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Pentasodium triphosphate

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Pentasodium triphosphate

Revised specifications prepared at the 96th JECFA (2023) and published in FAO monograph 31 (2023) superseding specifications prepared at the 55th JECFA (2000). No ADI was established, but a group MTDI of 70 mg/kg bw, expressed as phosphorus from all food sources, was established at the 26th JECFA (1982).

SYNONYMS Pentasodium tripolyphosphate, Sodium triphosphate, Sodium tripolyphosphate, Triphosphate; INS No. 451(i)

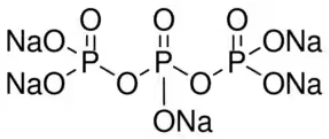
DEFINITION

Chemical names: Pentasodium triphosphate, pentasodium tripolyphosphate

C.A.S. number: 7758-29-4 (anhydrous); 15091-98-2 (hexahydrate)

Chemical formula: $Na_5P_3O_{10} \times H_2O$ (x = 0 or 6)

Structural formula



Formula weight: Anhydrous: 367.86
Hexahydrate: 475.94

Assay: Anhydrous: not less than 85% of $Na_5P_3O_{10}$; not less than 56% and not more than 59% of P_2O_5

Hexahydrate: not less than 65% of $Na_5P_3O_{10}$; not less than 43% and not more than 45% of P_2O_5

DESCRIPTION White, slightly hygroscopic granules or powder

FUNCTIONAL USES Sequestrant, texturizer

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4): Freely soluble in water; insoluble in ethanol

pH (Vol. 4): 9.1-10.2 (1% solution)

Test for phosphate (Vol. 4): Passes test

Test for sodium (Vol. 4): Passes test

PURITY

Loss on drying (Vol. 4)	Anhydrous: not more than 0.7% (105 °C, 1 h) Hexahydrate: not more than 23.5% (60 °C, 1 h, followed by 105 °C, 4 h)
Water-insoluble matter (Vol. 4)	Not more than 0.1%
Higher polyphosphates	Not detectable See description under TESTS
Fluoride (Vol. 4)	Not more than 50 mg/kg (Method I or III)
Arsenic (Vol. 4)	Not more than 3 mg/kg (Method II)
Lead (Vol. 4)	Not more than 2 mg/kg Determine using an atomic absorption technique appropriate to the specified level. The selection of sample size and method of sample preparation may be based on the principles of the method described in Volume 4, “Instrumental Methods”.

TESTS

Higher polyphosphates

Chromatographic solvent
Mix 75 ml of isopropanol, 10 ml of water, 20 ml of 20% trichloroacetic acid and 0.3 ml of 20% ammonia. Make fresh on a weekly basis.

Chromatographic spray
Dissolve 1 g of ammonium molybdate in 85 ml of water, 10 ml of 1 N hydrochloric acid and 5 ml of 60% perchloric acid.

Sample solution
Dissolve 1 g of the sample in 50 ml of water.

Reference solution
Dissolve 1 g of the pentasodium triphosphate standard in 50 ml of water.

Procedure
Place 0.01 ml of the sample solution and 0.01 ml of reference solution on the starting line of the chromatographic paper and allow to dry in a stream of warm air. Use ascending chromatography at 18-20 °C until the solvent has ascended about 25 cm from the starting line (12-15 h). Dry at 60 °C in an oven and spray with the chromatographic spray. Place the paper under an ultraviolet lamp and irradiate until the phosphates are visible as blue spots (about 2 min).

Three spots (one from the monophosphate (R_f = 0.69), a second from the diphosphate (R_f = 0.44) and the third from the triphosphate (R_f = 0.29) are observed, and no other spot is observed.

METHOD OF ASSAY

1.Determination of $Na_5P_3O_{10}$

Reagents and solutions

- Potassium acetate buffer (pH 5.0): Dissolve 78.5 g of potassium acetate for 15 to 20 min. Add methyl orange TS and neutralize the solution with stronger ammonia TS. Add 1 g of ammonium nitrate crystals, stir to dissolve, and cool. Add 15 ml of ammonium molybdate TS, with stirring, and stir vigorously for 3 min or allow to stand with occasional stirring for 10 to 15 min. Filter the contents of the beaker with suction through a 6-7 mm paper pulp filter pad supported in a 25 mm porcelain disk. The filter pad should be covered with a suspension of a filtering aid. After the contents of the beaker have been transferred to the filter, wash the beaker with five 10 ml portions of a 1% solution of sodium or potassium nitrate, passing the washings through the filter, then wash the filter with five 5-ml portions of the wash solution. Return the filter pad and the precipitate to the beaker, wash the funnel thoroughly with water into the beaker, and dilute to about 150 ml. Add 0.1 N sodium hydroxide from a buret until the yellow precipitate is dissolved, then add 5 to 8 ml in excess. Add phenolphthalein TS and titrate the excess alkali with 0.1 N nitric acid. Finally, titrate with 0.1 N sodium hydroxide to the first appearance of the pink colour. The difference between the total volume of 0.1 N sodium hydroxide added and the volume of nitric acid required represents the volume, V, in ml, of 0.1 N sodium hydroxide consumed by the phosphomolybdate complex.

Calculate the $Na_5P_3O_{10}$ content of the sample in % by the formula

$$\%Na_5P_3O_{10} = \frac{0.533 \times 25 \times V}{\mathrm{a}} \times 100$$

where

a = the weight of the sample (mg)

V= Volume of 0.1 N sodium hydroxide consumed by the phosphomolybdate complex

2.Determination of P_2O_5

Accurately weigh about 20 g of the sample into a beaker. Add 150 ml water and 20 ml concentrated nitric acid. Introduce anti-bumping granules, cover the beaker with a watch glass and boil gently for 1 h. Cool to room temperature. Quantitatively transfer the solution to a 500-ml volumetric flask, dilute with water, mix well and dilute to the mark with water. Transfer 20.0 ml of the solution to a plastic beaker, dilute to about 50 ml with water and place the beaker in an automatic titrator equipped with a pH meter. Adjust the pH of the solution to between 2.5 and 2.8 with 5 mol/l sodium hydroxide. Titrate the solution with 0.5 mol/l sodium hydroxide. Record the consumed volumes at the inflection points at about pH 4 (V1) and about pH 9 (V2).

Calculate the P_2O_5 content of the sample in % by the formula

$$\%\ P_2O_5 = \left[\frac{V2-V1}{2000}\right] x\ f\ x\ 70.97\ x\ \left(\frac{500}{20}\right) x\ (\frac{100}{w}) = \left[\frac{V2-V1}{w}\right] x\ f\ x\ 88.7$$

where
w = weight of the sample (g)
f = factor of 0.5 mol/l sodium hydroxide (= actual molarity/0.5)