PENTAPOTASSIUM TRIPHOSPHATE

Prepared at the 29th JECFA (1985), published in FNP 34 (1986) and in FNP 52 (1992). Metals and arsenic specifications revised at the 63rd JECFA (2004). A group MTDI of 70 mg/kg bw, as phosphorus from all food sources, was established at the 26th JECFA (1982)

SYNONYMS Pentapotassium tripolyphosphate, potassium triphosphate, potassium tripolyphosphate; INS No. 451(ii)

DEFINITION

Chemical names	Pentapotassium triphosphate, pentapotassium tripolyphosphate
C.A.S. number	13845-36-8
Chemical formula	$K_5O_{10}P_3$
Formula weight	448.42
Assay	Not less than 85% of $K_5O_{10}P_3$ on the dried basis, the remainder being principally other potassium phosphates

DESCRIPTION Hygroscopic white granules or powder

FUNCTIONAL USES Texturizer

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4)	Very soluble in water
pH (Vol. 4)	9.2 - 10.1 (1 in 100 soln)
Test for phosphate (Vol. 4)	Passes test
Test for potassium (Vol. 4)	Passes test

PURITY

Water insoluble matter (Vol. 4)	Not more than 2%
Loss on ignition (Vol. 4)	Not more than 0.4% after drying (105°, 4 h), followed by ignition at 550° for 30 min.
P_2O_5 content	Not less than 46.5% and not more than 48.0% Proceed as directed in the *Phosphate Determination as P_2O_5* using about 1.5 g of the dried sample accurately weighed
Fluoride	Not more than 10 mg/kg

See description under TESTS

Arsenic (Vol. 4) — Not more than 3 mg/kg (Method II)

Lead (Vol. 4) — Not more than 4 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

PURITY TESTS

Fluoride

Place 5 g of the sample, 25 ml of water, 50 ml of perchloric acid, 5 drops of silver nitrate solution (1 in 2), and a few glass beads in a 250-ml distilling flask connected with a condenser and carrying a thermometer and a capillary tube, both of which must extend into the liquid. Connect a small dropping funnel, filled with water, or a steam generator to the capillary tube. Support the flask on an asbestos mat with a hole which exposes about one-third of the flask to the flame. Distil into a 250-ml flask until the temperature reaches 135^{o}. Add water from the funnel or introduce steam through the capillary to maintain the temperature between 135 and 140^{o}. Continue the distillation until 225-240 ml has been collected, then dilute to 250 ml with water, and mix. Place a 50-ml aliquot of this solution in a 100-ml Nessler tube. In another similar Nessler tube place 50 ml of water as a control. Add to each tube 0.1 ml of a filtered solution of sodium alizarin-sulfonate (1 in 1000) and 1 ml of freshly prepared hydroxylamine hydrochloride solution (1 in 4000), and mix well. Add, dropwise, and with stirring, 0.05 N sodium hydroxide to the tube containing the distillate until its colour just matches that of the control, which is faintly pink. Then add to each tube exactly 1 ml of 0.01 N hydrochloric acid, and mix well. From a buret, graduated in 0.05 ml, add slowly to the tube containing the distillate enough thorium nitrate solution (1 in 4000) so that, after mixing, the colour of the liquid just changes to a faint pink. Note the volume of the solution added, add exactly the same volume to the control, and mix. Now add to the control sodium fluoride TS (10 µg, F per ml) from a buret to make the colours of the two tubes match after dilution to the same volume. Mix well, and allow all air bubbles to escape before making the final drops of sodium fluoride TS to the control. A distant change in colour should take place. Note the volume of sodium fluoride added. The volume of sodium fluoride TS required for the control solution should not exceed 10 ml.

METHOD OF ASSAY

Reagents and Solutions
- Potassium acetate buffer (pH 5.0): Dissolve 78.5 g of potassium acetate in 1000 ml of water. and adjust the pH of the solution to 5.0 with acetic acid. Add a few mg of mercuric iodide to inhibit mould growth.
- 0.3 M Potassium chloride: Dissolve 22.35 g of potassium chloride in water, add 5 ml of potassium acetate buffer, dilute with water to 1000 ml, and mix. Add a few mg of mercuric iodide.
- 0.6 M Potassium chloride: Dissolve 44.7 g of potassium chloride in water, add 5 ml of potassium acetate buffer, dilute with water to 1000 ml, and mix. Add a few mg of mercuric iodide.

- 1 M Potassium chloride: Dissolve 74.5 g of potassium chloride in water, add 5 ml of potassium acetate buffer, dilute to 1000 ml with water, and mix. Add a few mg of mercuric iodide.

Chromatographic Column:
Use a standard chromatographic column 20 to 40 cm in length, 20 to 28 cm in inside diameter, with a sealed-in, coarse porosity fritted disk. If a stopcock is not provided, attach a stopcock having a 3 to 4 mm, diameter bore to the outlet of the column with a short length of flexible vinyl tubing.

Procedure:
Close the column stopcock, fill the space between the fritted disk and the stopcock with water, and connect a vacuum line to the stopcock. Prepare a 1:1 water slurry of Dowex F x 8, or equivalent, chloride form, 100-200 or 200-400 mesh, styrenedivinylbenzene ion exchange resin, and decant off any fine particles and any foam. Do this two or three times or until no more finely suspended material or foaming is observed. Fill the column with the slurry, and open the stopcock to allow the vacuum to pack the resin bed until the water level is slightly above the top of the resin, then immediately close the stopcock. Do not allow the liquid level to fall below the resin level at any time. Repeat this procedure until the packed resin column is 15 cm above the fritted disk. Place one circle of tightly fitting fiber filter paper on top of the resin bed, then place a perforated polyethylene disk on top of the paper. Alternatively, a loosely packed plug of glass wool may be placed on top of the bed. Close the top of the column with a rubber stopper in which a 7.6 cm length of capillary tubing (1.5 mm i.d., 7 mm 0.d.) has been inserted through the centre, so that about 12 mm of the tubing extends through the bottom of the stopper. Connect the top of the capillary tubing to the stem of a 500 ml separator with flexible vinyl tubing, and clamp the separator to a ring stand above the column. Wash the column by adding 100 ml of water to the separator with all stopcocks closed. First open the separator stopcock, then open the column stopcock. The rate of flow should be about 5 ml per min. When the separator is empty, close the stopcock on the column then close the separator stopcock.
Transfer about 500 mg of the sample previously dried at 105º for 4 h and accurately weighed, into a 250 ml volumetric flask, dissolve and dilute to volume with water, and mix. Transfer 10 ml of this solution into the separator, open both stopcocks and allow the solution to drain into the column, rinsing the separator with 20 ml of water. Discard the eluate. Add 370 ml of 0.3 M Potassium Chloride to the separator, and allow this solution to pass through the column, discarding the eluate. Add 250 ml of 0.6 M Potassium Chloride to the column, allow the solution to pass through the column, and receive the eluate in a 400 ml beaker. (To ensure a clean column for the next run, pass 100 ml of 1 M Potassium Chloride through the column, followed by 100 ml of water. Discard all washings.) To the beaker add 15 ml of nitric acid, mix, and boil 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 infusorial earth. After the contents of the beaker have been transferred to

the filter, wash the beaker with five 10 ml portions of a 1 in 100 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 quantity, in mg, of $K_5O_{10}P_3$ in the sample taken by the formula 0.650 x 25V.