4 mg/mL of Benzalkonium Chloride, prepared from USP Benzalkonium Chloride RS and water.

Sample solution: 4 mg/mL of Benzalkonium Chloride

Chromatographic system

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

Mode: LC

Detector: UV 254 nm

Column: 3.9-mm × 30-cm; packing L10, or 4.6-mm × 25-cm; 10-µm packing L10

Flow rate: 2 mL/min

Injection size: 20 µL

System suitability

Sample: *Standard solution*

[NOTE—See the relative retention times in the table below. Relative retention times are provided for information only, and the standard should be used to ensure appropriate peak identification.]

Name	Relative Retention Time
C_{10} homolog	0.9
C_{12} homolog	1.0
C_{14} homolog	1.3
C_{16} homolog	1.7

Suitability requirements

Resolution: NLT 1.5 between the C_{12} and C_{14} peaks

Relative standard deviation: NMT 2.0% from the C_{12} peak

Analysis

Samples: *Standard solution* and *Sample solution*

Identify the homolog peaks by comparison of the retention times with those from the *Standard solution*.

Calculate the percentage of each quaternary ammonium homolog taken:

$$\text{Result} = \frac{r_U \times M_r}{\sum_i (r_U \times M_r)} \times 100$$

r_U = area of the peak due to a given homolog in the chromatogram from the *Sample solution*

M_r = molecular weight of a given homolog. The molecular weights of C_{10}, C_{12}, C_{14}, and C_{16} homologs are 312, 340, 368, and 396, respectively.

Acceptance criteria: On the anhydrous basis, the content of the *n*-$C_{12}H_{25}$ homolog is NLT 40.0%, and the content of the *n*-$C_{14}H_{29}$ homolog is NLT 20.0% of the total alkylbenzyldimethylammonium chloride content. The amount of the *n*-$C_{12}H_{25}$ and *n*-$C_{14}H_{29}$ homolog components together is NLT 70.0% of the total alkylbenzyldimethylammonium chloride content.

- **TOTAL ALKYLBENZYLDIMETHYLAMMONIUM CHLORIDES**

Sample: Weigh a quantity of Benzalkonium Chloride equivalent to 500 mg of anhydrous benzalkonium chloride.

Analysis: Transfer the *Sample*, with the aid of 35 mL of water, to a glass-stoppered, 250-mL conical separator containing 25 mL of methylene chloride. Add 10 mL of 0.1 N sodium hydroxide, and 10.0 mL of freshly prepared potassium iodide solution (1 in 20), insert the stopper into the separator, shake, allow the layers to separate, and discard the methylene chloride layer. Wash the aqueous layer with three 10-mL portions of methylene chloride, and discard the washings. Transfer the aqueous layer to a glass-stoppered, 250-mL conical flask, and rinse the separator with three 5-mL portions of water, adding the washings to the flask. Add 40 mL of cold hydrochloric acid to the flask, mix, and titrate with 0.05 M potassium iodate VS until the solution becomes light brown in color. Add 5 mL of methylene chloride, insert the stopper into the flask, and shake vigorously. Continue the titration, dropwise, with shaking after each addition, until the methylene chloride layer becomes colorless and the aqueous layer is clear yellow. Record the titrant volume, V_t (mL). Perform a blank determination, using 20 mL of water as the sample, and record the titrant volume, V_b (mL). [NOTE—$V_b > V_t$.] The difference between the two titrations represents the amount of potassium iodate equivalent to the weight of benzalkonium chloride in the sample. Each mL of 0.05 M potassium iodate is equivalent to x/10 mg of benzalkonium chloride, where x represents the average molecular weight of the sample, derived by summing, for all homologs, the products:

$$\text{Result (x)} = \sum_i \left[(r_U / r_T) \times M_r \right]$$

r_U = area of the peak produced by a given homolog in the chromatogram from the *Ratio of Alkyl Components* test

r_T = sum of the peak areas for all homologs in the chromatogram from the *Ratio of Alkyl Components* test

M_r = molecular weight of a given homolog. The molecular weights of the C_{10}, C_{12}, C_{14}, and C_{16} homologs are 312, 340, 368, and 396, respectively.

Acceptance criteria: 97.0%–103.0% on the anhydrous basis

IMPURITIES

Inorganic Impurities

- **RESIDUE ON IGNITION** ⟨**281**⟩**:** NMT 2.0%

Organic Impurities

- **PROCEDURE 1: LIMIT OF AMINES AND AMINE SALTS**

Sample: 5.0 g of Benzalkonium Chloride

Analysis and **Acceptance criteria:** Dissolve the *Sample* with heating carefully e.g., on top of a steam bath with water as the steam source in 20 mL of a mixture of methanol and 1 N hydrochloric acid VS (97:3). [NOTE—However, the mixed solution must not reach the boiling point.] Add 100 mL of isopropyl alcohol. Pass a stream of nitrogen slowly through the solution. Gradually add 12.0 mL of 0.1 N tetrabutylammonium hydroxide VS, while recording the potentiometric titration curve. If the curve shows two

inflection points, the volume of titrant added between the two points is NMT 5.0 mL, corresponding to NMT 0.1 mmol/g of amines and amine salts. If the curve shows no point of inflection, the substance being examined does not comply with the test. If the curve shows one point of inflection, repeat the test, but add 3.0 mL of a 25.0 mg/mL solution of dimethyldecylamine in isopropyl alcohol before the titration. If after addition of 12.0 mL of the titrant, the titration curve shows only one point of inflection, the substance being examined does not comply with the test.

- **PROCEDURE 2: LIMIT OF BENZYL ALCOHOL, BENZALDEHYDE, AND (CHLOROMETHYL)BENZENE**

[NOTE—Prepare the solutions immediately before use.]

Solution A: Dissolve 1.09 g of sodium 1-hexanesulfonate and 6.9 g of monobasic sodium phosphate in water in a 1000-mL volumetric flask, adjust with phosphoric acid to a pH of 3.5, and dilute with water to volume.

Solution B: Methanol

Mobile phase: See the gradient table below.

Time (min)	Solution A (%)	Solution B (%)
0	80	20
10	80	20
14	50	50
35	50	50
36	20	80
55	20	80
56	80	20
65	80	20

Standard solution A: 0.25 mg/mL of USP Benzyl Alcohol RS in methanol

Standard solution B: 0.075 mg/mL of USP Benzaldehyde RS in methanol

Standard solution C: 0.025 mg/mL of USP Benzyl Alcohol RS in methanol, prepared from *Standard solution A* and methanol

Sample solution: 50 mg/mL of Benzalkonium Chloride in methanol

Chromatographic system

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

Mode: LC

Detector: UV 210 nm for benzyl alcohol and (chloromethyl)benzene; UV 257 nm for benzaldehyde

Column: 4.6-mm × 15-cm analytical column; 5-µm packing L1

Column temperature: 30°

Flow rate: 1.0 mL/min

Injection size: 20 µL

System suitability

Samples: *Standard solution A*, *Standard solution B*, *Standard solution C*, and *Sample solution*

[NOTE—See the relative retention times in the table below.]

Name	Relative Retention Time
Benzyl alcohol	1.0
Benzaldehyde	1.3
(Chloromethyl)benzene	2.4

Suitability requirements

Relative standard deviation: NMT 5.0% for the benzyl alcohol peak, *Standard solution A*

Signal-to-noise ratio: NLT 10 for the principal peak in the chromatogram, *Standard solution C*

Analysis

Samples: *Standard solution A*, *Standard solution B*, *Standard solution C*, and *Sample solution*

To calculate the content of (chloromethyl)benzene, multiply the peak area of (chloromethyl)benzene by 1.3. [NOTE—The correction factor is used due to baseline shift.]

Acceptance criteria

Benzyl alcohol: The response of the benzyl alcohol peak from the *Sample solution* is NMT that of the benzyl alcohol peak from the *Standard solution A*, corresponding to NMT 0.5%.

Benzaldehyde: The response of the benzaldehyde peak from the *Sample solution* is NMT that of the benzaldehyde peak from *Standard solution B*, corresponding to NMT 0.15%.

(Chloromethyl)benzene: The response of the (chloromethyl)benzene peak from the *Sample solution* is NMT 0.1 times that of the principal peak in the chromatogram from *Standard solution A*, corresponding to NMT 0.05%.

SPECIFIC TESTS

- **ACIDITY OR ALKALINITY**

Sample: 0.5 g of Benzalkonium Chloride

Analysis: Dissolve the *Sample* in water, dilute with water to 50 mL, and mix. Add 0.1 mL of bromocresol purple TS.

Acceptance criteria: NMT 0.1 mL of 0.1 N hydrochloric acid or 0.1 N sodium hydroxide is required to change the color of the indicator.

- **WATER DETERMINATION,** *Method I* ⟨**921**⟩**:** NMT 15.0%
- **WATER-INSOLUBLE MATTER:** A solution (1 in 10) is free from turbidity and insoluble matter.

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in tight containers. No storage requirements specified.
- **USP REFERENCE STANDARDS** ⟨**11**⟩

USP Benzalkonium Chloride RS
USP Benzyl Alcohol RS
USP Benzaldehyde RS

Benzalkonium Chloride Solution

DEFINITION

Benzalkonium Chloride Solution contains NLT 95.0% and NMT 105.0% of the labeled amount of benzalkonium chloride in a solution that has a concentration of 1.0% or more; and NLT 93.0% and NMT 107.0% of the labeled amount in a solution that has a concentration of less than 1.0%. It may contain a suitable coloring agent and may contain NMT 10% of alcohol.

[**CAUTION–**Mixing Benzalkonium Chloride Solution with ordinary soaps and with anionic detergents may decrease or destroy the bacteriostatic activity of the Solution.]

IDENTIFICATION

- **A. PROCEDURE**

Analysis: Add 1 mL of 2 N nitric acid to 2 mL of a solution having an equivalent to 10 mg/mL of benzalkonium chloride.

Acceptance criteria: A white precipitate is formed, and it is dissolved after adding 5 mL of alcohol.

- **B. IDENTIFICATION TESTS—GENERAL,** *Chloride* ⟨**191**⟩**:** A solution of it in a mixture of equal volumes of water and alcohol meets the requirements.
- **C. PROCEDURE**

Analysis: Dissolve the residue obtained by evaporating on a steam bath, a volume of Solution equivalent to 200 mg of benzalkonium chloride in 1 mL of sulfuric acid, add 100 mg of sodium nitrate, and heat on a steam bath for 5 min. Cool, dilute with water to 10 mL, add 500 mg of zinc dust, and warm for 5 min on a steam bath. To 2 mL of the clear supernatant add 1 mL of sodium nitrite solution (1 in 20),