

ChemScan[®]

PROCESS ANALYZERS

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ChemScan[®] Method Summary #132 Poly-Phosphorous

Phosphorous Analysis Classifications

Phosphorous analysis can be classified by the type of preprocessing performed on a sample. Phosphorous may be found in several forms in water or wastewater, including dissolved form (orthophosphate), inorganic form (reactive plus condensed or acid hydrolyzable phosphate) and organically bound forms. Total Phosphorous is the sum of reactive, condensed and organic phosphorous. A significant fraction of condensed and organic phosphorous in treated wastewater represents phosphorous after chemical or biological treatment, available for removal by sedimentation or filtration.

Water utilities and industrial water treatment programs use a variety of phosphate products to control scale and corrosion within the water system. Phosphate also is used to sequester specific metal ions, which may present a health problem or result in poor water quality. Products can be classified as either orthophosphates or polyphosphates (molecularly dehydrated phosphate). Although polyphosphates tend to revert to an orthophosphate form in water, the rate of reversion is very slow in pure water. The reversion rate can be accelerated as pH is lowered, as water temperature is increased and also with exposure to intense uv light. Several hours to days are required for complete reversion at normal water distribution system temperatures and at neutral to high pH. Reversion can be reduced to a few minutes with exposure to uv light and low pH.

Certain organic phosphate products (phosphonates) will rapidly revert to orthophosphate upon exposure to intense uv light for a short period of time (minutes).

ChemScan Analysis Methods

ChemScan uses a vanadomolybdate reagent to detect the available inorganic phosphorous in water. ASA also has used a ferric method that will respond to all phosphorous present that is available to sequester metal ions.

The vanadomolybdate method will detect the orthophosphate fraction of inorganic phosphorous in water plus any forms of phosphate converted to orthophosphate prior to analysis. Vanadomolybdate does not respond to polyphosphates but, because of the acidic nature of the method, will tend to redissolve any particulate or colloidal phosphate in the sample. (See ChemScan Method Summary #40, Ortho Phosphorous)

Subtraction of the ChemScan results using a total phosphorous method from the results using an ortho-phosphorous method can be used under certain conditions with recalculation of results as P to results as PO₄ to provide a determination of polyphosphate under the following general formula:

$$\text{Total phosphate} - \text{orthophosphate} = \text{polyphosphate}$$

Apparatus

A ChemScan Process Analyzer can be used to detect total phosphate or orthophosphate. A ChemScan analyzer can also detect total, ortho and poly phosphate fractions using a combination of methods.

Although filtration of water samples is not required for analysis, some fraction of phosphate present may be in the form of precipitates or coagulated products from prior treatment steps. Acidification of the sample by ChemScan prior to analysis will hydrolyze these substances making the bound phosphate available for analysis. Acid hydrolysis may also convert some polyphosphate present into orthophosphate form and should therefore not be performed when the exact form of phosphate is important or if only the amount of phosphate available to sequester metal ions is to be measured.