DISCRETE ANALYZER CHEMISTRY

o-Phospate (PO_4^{-3}) Method

Methods Referenced

- Standard Methods 4500-PO_4^{-3} E — *Automated Ascorbic Acid Reduction Method*
- EPA Method 365.1 Rev 2.0 — *Colorimetric, Automated, Ascorbic Acid*

Reagent Composition

Two reagents are used for the PO_4^{-3} method:

- Reagent 1, DA-PO4-ASCORBIC, is 15 g/L Ascorbic acid in DI water.
- Reagent 2, DA-PO4-COLOR, is made from two separate sub-solutions combined in dilute sulfuric acid:
  - Sub-solution 1: 3 g/L Potasssium antimonyl tartrate in DI water
  - Sub-solution 2: 40 g/L Ammonium molybdate in DI water

Final Concentrations are as follows:

DA-PO4-ASCORBIC

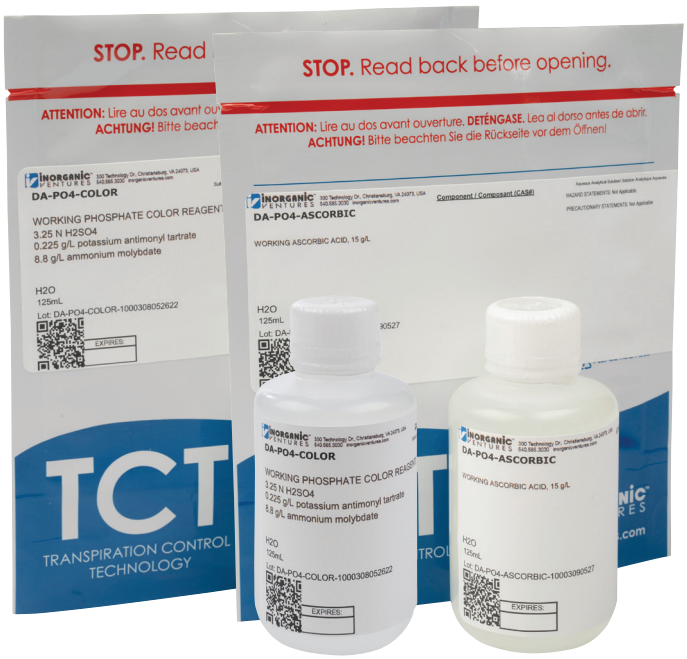
15 g/L Ascorbic acid

DA-PO4-COLOR

0.225 g/L Potassium antimonyl tartrate

8.8 g/L Ammonium molybdate

3.25 N Sulfuric acid



Chemical Reactions

Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The color is proportional to the phosphorus concentration.

Note: The stoichiometry of these reaction is still in question, but the paper, *The molybdenum blue reaction for the determination of orthophosphate revisited: Opening the black box* by EA Nagul, goes into more detail about the formation of the blue color used for this analysis. This paper gives the following equations and mentions that the presence of antimony speeds up the formation of the blue color.

$$PO_4^{-3} + 12MoO_4^{-2} + 27H^+ \rightarrow H_3PO_4(MoO_3)_{12} + 12H_2O$$

$$H_3PMo(VI)_{12}O_{40} + \text{Reductant} \rightarrow [H_4PMo(VI)_8Mo(V)_4O_{40}]^{-3}$$

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