Water Technologies & Solutions
analytical procedure

Hypersperse* MDC704i

PhosVer 3 with persulfate UV oxidation[1]
1.00 to 24.00 mg/L Hypersperse MDC704i

[1] *Adapted from Blystone, P., Larson, P., A Rapid Method for Analysis of Phosphate Compounds, International Water Conference, Pittsburgh, PA. (Oct 26-28, 1981)*

instrument specific information

Table 1 shows the sample cell and cell orientation requirements for the SUEZ instrument that can use this Analytical Procedure (AP).

Table 1 Instrument-specific information

Instrument	Sample cell orientation	Sample cell
DR/890	The fill lines and diamond mark are toward the display.	L1976 

before starting

Sample with high salt content may require a dilution. To check run the sample undiluted and with a dilution. If diluted sample result is higher continued diluting until no increase is observed.
Clean all glassware with 6.0 N (50%) hydrochloric acid, then rinse thoroughly with deionized water to remove contaminants.
Do not use a detergent that contains phosphate to clean glassware. The phosphate in the detergent will contaminate the sample.
Wear UV safety goggles while the UV lamp is on.
Do not touch the UV lamp surface with bare fingers. Fingerprints can damage the glass. Rinse the lamp and wipe with a soft, clean tissue between tests.
The UV digestion in this procedure is typically complete in less than 10 minutes. However, high-organic loaded samples or a weak lamp can cause incomplete conversion. To check conversion efficiency, use a longer digestion time and make sure that the readings do not increase.

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Two UV lamps can connect to a single power supply with a cord adapter for digestion of two samples at the same time. A second UV lamp is necessary.
Refer to the instrument user manual for timer operation instructions.
For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results automatically with the reagent blank adjust option.
Clean the outside of the sample cells before insertion into the instrument cell holder. Use a damp towel followed by a dry one to remove fingerprints or other marks.
Highly buffered samples or extreme pH may exceed the buffering capacity of the reagent and require sample pre-treatment.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use any recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Consult the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.
Results that are not within the working range of this procedure are not valid.

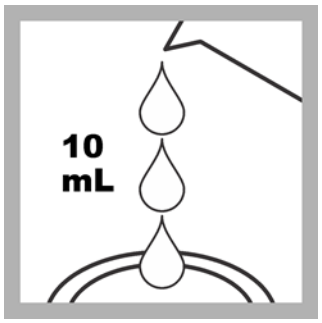
target concentration and sample collection information

- The target Hypersperse concentration in the concentrate stream will be based on the target in the feed and the % recovery that the RO is operating at. The % recovery controls the concentration factor and therefore the amount that is expected in the concentrate.
- The calculation for concentration factor is CF = 1/(1-recovery). For example, the concentration factor for an RO operating at 75% recovery is CF = 1/(1-0.75) = 4
- Using the concentration factor: the target ppm of Hypersperse in the concentration stream is the target ppm in the feed multiplied by the concentration factor. For example, if the target Hypersperse dosage in the feed is 2 ppm and the RO is operating at 75% recovery, then the target in the concentrate is: (2 ppm)(CF of 4) = 8 ppm
- Since Hypersperse products are typically fed at low concentrations to the feedwater, the test should be performed on the concentrate (brine or reject) stream rather than on the feedwater.
- Collect samples in clean glass or plastic bottles that have been cleaned with 6 N (50%) hydrochloric acid and rinsed with deionized water.
- Do not use a commercial detergent to clean the sample bottles. The phosphate in the detergent will contaminate the sample.
- To preserve samples for later analysis, adjust the sample pH to less than 2 with concentrated sulfuric acid (about 2 mL per liter). No acid addition is necessary if the sample is tested immediately.
- Keep the preserved samples at or below 6 °C (43 °F) for up to 24 hours.
- Let the sample temperature increase to room temperature before analysis.
- Before analysis, adjust the pH to 7 with 5 N sodium hydroxide solution.
- Correct the test result for the dilution caused by the volume additions.

procedure

1. Enter the stored program number by: Pressing **PRGM** followed by **79**, **Enter**. The display will show **mg/L PO_4** and the **ZERO** icon.

2. Use a syringe to push at least 50 mL of sample through a 0.22-micron filter membrane apparatus.



3. Prepare the blank: Fill a sample cell to the 10-mL mark with filtered sample from step 2.

4. Prepare the digested sample: Fill a mixing bottle to the 25-mL mark with the filtered sample from step 2.

5. Add the contents of one Potassium Persulfate for Phosphonate Powder Pillow to the 25-mL sample.

6. Swirl to mix.

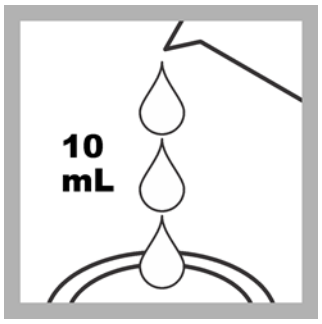
7. Put on UV safety goggles

8. Put the ultraviolet lamp into the mixing bottle. Turn on the UV lamp.

Make sure that only the glass portion of the lamp is in contact with the sample.

9. Begin a 10-minute reaction period by pressing: **Timer**, **Timer, 1000, Enter.**

10. When the timer expires, turn off the UV lamp. Remove the UV lamp from the sample.



11. Prepare the sample: Fill a second sample cell to the 10-mL mark with the digested sample.

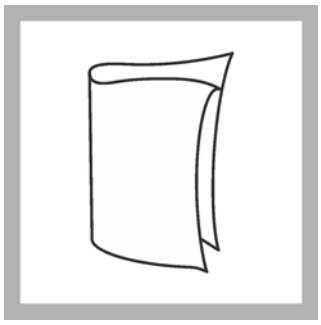
12. Add the contents of one PhosVer 3 Phosphate Reagent Powder Pillow to both the blank and the prepared sample.

13. ***Immediately*** swirl both cells vigorously for 20–30 seconds to mix. Some powder may not dissolve.

A blue color shows if phosphate is present. Both the sample and the blank may show color.

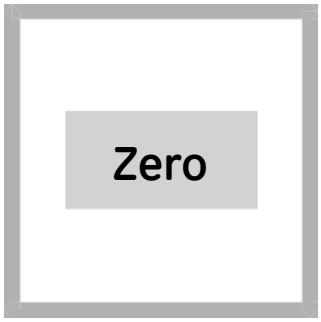
14. Begin a 2-minute reaction period by pressing: **Timer, Enter**

If the sample temperature is less than 15 °C (59 °F), wait 4 minutes for color development.

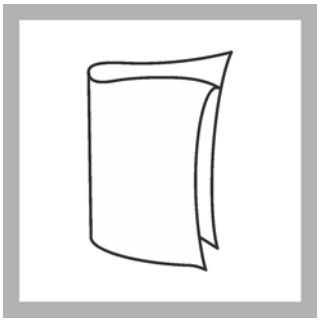


15. When the timer expires, clean the blank sample cell. Complete the rest of the steps in this procedure within 3 minutes.

16. Insert the blank into the cell holder.

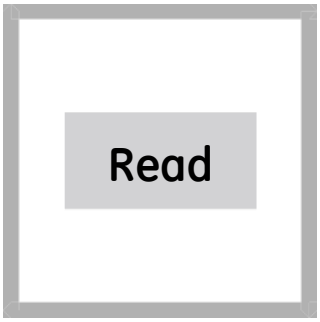


17. Push **ZERO**. The display shows 0.00 mg/L PO_4^{3-}.



18. Clean the prepared sample cell.

19. Insert the prepared sample into the cell holder.



20. Push **READ**. Multiple the displayed result by 9.7 to express as mg/L Hypersperse MDC704i.

interferences

Interfering substance	Interference level
Aluminum	10 mg/L
Arsenate	Interferes at all levels
Benzotriazole	1 mg/L
Bicarbonate	100 mg/L
Bromide	10 mg/L
Calcium	500 mg/L
CDTA	10 mg/L
Chloride	500 mg/L
Chromate	10 mg/L
Copper	10 mg/L
Cyanide	10 mg/L (Increase the UV digestion to 30 minutes.)
Diethanoldithiocarbamate	5 mg/L
EDTA	10 mg/L
Iron	20 mg/L
Nitrate	20 mg/L
NTA	25 mg/L
Orthophosphate	1.5 mg/L
Phosphites and organophosphorus compounds	Reacts quantitatively. Metaphosphates and polyphosphates do not interfere.
Silica	50 mg/L
Silicate	10 mg/L
Sulfate	200 mg/L
Sulfide	Interferes at all levels
Sulfite	10 mg/L
Thiourea	1 mg/L
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment of the sample by the reagents. Sample pre-treatment may be necessary.

summary of method

The procedure is based on a UV-catalyzed oxidation of the Hypersperse MDC704i. The measurement wavelength is 610 nm.

lab supply code numbers

Required reagents[2]

Description	Quantity/test	Unit	Code
Hydrochloric Acid Solution, 6 N (50%)	varies	60 mL	L247.0060
PhosVer ® 3 Phosphate Reagent Powder Pillow[3], 10-mL	2	100/pkg	L2325
Potassium Persulfate Powder Pillow for Phosphonate	1	100/pkg	L2045
Water, deionized	varies	4000 mL	L243.4000

[2] Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use any recommended personal protective equipment.
[3] PhosVer is a registered trademark of Hach Company.

Required apparatus

Description	Quantity/test	Unit	Code
Bottle, square, with 25-mL mark	1	each	L2633
Cylinder, graduated mixing, 50-mL, with glass stopper	1	each	L2631
DR/890 Colorimeter with accessories	1	each	NA
Pipet, plastic graduated, 1/10, 10-mL	1	each	L395
Filter membrane, 0.22-micron, 25-mm	1	100/pkg	L774
Filter holder, 25-mm membrane filter	1	each	L773
Lamp, UV (for 110 V power supply)	1	each	L2666
Lamp Kit, 110 V (includes power supply and UV Lamp L2666)	1	each	L2692
Safety bulb, rubber	1	each	L1575
Sample cells, 10-20-25-mL, with cap	2	6/pkg	L1976
Syringe, plastic 50-mL	1	each	L775
UV lamp, shortwave 254 nm (EMEA, for 220 V power supply)	1	each	L2138
Power supply for UV lamp, 220 V (EMEA, requires UV lamp L2138)	1	each	L2693.0020
UV safety goggles	1	each	L2668

Optional reagents and apparatus

Description	Unit	Code
Phosphate Standard Solution Complex, 10-mg/L PO4	1000 mL	L477.1000
Cord Adapter, for dual UV lamps (110 V power supply)	each	L2669
Pipetter, adjustable volume, 1.00–10.00 mL	each	L1089
Tips for L1089 Pipetter, 10 mL	200/pkg	L20002
Pipetter, Socorex Calibra 832.10, 1.0–10.0 mL (EMEA only)	each	L8035
Tips for L8035 Pipetter, Socorex 312.10, 10 mL (EMEA only)	100/pkg	L8036
Pipetter, Socorex Calibra 822.1000, 100–1000 µL (EMEA only)	each	L8034
Tips for L8034 Pipetter, Socorex 319.1000B, 1000 µL (EMEA only)	250/pkg	L8037