

Method Abstract

Scope This method is used for the determination of orthophosphate in drinking water, surface water, and domestic and industrial wastes according to USEPA Method 365.1 and Standard Methods 4500–P F. This method can also be used for the determination of orthophosphate in saline water and potassium chloride (KCl) extracts of soils and plants. Additionally, this method enables orthophosphate analysis according to ISO method 15681–2.

Summary Orthophosphate reacts with molybdenum(VI) and antimony(III) in an acidic solution to form an antimony-phosphomolybdate complex. This complex is subsequently reduced with ascorbic acid to form a blue color, and the absorbance is measured at 660 nm.

Interferences Filter turbid samples prior to analysis. Samples containing iron, copper, or silicate at concentrations greater than 50, 10, and 10 mg/L, respectively, interfere with this assay. The salt error for 5–20% salt samples was less than 1%. Although often at low concentrations, arsenate can cause a positive interference. Samples with background absorbance at the analytical wavelength may interfere. Residual phosphate in the flow system components and from continuous phosphate analysis may interfere. Wash the system and glassware with diluted HCl to correct phosphate interferences.

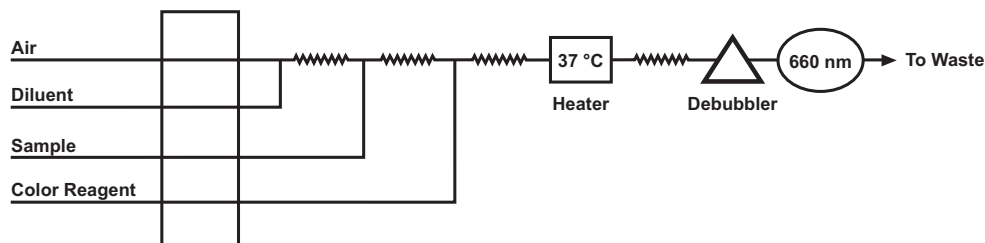
Performance Specifications

Range:	0.01–2.0 mg/L
Throughput:	45 samples/hour
Precision (at 0.10 mg/L):	<2% RSD
Precision (at 1.0 mg/L):	<1% RSD
Method Detection Limit (MDL):	0.001 mg/L
Accuracy:	98.98%

Chemicals

Ammonium Molybdate Tetrahydrate, $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$	DOWFAX® 2A1
Antimony Potassium Tartrate, $\text{K}(\text{SbO})\text{C}_4\text{H}_4\text{O}_6 \cdot \frac{1}{2}\text{H}_2\text{O}$	Hydrochloric Acid, concentrated, HCl
Ascorbic Acid, $\text{C}_6\text{H}_8\text{O}_6$	Potassium Phosphate Monobasic, KH_2PO_4
Deionized (DI) Water, ASTM Type I or II	Sodium Hydroxide, NaOH
	Sulfuric Acid, concentrated, H_2SO_4

Basic Flow Diagram



Selected Reference

Methods for the Determination of Inorganic Substances in Environmental Samples; EPA/600/R-93/100; U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory: Cincinnati, OH, 1993; Method 365.1.

Standard Methods for the Examination of Water and Wastewater, 21st ed.; American Public Health Association: Washington, D. C., 2005.

Figures

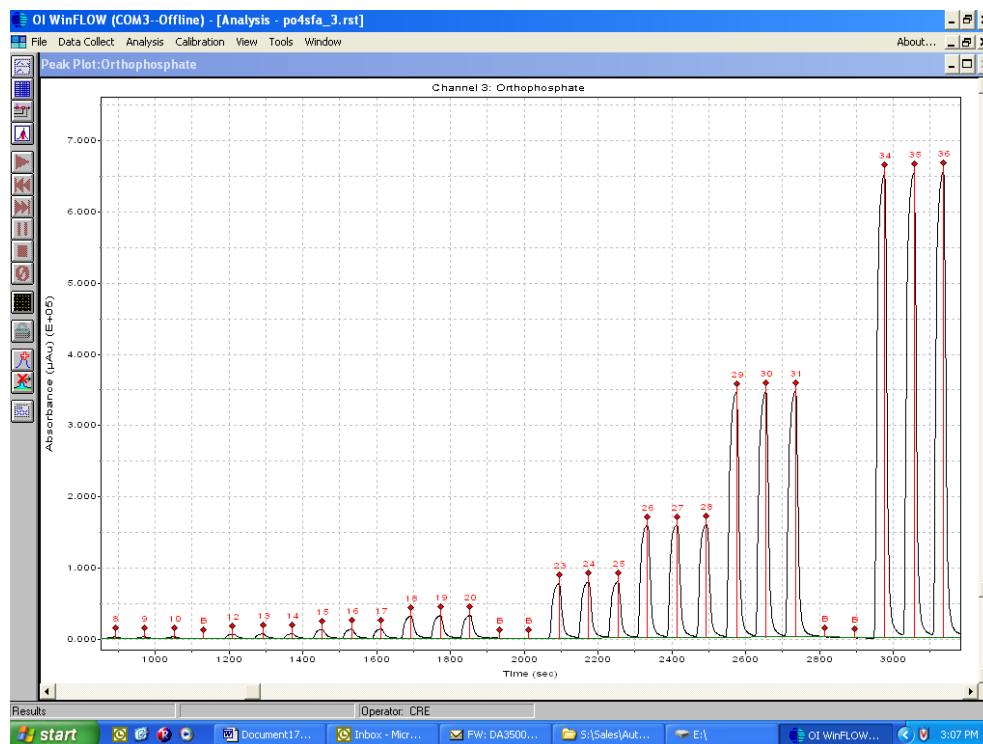


Figure 1. Orthophosphate Calibration (0.01-2.0 ppm)

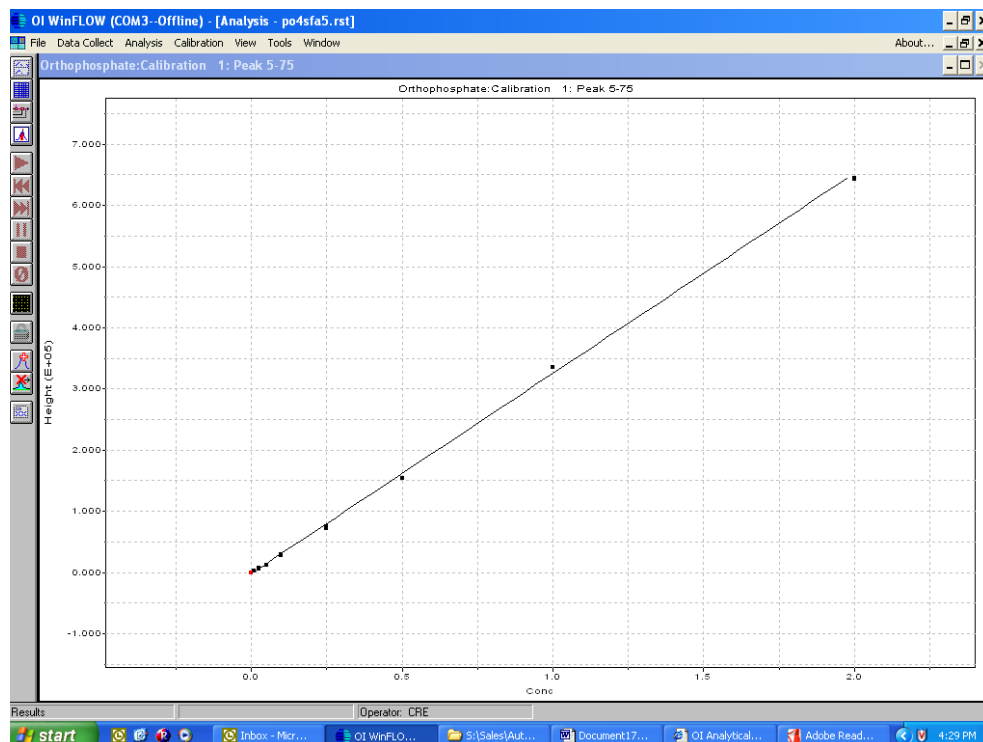


Figure 2. Orthophosphate Calibration Curve (0.01–2.0 ppm)

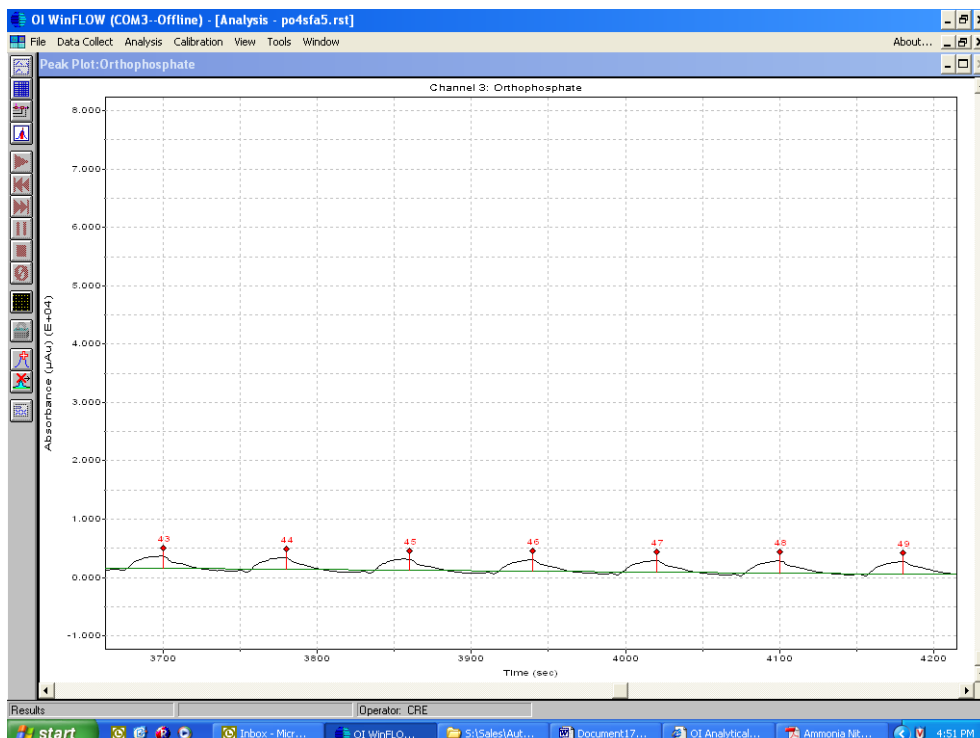


Figure 3. Orthophosphate Method Detection Limit (at 0.01 ppm)

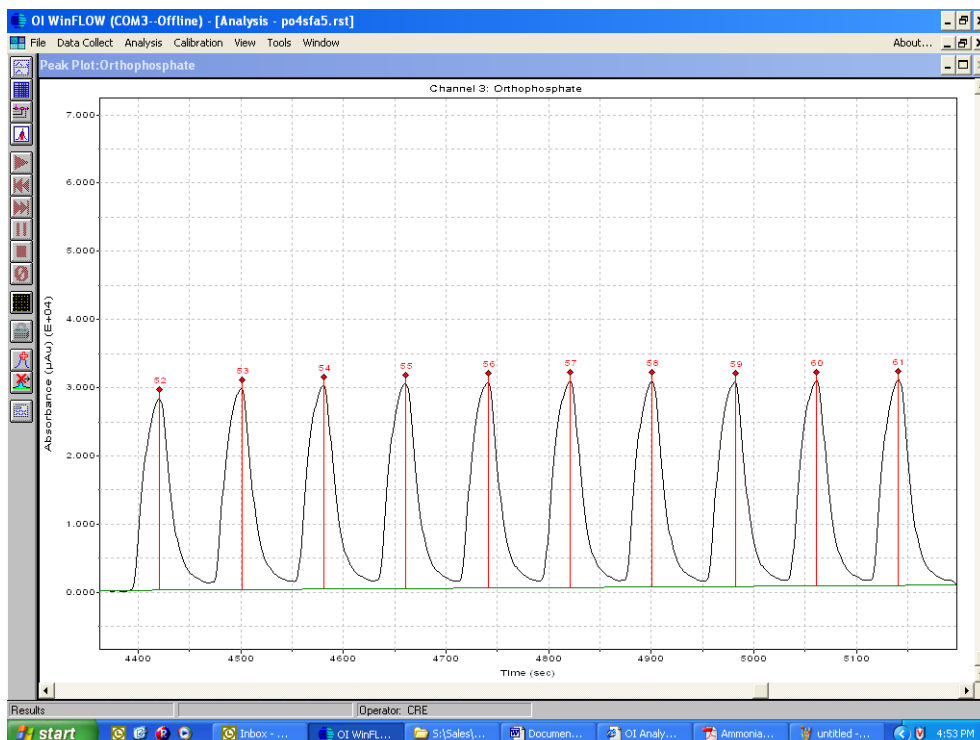


Figure 4. Orthophosphate Precision (at 0.10 ppm)

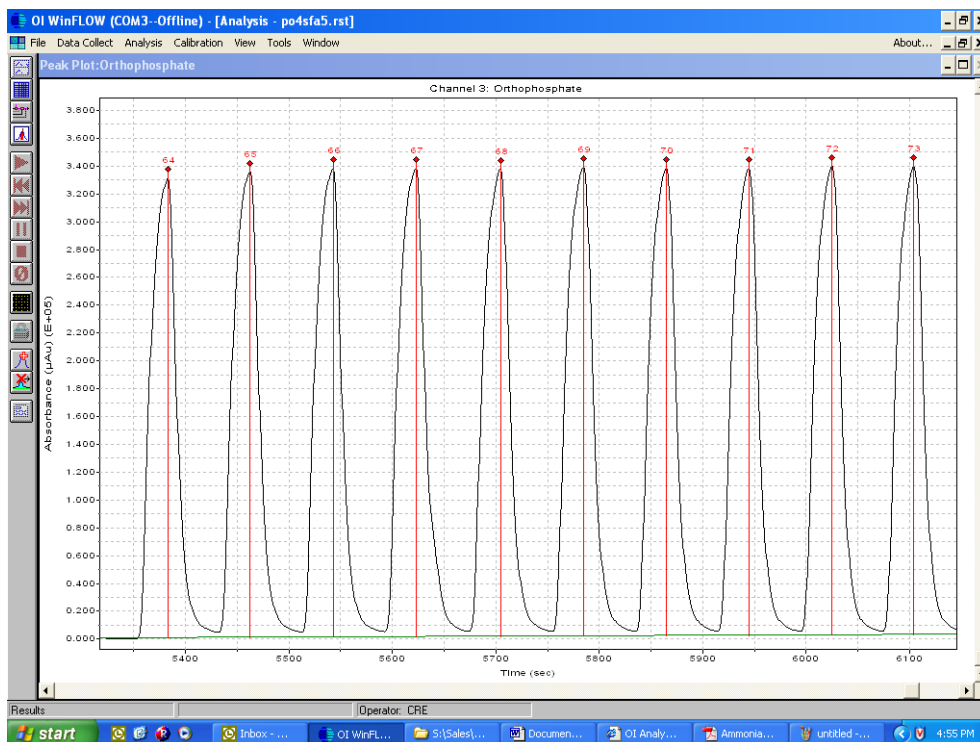


Figure 5. Orthophosphate Precision (at 1.0 ppm)

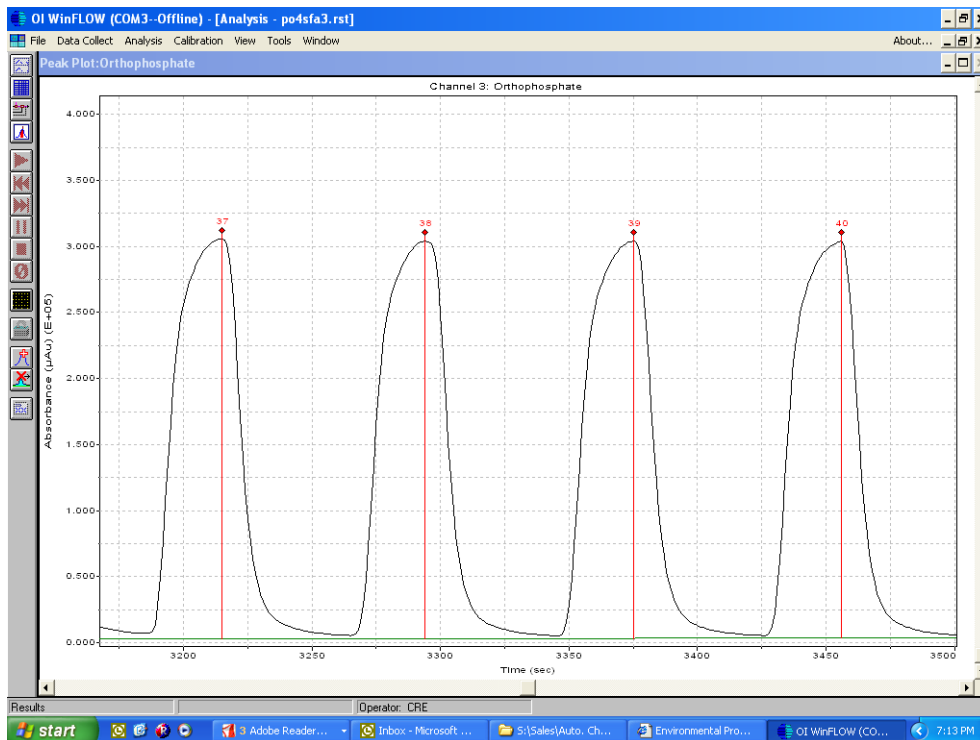


Figure 6. Orthophosphate QC Sample Precision (ERA 0.914 ppm at 98.98%)

OI WinFLOW (COM3--Offline) - [Analysis : po4sfa5.rst]

File Data Collect Analysis Calibration View Tools Window

Orthophosphate:Calibration 1: Peak 5:75

1.1		*	
	Name	Conc	Height
*	Cal 0.00 ppm	0.000000	-179.65591
*	Cal 0.00 ppm	0.000000	-236.47697
*	Cal 0.00 ppm	0.000000	-417.68838
*	Cal 0.01 ppm	0.010000	1921.03753
*	Cal 0.01 ppm	0.010000	2188.00244
*	Cal 0.01 ppm	0.010000	2238.76703
*	Cal 0.025 ppm	0.025000	6335.49951
*	Cal 0.025 ppm	0.025000	6525.77533
*	Cal 0.025 ppm	0.025000	6482.07714
*	Cal 0.05 ppm	0.050000	11544.6210
*	Cal 0.05 ppm	0.050000	11782.9195
*	Cal 0.05 ppm	0.050000	11854.9248
*	Cal 0.10 ppm	0.100000	28425.6347
*	Cal 0.10 ppm	0.100000	29218.7402
*	Cal 0.10 ppm	0.100000	29433.3378
*	Cal 0.25 ppm	0.250000	71683.4375
*	Cal 0.25 ppm	0.250000	74350.5623
*	Cal 0.25 ppm	0.250000	74843.7812
*	Cal 0.50 ppm	0.500000	153312.353
*	Cal 0.50 ppm	0.500000	154369.203
*	Cal 0.50 ppm	0.500000	153858.103
*	Cal 1.00 ppm	1.000000	335121.873
*	Cal 1.00 ppm	1.000000	335933.031
*	Cal 1.00 ppm	1.000000	335226.937
*	Cal 2.00 ppm	2.000000	643270.625
*	Cal 2.00 ppm	2.000000	644735.562
*	Cal 2.00 ppm	2.000000	644411.125
Calib Coef:			
y=bx+a			
a: (intercept)		-1.7277e+03	
b:		3.2731e+05	
Corr Coef:		0.999664	
Carryover:		0.3624	
No Drift Peaks			

Figure 7. Orthophosphate Calibration Results (0.01–2.0 ppm)

Method Abstract

Table 1. Orthophosphate Method Data

Parameter	Calibrant 0.01 mg/L	Calibrant 0.1 mg/L	Calibrant 1.0 mg/L	ERA QC Standard 0.914 mg/L
Rep 1	0.0089	0.0932	1.031	0.9083
Rep 2	0.0088	0.0967	1.037	0.9068
Rep 3	0.0087	0.0979	1.035	0.9059
Rep 4	0.0088	0.0986	1.037	0.9070
Rep 5	0.0090	0.0982	1.039	—
Rep 6	0.0091	0.0988	1.036	—
Rep 7	0.0096	0.0983	1.032	—
Rep 8	—	0.0979	1.034	—
Rep 9	—	0.0977	1.032	—
Rep 10	—	0.0977	1.029	—
Average	0.0090	0.0975	1.034	0.9070
Standard Deviation	0.0002787	0.001625	0.003287	0.001008
% RSD	3.10	1.67	0.32	0.11
MDL	0.001	—	—	—
% Accuracy	—	—	—	98.98%