DIGITAL WATER ANALYZER

Instruction Manual

DIGITAL PACK TEST·MULTI

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CONTENTS

1. Introduction

Thank you very much for your purchasing of our product, DIGITALPACKTEST·MULTI.
The calibration curve is already programmed in this instrument.
By using simplified reagents such as PACKTEST, anyone can make water quality analysis easily.
For your understanding and proper use, please read this Instruction Manual attentively before using.
This Instruction Manual is common to 2 models as below:

- DIGITALPACKTEST·MULTI (Model: DPM-MT-E)
- DIGITALPACKTEST·MULTI Set (Model: DPM-MT-SE-E)

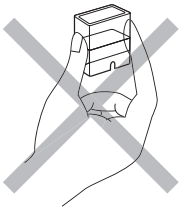
2. Precaution for Reagent

1. Use appropriate reagent made by KYORITSU CHEMICAL-CHECK Lab., Corp. for each analyte. For selecting the reagent, refer to "6. Reagent List" or "8. Measurement Procedures".
2. Check the expiration date of reagent before measuring.
3. Store in dark, cool and dry place and keep away from children.
   Use as soon as possible after the laminated package is opened.
4. First Aid
   Eye contact → Immediately rinse your eyes with water for at least 15 minutes.
   Skin contact → Immediately flush skin with water.
   Ingestion → Immediately rinse mouth. Consult a physician.
   In case of doubt, consult a physician.
   More importantly, in case of ingestion, drink a large glass of milk or water and immediately consult a physician.
   For Cautions and First Aid of each reagent that you prepare, refer to its own MSDS.
5. Analyte and the analytical reagents are contained in each waste solution after measurement. Moreover, some solutions have strong acidity of pH2.0 or less, or strong alkaline of pH12.5 or more. When you abandon them, handle carefully and process them appropriately.

3. Precaution for Cell Handling

Use Cells (PACKTEST Square Cup) at the measurement.
For some analyte, use vials at reaction.

1. Use only PACKTEST Square Cup. (Model: WAK-CC10)
2. Use the same cell from zero adjustment through measurement completion.
3. Do not hold the light path. The light goes through the shorter side of the cell.



4. If the sample temperature is very low compared with the ambient temperature, the cell could be misted and could induced a measurement error.
5. Clean up the cell surface to wipe off water drop or fingerprint before insert the cell into the cell box.
6. After use, rinse cells and vials several times with tap water and the thoroughly with pure water.
   If pure water is not available, rinse well with the tap water. Then rinse the cell with sample before measuring.
7. A crack or dirt on cell surface may cause result error. Replace with new one if necessary.
8. Materials of cell and vial are as follows. Comply with local regulations for disposal.

Sort of cell	Material of cell	Material of cap
Cell (PACKTEST Square Cup)	polystyrene	polyethylene
Vial (Lambda-9000 Round Cell Bottle)	glass	polypropylene(PP)

9. Displayed value without setting the cell is invalid.

4. Cautions

1. The general measurement procedure is as follows:
   · Insert the cell into the cell box and press <Blank> to cancel the color of sample.
   · Draw the sample into the specified tube or add the specified reagent to the vial, then press <Start>.
   · Return the sample into the cell gently, and insert the cell into the cell box during the reaction time.
   · Measurement values are displayed automatically after the reaction time expires.

2. As reagents for measurement, "PACKTEST", "Reagent Set for Water Analyzer" and other reagent set can be used.
   For details of each reagent, refer to the respective instructions.
   The measurement range, reaction time, and interferences are different from those for a visual comparison method using standard color.
   Some analyte may require specific pre-treatment, using optional apparatus (available separately) and reagents (available separately or prepared by yourself).
   For details of each analyte, refer to "8. Measurement Procedures".

3. Reagents contain buffers to adjust the pH of sample to the correct range. Adjusting neutral sample is unnecessary; however, the sample of strong acid, strong alkaline, especially acid fixed or and alkaline fixed samples requires neutralization before measurement.

4. Zero adjustment may not be possible if sample water present turbidity and color.
   Filtering or dilution may be required.

5. Color development is not affected even if reagents do not dissolve completely. Floating or adhesion of the reagent on cell wall will cause measurement error. Leave the cell during reaction time, if undissolved reagent and/or bubbles stick on cell wall, remove them as much as possible by tapping the cell with fingers.

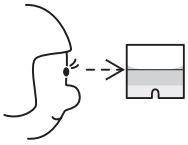
6. The sample temperature should be within 15 - 30 ℃ .
   Depending on the analyte, Temperature Correction Factor may be specified. Please read instruction manual carefully.
   The most ideal sample temperature is 20 ℃ because pre-programmed calibration curves and data of DPM-MT are made at 20 ℃ .
   In case of excessively high or low temperature, take one of the following procedures.
   (1) Adjust the sample temperature to 20 ℃ by using constant temperature water bath before the procedure.
   (2) When the Temperature Correction Factor is spcified in the instruction manual, calculate the value using the factor to get the estimate.

7. If the result is over the measurement range, dilute the sample and proceed the measurement from first again.
   (For exceeded result, the display shows: Over.)

8. Pretreatment is required if interferences affect the result.

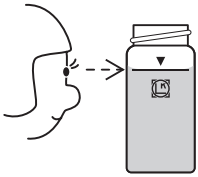
5. Standard Procedure

This chapter explains the standard procedure.



Fill the cell with 1.5 mL of sample (up to the line).

With your eyes being at the sample level as the meniscus, take sample to the line of the cell so bottom of meniscus rests on the line.



Fill the vial with 25 mL of sample (up to the line).

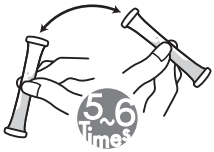
With your eyes being at the same level as the meniscus, take sample to white line of the vial so bottom of meniscus rests on line.

Press <Blank>.

To cancel the color of sample before measuring.

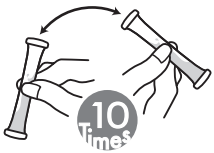
Press <Start>.

The timer will count down.
When the reaction time reaches, the absorbance is measured and the result is displayed.



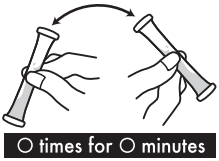
Shake the tube lightly 5-6 times.

After the sample is drawn into the tube thoroughly, shake the tube slowly.



Shake the tube 10 times.

After the sample is drawn into the tube thoroughly, shake the tube slowly.



Shake the tube ○ times for ○ minutes.

After the sample is drawn into the tube thoroughly, shake the tube at a speed of one time a second.

Pour the sample into the cell when the reaction timer count down ○ minutes to go.

During the reaction, bubbles will be formed and stick on the cell wall. To avoid these bubbles, pour the sample from tube to the cell ○ minutes before the reaction time reaches.

Snap the cell with fingers to remove bubbles of the cell wall.

If bubbles still stick on the cell wall, remove them by snapping the cell with fingers.

Wait for ○ min.

Waiting time is indicated in the sign. Place the cell or the tube after shake on the flat surface during the waiting time.

Stir 5 - 6 times.

Hold top of the vial, rotate it circularly.

Shake the vial 5 - 6 times.

Hold the vial without touching the side of vial and shake the vial up and down for 5 - 6 times to mix throughly.

Shake the vial strongly for 10 sec.

Close the lid immediately after adding the reagents.
Shake the vial strongly for 10 sec. at a speed of two times per second.

6. Reagent List

As reagents for measurement, PACKTEST (1.5mL of Sample) (Model: WAK-), Reagent Set for Water Analyzer (25mL of Sample) (Model: LR-), Reagent Set (Model: WA-), and DPR Reagent Set (Model: DPR-) are used.

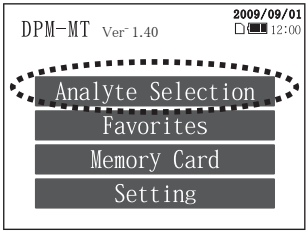
Item		Range(mg/L)	Reaction Time	Reagent model	Remarks/Required Reagent & Apparatus
Al	Aluminum	0.050～0.400	5min.	LR-Al	
As	Arsenic	0.20～3.00	[30min.]	DPR-As	
B-C	Boron (High Range)	5.0～40.0	12min.	WAK-B(C)	
B	Boron	0.50～4.00	40min.	WAK-B	
Ca	Calcium	0.5～15.0	2min.	LR-Ca-B	
Cl	Chloride	2.0～40.0	3min.	LR-Cl	
ClO-C	Residual Chlorine (High Range)	2～320	1min.	WAK-ClO(C)	
ClO-DPD	Residual Chlorine (Free)	0.10～3.00	1min.	WAK-ClO-DP	
T-ClO	Total Residual Chlorine	0.10～3.00	2min.	WAK-T-ClO	
ClO_2	Chlorine Dioxide	0.20～6.00	1min.	WAK-ClO_2	
CN	Free Cyanide	0.020～0.400	10min.	WAK-CN	
CN^T	Total Cyanide	0.10～3.00	[18min.]	LR-CN^T	Water Analysis Set Total Cyanide
CN^T-D	Total Cyanide (Low Range)	0.005～0.150	[40min.]	LR-CN-B	Water Analysis Set Total Cyanide (Low Range)
COD	Chemical Oxygen Demand	2.0～10.0	10min.	LR-COD-B	
Color	Chromaticity	100～1000°	0min.	—	
Cr^{6+}	Chromium (Hexavalent)	0.050～1.400	2min.	WAK-Cr^{6+}	
Cr^T	Total Chromium	0.050～1.400	[12min.]	WAK-Cr^{6+}	Cr-RA
Cu	Copper	0.10～5.00	1min.	WAK-Cu	
DET	Anionic Surfactants	0.05～1.20	[3min.]	WA-DET	
DO	Dissolved Oxygen	2.0～11.0	2min.	AZ-DO-30	DO Adapter
F	Fluoride (Free)	0.40～1.50	15min.	WAK-F	
Fe	Iron	0.20～5.00	3min.	WAK-Fe	
Fe-D	Iron (Low Range)	0.05～2.00	3min.	WAK-Fe(D)	
Fe^{2+}	Iron (Divalent)	0.20～5.00	3min.	WAK-Fe^{2+}	
Fe^{2+}-D	Iron (Divalent) (Low Range)	0.05～2.00	3min.	WAK-Fe^{2+}(D)	
FOR	Formaldehyde	0.20～1.00	5min.	WAK-FOR	
H_2O_2-C	Hydrogen Peroxide (High Range)	3～200	1min.	WAK-H_2O_2(C)	
H_2O_2	Hydrogen Peroxide	0.10～2.50	2min.	WAK-H_2O_2	
K	Potassium	2.00～8.00	5min.	LR-K	
$KMnO_4$	Potasium Permanganate Consumption	2.0～10.0	10min.	LR-COD-B	common reagent as COD
Mn	Manganese	0.6～20.0	3min.	WAK-Mn	
NH_4	Ammonium	0.20～5.00	10min.	WAK-NH_4	
NH_4-N	Ammonium-Nitrogen	0.20～4.00	10min.	WAK-NH_4	
NH_4-D	Ammonium (Low Range)	0.05～2.00	[30min.]	LR-NH_4-A	Water Analysis Set Ammonium (Low Range)
NH_4-N-D	Ammonium-Nitrogen (Low Range)	0.05～1.50	[30min.]	LR-NH_4-A	Water Analysis Set Ammonium (Low Range)

Item		Range(mg/L)	Reaction Time	Reagent model	Remarks/Required Reagent & Apparatus
Ni	Nickel	1.00 ~ 8.00	5min.	LR-Ni	by Dimethylglyoxime Method
Ni-D	Nickel(DPM)	0.30 ~ 5.00	5min.	WAK-Ni(D)	by Nioxime Method
NO_2-C	Nitrite(High Range)	5 ~ 100	5min.	WAK-NO_2(C)	
NO_2-N-C	Nitrite-Nitrogen (High Range)	2.0 ~ 30.0	5min.	WAK-NO_2(C)	
NO_2	Nitrite	0.020 ~ 1.000	3min.	WAK-NO_2	
NO_2-N	Nitrite-Nitrogen	0.010 ~ 0.300	3min.	WAK-NO_2	
NO_3-C_1	Nitrate (High Range) ($NO_2 \leq 1$)	200 ~ 2000	5min.	WAK-NO_3(C)	
NO_3-C_2	Nitrate (High Range) (NO_2 1 ≤ 10)	200 ~ 2000	[10min.]	WAK-NO_3(C)	NO_3-RA
NO_3-N-C_1	Nitrate-Nitrogen (High Range) (NO_2-N ≤ 0.3)	45 ~ 450	5min.	WAK-NO_3(C)	
NO_3-N-C_2	Nitrate-Nitrogen (High Range) (NO_2-N 0.3 ≤ 3)	45 ~ 450	[10min.]	WAK-NO_3(C)	NO_3-RA
NO_3_1	Nitrate (NO_2 = 0)	1.0 ~ 25.0	5min.	WAK-NO_3	
NO_3_2	Nitrate ($NO_2 \leq 0.2$)	1.0 ~ 25.0	[8min.]	WAK-NO_3	WAK-NO_2
NO_3_3	Nitrate ($NO_2 \leq 5$)	1.0 ~ 25.0	[10min.]	WAK-NO_3	NO_3-RA
NO_3-N_1	Nitrate-Nitrogen (NO_2-N = 0 mg/L)	0.20 ~ 5.80	5min.	WAK-NO_3	
NO_3-N_2	Nitrate-Nitrogen (NO_2-N ≤ 0.06)	0.20 ~ 5.80	[8min.]	WAK-NO_3	WAK-NO_2
NO_3-N_3	Nitrate-Nitrogen (NO_2-N ≤ 1.5)	0.20 ~ 5.80	[10min.]	WAK-NO_3	NO_3-RA
O_3	Ozone	0.25 ~ 6.00	2min.	WAK-O_3	
Pb-SPK	Lead (SPK)	0.03 ~ 0.50	[12min.]	SPK-Pb	
Phenol	Phenol	0.20 ~ 5.00	8min.	WAK-PNL	
PO_4-C	Phosphate (High Range)	2.0 ~ 30.0	3min.	WAK-PO_4(C)	
PO_4-P-C	Phosphate-Phosphorus (High Range)	0.70 ~ 10.00	3min.	WAK-PO_4(C)	
PO_4	Phosphate	0.10 ~ 5.00	3min.	WAK-PO_4	
PO_4-P	Phosphate-Phosphorus	0.030 ~ 1.500	3min.	WAK-PO_4	
PO_4-D	Phosphate (Low Range)	0.10 ~ 3.00	5min.	WAK-PO_4(D)	
PO_4-P-D	Phosphate-Phosphorus (Low Range)	0.030 ~ 1.000	5min.	WAK-PO_4(D)	
S	Sulfide(Hydrogen sulfide)	0.050 ~ 0.800	3min.	WAK-S	
SiO_2	Silica	3.0 ~ 60.0	8.5min.	WAK-SiO_2	
SiO_2-D	Silica (Low Range)	0.30 ~ 7.00	8.5min.	WAK-SiO_2(D)	
SO_4	Sulfate	10 ~ 100	3min.	DPR-SO_4	
TH	Total Hardness	20 ~ 100	2min.	WAK-TH	
TN	Total Nitrogen	0.5 ~ 7.0	[30min.]	DPR-TN	WA-UVR-L
TP	Total Phosphorus	0.10 ~ 2.00	[30min.]	DPR-TP	WA-UVR-L
Turbid	Turbidity	10.0~100.0°	0min.	—	
Zn	Zinc	0.10 ~ 2.00	5min.	LR-Zn	
Zn-KCN	Zinc (use of KCN)	0.15 ~ 2.00	6min.	LR-ZnB	KCN
Zn-D	Zinc (Low Range)	0.030 ~ 0.400	1min.	WAK-Zn(D)	
ABS	Absorbance	-3.000 ~ 3.000 Abs	–		

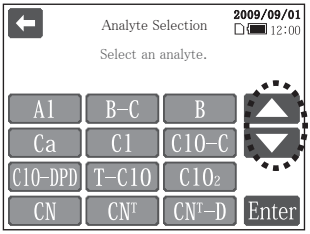
※ KCN solution need to prepared on users own.
※ Figure in [ ] is an approximate time including pretreatment procedure.

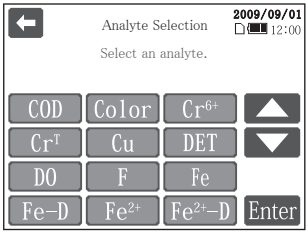
7. Standard Measurement Procedure

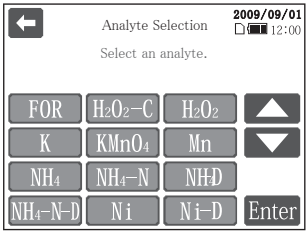
(1) From the Main Menu, select <Analyte Selection>.

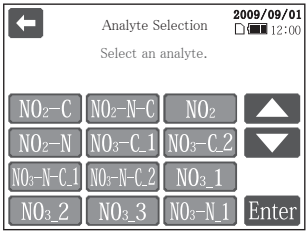


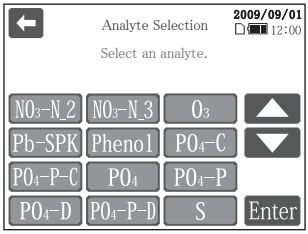
(2) Analyte Selection menu will be displayed.
Press <▼> to move to the next page.
Press <▲> to move to the previous page.
Pressing <▼> at the last page will return to the first page of the menu.
Pressing <▲> at the first page will move to the last page of the menu.
If the button is blank, there is no analyte program for it.

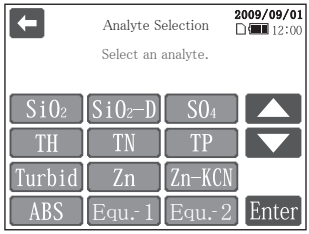


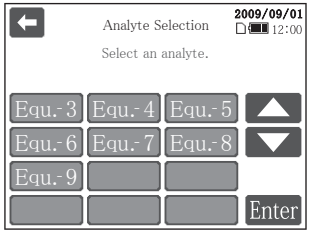




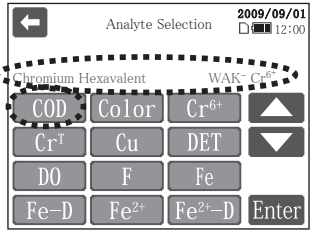




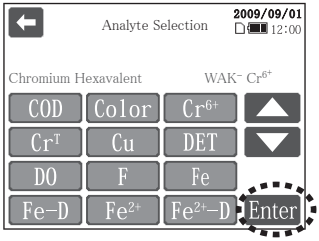




(3) After pressing one analyte, the item and the model of the reagent to be used will be displayed.



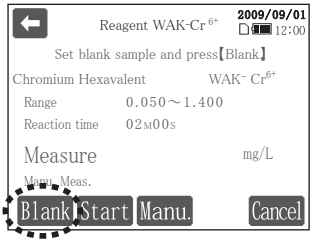
(4) Confirm the item and the model of the reagent and press <Enter>.

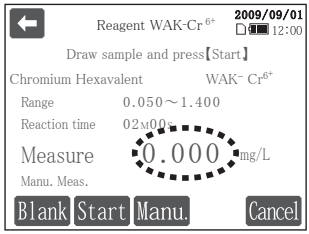


Blank

(5) Insert the cell into the cell box, and press <Blank>.
<Blank> changes to yellow when Zero adjustment starts.
Zero adjustment can be performed repeatedly.

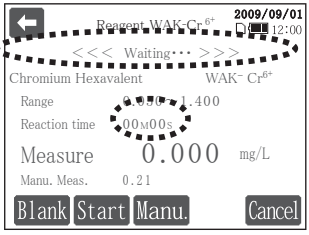
(6) When Zero adjustment is done, the instruction [Draw sample and press <Start>.] will be displayed.
The display will show : [Measure] 0.000.

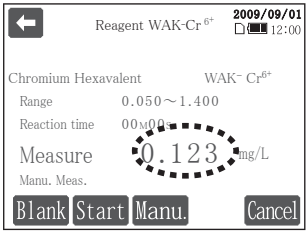




Measurement

(7) After the Zero adjustment, press <Start>. The reaction timer will count down with display [〈〈〈 Waiting··· 〉〉〉].
<Blank> returns to white and <Start> changes to yellow. When the reaction time reaches, the result is displayed with a sound"Pip Pip".



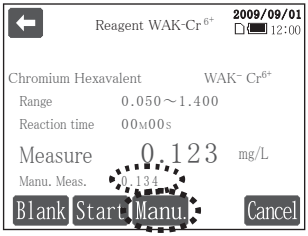


Point

· After the measurement has been completed,<Blank> <Manu> <Cancel> will be active.
· When the count down shows 30 seconds left, a warning (Pip) sounds to prevent unsetting the cell.

Manual measurement

(8) After the Zero adjustment, press <Manu>. The result will be displayed at [Manu. Meas.] with a sound "Pip Pi Pip".

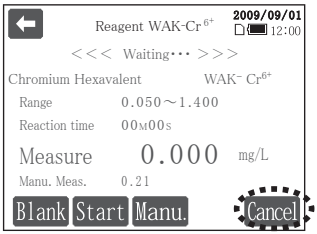


Point

· Manual start can be also used during or after the measurement.

Cancel

(9) By pressing <Cancel> during or after the measurement will return to the condition before Zero adjustment.
<Cancel> can not be used after Zero adjustment or before pressing <Start>.



Important

· If you wish to turn off during the measurement, please be sure to press <Cancel> before turn off the power.

8. Measurement Procedures

Al Aluminum

Color change : Yellow → Orange → Red
Method : ECR
Range : 0.050 - 0.400 mg/L (ppm)
Reagent : LR-Al No. 24 R-1(Liquid) R-2 (Pack)
Reaction time : 5 min. after R-2 reagent is added.

Procedure

1. Select <Al> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add 2 mL of R-1 reagent with the attached plastic pipette into the vial. Cap the vial tightly and shake the vial 5 - 6 times. (Fig.3)
6. Add R-1 reagent and press <Start>. Cap the vial tightly and shake the vial strongly for 10 seconds. (Fig.4)
7. Before 5 minutes pass, return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

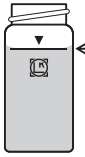


Fig.1

Fig.2

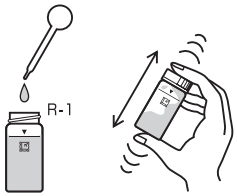


Fig.3

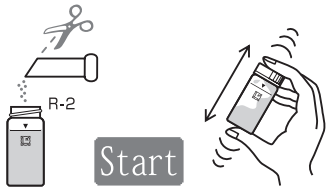


Fig.4

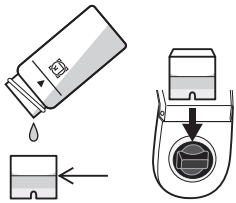


Fig.5

Cautions

1. Aluminum ion (Al^{3+}) can be determined in this method.
   The pH of sample and suspended particles will affect the dissolved ions state. The sample must be pretreated in accordance with its state before the measurement.
2. The optimum pH is 6 in the reaction.
   Adjust the sample pH, if the sample after R-1 addition is not pH 6.
3. Keep sample temperature in the range of 15 - 30℃ .
4. R-1 reagent contains a dilute Acetic Acid of less than 5%.
5. The pH of the measured sample is about 6.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , SO_4^{2-} , Anionic Surfactant , Phenol , Residual Chlorine
≤ 10 mg/L,	:	PO_4^{3-}
Sub-ppm level	:	F^-

Heavy metal ions:

≤ 10 mg/L,	:	Ba^{2+} , CN^- , Co^{2+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}
≤ 1 mg/L,	:	Cr^{3+}
Sub-ppm level	:	Cr(Ⅵ)

Not suitable for seawater samples.

As Arsenic

Features

This product is based on the molybdenum blue method, in which Arsenate ion (As(V)) and Phosphate ion (PO_4^{3-}) will both react at the same time.

When the sample contains Arsenate ion (As(V)), Arsenous ion (As(III)), and Phosphate ion (PO_4^{3-}), reduce Arsenate ion to Arsenous ion first, then react only Phosphate ion with reagent to give a color for zero adjustment. (See upper half of the flowchart below).

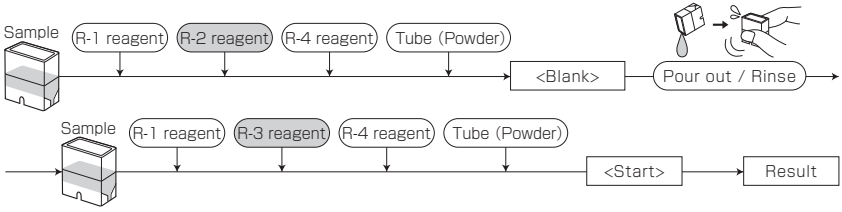
Next, oxidize Arsenous ion to Arsenate ion, then react as Arsenate ion and Phosphate ion together with reagent to give a color for the measurement. (See lower half of the flowchart below).

Result will be obtained by subtraction of these two steps.

Caution

When Phosphate ion coexists >1mg/L, the Arsenate ion cannot be measured with this method.

Flowchart of the Measuring Procedure



As Arsenic

Color change : None → Light blue → Blue
Method : Molybdenum Blue
Range : 0.20 - 3.00 mg/L (ppm)
Reagent : DPR-As R-1(Liquid), R-2(Liquid), R-3(Liquid), R-4(Liquid), Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

STEP 1: For Zero Adjustment, react Phosphate ion with reagent to give a color.

1. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

2. Add 1 drop of R-1 reagent.
   Put the cap on and shake the cell 2-3 times. (Fig.2)

3. Add 2 drops of R-2 reagent.
   Put the cap on and shake the cell 2-3 times, and let it sit for 10 minutes. (Fig.3)

4. Add 4 drops of R-4 reagent.
   Put the cap on and shake the cell 2-3 times. (Fig.4)

5. Draw the whole sample inside the cell into the tube. Shake the tube 5 - 6 times. (Fig.5)

6. Return the sample into the cell gently. And wait for 5 minutes. (Fig.6)

7. Select <As> on the screen.

8. Press <Enter> to display the measuring procedure.

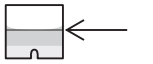


Fig.1

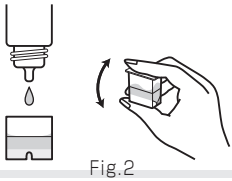


Fig.2

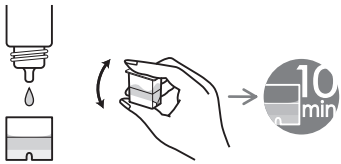


Fig.3

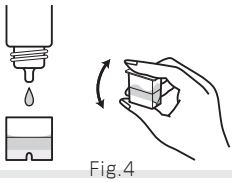


Fig.4


Fig.5

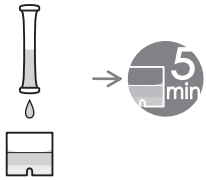


Fig.6

9. Insert the cell filled with colored sample into the cell box and press <Blank>. (Fig.7)

10. Remove the cell from the cell box and pour out the colored sample. Rinse the cell with pure water. (Fig.8)

STEP 2: React Arsenate ion, Arsenous ion and Phosphate ion together with reagent.

11. Fill the cell up to the line (1.5 ml) with sample. (Fig.9)

12. Add 1 drop of R-1 reagent and 1 drop of R-3 reagent.
Put the cap on and shake the cell 2-3 times. (Fig.10)

13. Add 4 drop of R-4 reagent.
Put the cap on and shake the cell 2-3 times. (Fig.11)

14. Draw the whole sample inside the cell into the tube and press <Start> on the display at the same time. (Fig.12)

15. Shake the tube 5 - 6 times. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.13)

16. After 5 minutes, the measurement value will be displayed.
The result will be printed out when the printer is connected.

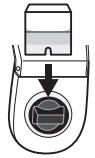


Fig.7

Fig.8

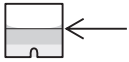


Fig.9

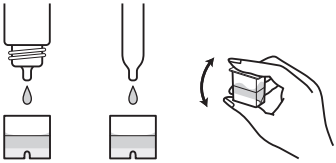


Fig.10

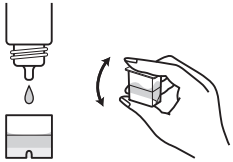


Fig.11

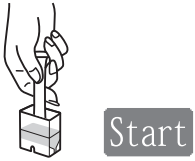


Fig.12

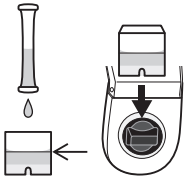


Fig.13

Cautions

1. Only Arsenate ion (As(V)) and Arsenous ion (As(III)) will be determined with this method.
   Other forms of Arsenic cannot be measured.
   When Phosphate ion coexists >1mg/L, Arsenate ion cannot be measured with this method.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 20 - 25℃ .
   If the sample temperature or ambient temperature is low, reddish purple color of R-3 reagent will remain after [procedure 15], and the reading will be lower in result. Shake the tube until the color disappears.
4. If the sample is highly oxidative, or contains >10mg/L of Arsenate ion concentrate, this product is not suitable for use.
5. The pH of the measured sample is ≤ 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L,	:	$B(Ⅲ)$, Cl^- , CN^- , K^+ , Na^+ , NH_4^+ , SO_4^{2-}
≤ 500 mg/L,	:	Ca^{2+} , Mg^{2+} , NO_3^-
≤ 200 mg/L,	:	NO_2^-
≤ 100 mg/L,	:	SiO_2
≤ 50 mg/L,	:	F^- , I^- , Phenol
≤ 1 mg/L,	:	Residual Chlorine , PO_4^{3-}

Heavy metal ions:

≤ 1000 mg/L,	:	Zn^{2+}
≤ 100 mg/L,	:	Cr^{3+} , Ni^{2+}
≤ 50 mg/L,	:	Al^{3+} , Co^{2+} , Mn^{2+} , $Mo(Ⅵ)$
≤ 10 mg/L,	:	Fe^{2+} , Fe^{3+}
≤ 5 mg/L,	:	$Cr(Ⅵ)$
Sub-ppm level	:	Ba^{2+} , Cu^{2+}

Not suitable for seawater.
Oxdizing substances and Reductive substances can interfere.

B-C Boron (High Range)

Color change : Light yellow → Yellow
Method : Azomethine H
Range : 5.0 - 40.0 mg/L (ppm)
Reagent : WAK-B(C) K-1(Liquid) , Tube
Reaction time : 12 min. after drawing sample into the tube.

Procedure

1. Select <B-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Take 0.2 mL of sample in the cell with the plastic pipette (small). (Fig.1)
4. Add 1.5 mL of K-1 reagent with the plastic pipette (large) into the cell. Put the cap and shake the cell 2-3 times. (Fig.2)
5. Insert the cell into the cell box and press <Blank>. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 60 times for 1 minute. (Fig.5)
8. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.6)
9. After 12 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

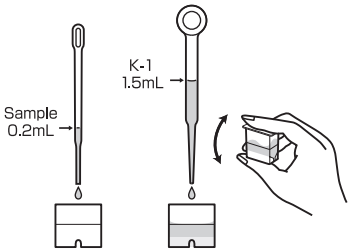


Fig.1 Fig.2

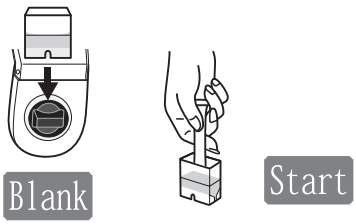


Fig.3 Fig.4

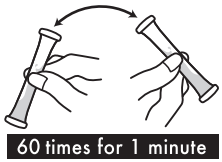


Fig.5

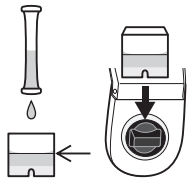


Fig.6

Cautions

1. Borate ion or Borax can be determined in this method, and convert into the value of Boron.
   Borofluoride ion (BF_4^-) can not be measured.
2. The optimum pH is 6 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. The sample temperature should be kept at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ····· ×0.95 25℃ ····· ×1.20
4. The pH of the measured sample is about 6.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 5000 mg/L,	:	Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , Phenol
≤ 2500 mg/L,	:	Mg^{2+}
≤ 1000 mg/L,	:	SO_4^{2-}
≤ 500 mg/L,	:	Ca^{2+}
≤ 250 mg/L,	:	Anionic Surfactant
≤ 50 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤ 5000 mg/L,	:	As(Ⅲ)
≤ 2500 mg/L,	:	Mn^{2+}
≤ 1000 mg/L,	:	Ni^{2+} , Zn^{2+}
≤ 500 mg/L,	:	Ba^{2+}
≤ 250 mg/L,	:	Al^{3+} , Cr^{3+}
≤ 100 mg/L,	:	Cu^{2+}
≤ 50 mg/L,	:	CN^- , Cr(Ⅵ)
≤ 25 mg/L,	:	Fe^{2+} , Sn^{2+}
Sub-ppm level	:	Ag^+ , Fe^{3+}

Suitable for seawater samples.
(Commonly seawater include Boron (about 4-5mg/L).)

B Boron

Color change : Light yellow → Yellow
Method : Azomethine H
Range : 0.50 - 4.00 mg/L (ppm)
Reagent : WAK-B Tube
Reaction time : 40 min. after drawing sample into the tube.

Procedure

1. Select <B> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 10 times.
   (If reagents do not dissolve into sample and become orange solid, shake the tube again.) (Fig.4)
7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 40 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

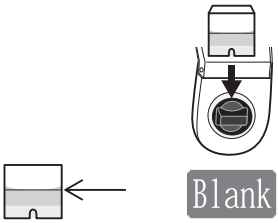


Fig.1 Fig.2

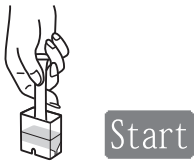


Fig.3

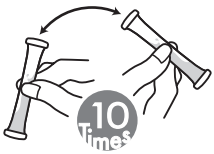


Fig.4

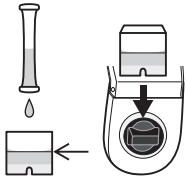


Fig.5

Cautions

1. This method can measure Borate ion or Borax and convert into the value of Boron.
   Borofluoride ion (BF_4^-) can not be measured.
2. The optimum pH is 6 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. The sample temperature should be kept at 20℃ .
   If sample temperature is out of 20 ℃ , multiply the results by the appropriate multiplier.
   15℃ ····· ×0.95 25℃ ····· ×1.25
4. The pH of the measured sample is about 6.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L,	:	Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , Phenol
≤ 500 mg/L,	:	Mg^{2+}
≤ 250 mg/L,	:	SO_4^{2-}
≤ 100 mg/L,	:	Ca^{2+}
≤ 50 mg/L,	:	Anionic Surfactant
≤ 10 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤ 1000 mg/L,	:	As(Ⅲ)
≤ 500 mg/L,	:	Mn^{2+}
≤ 250 mg/L,	:	Ni^{2+} , Zn^{2+}
≤ 100 mg/L,	:	Ba^{2+}
≤ 50 mg/L,	:	Al^{3+} , Cr^{3+}
≤ 25 mg/L,	:	Cu^{2+}
≤ 10 mg/L,	:	CN^- , Cr(Ⅵ)
≤ 5 mg/L,	:	Fe^{2+} , Sn^{2+}
Sub-ppm level	:	Ag^+ , Fe^{3+}

Suitable for seawater samples.
(Commonly seawater include Boron (about 4-5mg/L)

Ca Calcium

Color change : Yellow → Reddish purple → Purple
Method : Phthalein Complexone
Range : 0.5 - 15.0 mg/L (ppm)
Reagent : LR-Ca-B No.48 R-1(Pack)
Reaction time : 2 min. after R-1 reagent is added.

Procedure

1. Select <Ca> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add R-1 reagent into the vial and press <Start>. (Fig.3)
6. Cap the vial tightly and shake the vial strongly at once for 10 sec. (Fig.4)
7. Before 2 minutes pass, return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

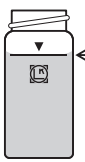


Fig.1

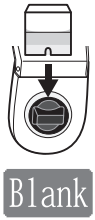


Fig.2

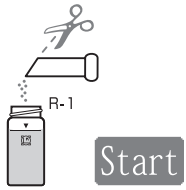


Fig.3

Fig.4

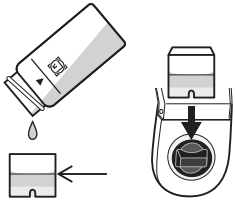


Fig.5

Cautions

1. Calcium ion (Ca^{2+}) can be determined in this method.
   If you wish to measure Total Calcium fraction including suspended particles, dissolve solid phases before the measurement.
2. The Calcium Hardness($CaCO_3$) can be calculated with Ca^{2+} concentration by the following equation.

   Calcium Hardness = Ca^{2+} concentration × 2.5
3. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temprature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 9.
   Measured sample contains about 40 mg/time of Boron.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 100 mg/L, : B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol , Residual Chlorine , Anionic Surfactant

≤ 10 mg/L, : Mg^{2+}

Heavy metal ions:

≤ 10 mg/L, : Al^{3+} , Ba^{2+} , CN^- , Cr^{3+} , Cr(Ⅵ) , Cu^{2+} , Mn^{2+} , Mo(Ⅵ) , Zn^{2+}

≤ 1 mg/L, : Co^{2+}

Sub-ppm level : Fe^{2+}、Fe^{3+}、Ni^{2+}

Not suitable for seawater samples.

Cl Chloride

Color change : Transparent → White Turbidity
Method : Silver Nitrate
Range : 2.0 - 40.0 mg/L (ppm)
Reagent : LR-Cl No.10 R-1(Pack)
Reaction time : 3 min. after R-1 reagent is added.

Procedure

1. Select <Cl> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add R-1 reagent into the vial and press <Start>. (Fig.3)
6. Cap the vial tightly and shake the vial strongly at once for 10 sec. (Fig.4)
7. Before 3 minutes pass, return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

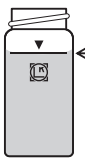


Fig.1

Fig.2

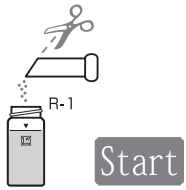


Fig.3


Fig.4

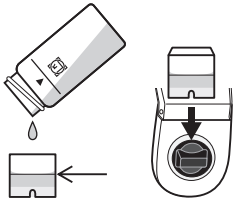


Fig.5

Cautions

1. Chloride ion (Cl^-) can be determined in this method.
   In case of Br^- or I^- coexisting, there is possibility to cause positive errors.
2. In case of higher concentration than 100 mg/L, the turbidity is not correlative to the Cl concentration.
   In case of very high concentration of Cl in sample, for example seawater, the turbidity would not occur at all.
   When the sample is expected to be very high concentration, compare the result with diluted value.
3. The Chloride does not mean the Chlorine for the disinfection (for example in the tap water).
   In case of measuring Chlorine for the disinfection, refer to "ClO-DPD Residual Chlorine".
4. The optimum pH is 5 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
5. Keep sample temprature in the range of 15 - 20℃ .
   If sample temperature is out of 15 - 20℃ , multiply the results by the appropriate multiplier.
   25℃ ····· ×0.8 30℃ ····· ×0.7
6. The pH of the measured sample is about 5.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 100 mg/L,	:	B(Ⅲ) , F^- , K^+ , Mg^{2+} , Na^+ , NO_2^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤ 50 mg/L,	:	NO_3^-
≤ 20 mg/L,	:	Ca^{2+}
≤ 10 mg/L,	:	NH_4^+
≤ 2 mg/L,	:	I^-
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤ 10 mg/L,	:	Al^{3+} , CN^- , Co^{2+} , Cr^{3+} , Cu^{2+} , Fe^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+}
≤ 1 mg/L,	:	Ba^{2+} , Fe^{2+} , Mo(Ⅵ)

Not suitable for seawater samples.

ClO-C Residual Chlorine (High Range)

Color change : None → Yellow → Orange → Red brown
Method : Potassium Iodide
Range : 2 - 320 mg/L (ppm)
Reagent : WAK-ClO(C) Tube
Reaction time : 1 min. after drawing sample into the tube.

Procedure

1. Select <ClO-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time.
   (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box.
   (Fig.4)
7. After 1 minute, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

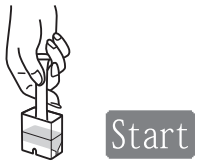


Fig.3

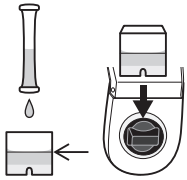


Fig.4

Cautions

1. Total Residual Chlorine (Free Residual Chlorine + Combined Residual Chlorine) can be determined in this method.
2. This Residual Chlorine means the Chlorine for the disinfection.
   In case of measuring Chloride ion, refer to "Cl Chloride".
3. The optimum pH is 4 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 4.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}

≤ 50 mg/L, : Anionic Surfactant

Heavy metal ions:

≤ 1000 mg/L, : Al^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+}

≤ 500 mg/L, : Ba^{2+}

≤ 10 mg/L, : Cr(Ⅵ) , Fe^{3+}

≤ 5 mg/L, : Cu^{2+}

Suitable for seawater samples.

Fe^{2+} , NO_2^- and other reductive substances can interfere by Residual Chlorine consumption.

H_2O_2 and other oxidizing substances can make positive error.

ClO-DPD Residual Chlorine (Free)

Color change : None → Pink
Method : N,N-diethyl-p-phenylenediamine sulfate
Range : 0.10 - 3.00 mg/L (ppm)
Reagent : WAK-ClO·DP Tube
Reaction time : 1 min. after drawing sample into the tube.

Procedure

1. Select <ClO-DPD> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 1 minute, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

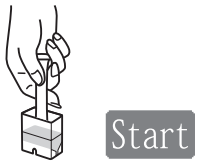


Fig.3

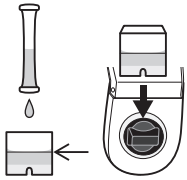


Fig.4

Cautions

1. Free Residual Chlorine can be determined in this method.
   In case of measuring Total Residual Chlorine (Free Residual Chlorine + Combined Residual Chlorine), refer to "T-ClO Total Residual Chlorine".
2. This Residual Chlorine means the Chlorine for the disinfection.
   In case of measuring Chloride ion (for example: salt), refer to "Cl Chloride".
3. The optimum pH is 7 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The result becomes lower value when Residual Chlorine concentration is higher than 500mg/L. In this case, dilute the sample with the pure water.
6. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L,	:	Cl^- , F^- , K^+ , Na^+ , PO_4^{3-} , SO_4^{2-}
≤ 500 mg/L,	:	B(Ⅲ) , Mg^{2+}
≤ 100 mg/L,	:	Ca^{2+} , NO_3^- , Phenol

Heavy metal ions:

≤ 1000 mg/L,	:	Mo(Ⅵ)
≤ 250 mg/L,	:	Mn^{2+}
≤ 100 mg/L,	:	Cr^{3+} , Ni^{2+}
≤ 25 mg/L,	:	Co^{2+}
≤ 10 mg/L,	:	Zn^{2+}
≤ 5 mg/L,	:	Al^{3+} , Fe^{3+}
≤ 1 mg/L,	:	Ba^{2+} , Cu^{2+}
Sub-ppm level	:	Ag^+ , Cr(Ⅵ)

Suitable for seawater samples.
CN^- , Fe^{2+} , NO_2^- and other reductive substances can consume Residual Chlorine.
The Free Residual Chlorine concentration can decrease because of the reaction with NH_4^+.
However, the Total Residual Chlorine remains unchanged.
If I^- coexist, the Total Residual Chlorine is measured.

T-ClO Total Residual Chlorine

Color change : None → Pink
Method : N,N-diethyl-p-phenylenediamine sulfate
Range : 0.10 - 3.00 mg/L (ppm)
Reagent : WAK-T·ClO Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <T-ClO> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

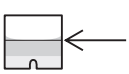


Fig.1

Fig.2

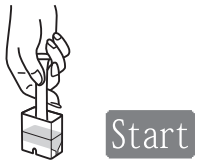


Fig.3

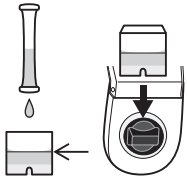


Fig.4

Cautions

1. Total Residual Chlorine can be determined in this method.
   In case of measuring Free Residual Chlorine (Total Residual Chlorine - Combined Residual Chlorine), refer to "ClO-DPD Residual Chlorine (Free)".
2. This Residual Chlorine means the Chlorine for the disinfection.
   In case of measuring Chloride ion (for example: the salt), refer to "Cl Chloride".
3. The optimum pH is 7 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The result becomes lower value when Total Residual Chlorine concentration is higher than 500mg/L. In this case, dilute the sample with the pure water.
6. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L,	:	$B(Ⅲ)$, Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}
≤ 500 mg/L,	:	Ca^{2+}
≤ 25 mg/L,	:	Phenol

Heavy metal ions:

≤ 1000 mg/L,	:	Mn^{2+} , $Mo(Ⅵ)$, Ni^{2+}
≤ 100 mg/L,	:	Cr^{3+}
≤ 50 mg/L,	:	Co^{2+} , Zn^{2+}
≤ 5 mg/L,	:	Al^{3+} , Fe^{3+}
≤ 2 mg/L,	:	Ag^+
≤ 1 mg/L,	:	Ba^{2+} , Cu^{2+}
Sub-ppm level	:	$Cr(Ⅵ)$

Suitable for seawater samples.
CN^- , Fe^{2+} , NO_2^- and other reductive substances can interfere by Residual Chlorine consumption.
Oxidizing substances can make positive error.

ClO_2 Chlorine dioxide

Color change : None → Pink
Method : N,N-diethyl-p-phenylenediamine sulfate with Glycine
Range : 0.20 - 6.00 mg/L (ppm)
Reagent : WAK-ClO_2 K-1(Dropper) , Tube
Reaction time : 1 min. after drawing sample into the tube.

Procedure

1. Select <ClO_2> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Add 2 drops of K-1 reagent.
   Put the cap and shake the cell 2-3 times. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 1 minute, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1 Fig.2

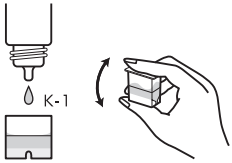


Fig.3

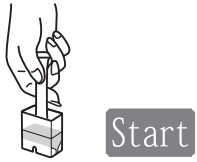


Fig.4

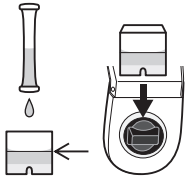


Fig.5

Cautions

1. Keep the reaction time. Exceed the reaction time, the reaction color will become stronger. In case of Residual Chlorine, Hypochlorite and Chlorite Acid are coexisting, the reaction time must be kept strictly.
2. The optimum pH is 7 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The result becomes lower value when Chlorine dioxide concentration is higher than 200mg/L. In this case, dilute the sample with the pure water.
5. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L,	:	B(Ⅲ) , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}
≤ 500 mg/L,	:	Chlorite ion , Chlorate ion
≤ 250 mg/L,	:	Ca^{2+} , NH_4^+
≤ 10 mg/L,	:	Phenol
≤ 1 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤ 1000 mg/L,	:	Mn^{2+} , Mo(Ⅵ)
≤ 100 mg/L,	:	Ni^{2+} , Zn^{2+}
≤ 25 mg/L,	:	Co^{2+} , Cr^{3+}
≤ 5 mg/L,	:	Al^{3+} , Fe^{3+}
≤ 1 mg/L,	:	Ba^{2+} , Cu^{2+}
Sub-ppm level	:	Ag^+ , Cr(Ⅵ) , Fe^{2+}

Suitable for seawater samples.
CN^- , Fe^{2+} , NO_2^- and other reductive substances can consume Residual Chlorine.
Oxidizing substances can make positive error.
If I^- coexist, the Residual Chlorine is measured.

CN Free Cyanide

Color change : None → (Red) → Blue
Method : 4-Pyridinecarboxylic acid
Range : 0.020 - 0.400 mg/L (ppm)
Reagent : WAK-CN K-1(Small Pack) , Tube
Reaction time : 10 min. after drawing sample into the tube.

Procedure

1. Select <CN> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Add K-1 reagent. Put the cap and shake the cell 5 - 6 times to dissolve. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 10 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5) (Fig.6)
8. After 10 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

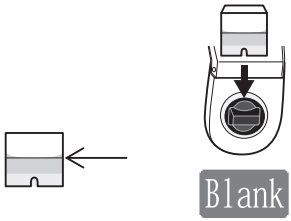


Fig.1 Fig.2

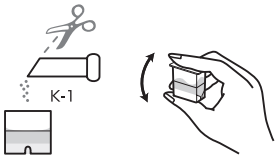


Fig.3

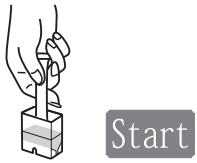


Fig.4

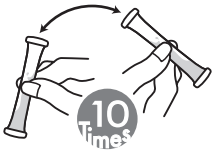


Fig.5

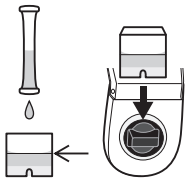


Fig.6

Cautions

1. Free Cyanide ion (CN^-) and Cyanogen Chloride (CNCl) can be determined in this method.
   When measuring Total Cyanide containing Metal cyanides, refer to page36-39 "CN^T Total Cyanide" "CN^T-D Total Cyanide (Low Range)".
2. The optimum pH is 5 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 20 - 30℃ .
   If sample temperature is out of 20 - 30℃ , multiply the results by the appropriate multiplier.
   10℃ ·····×2 15℃ ·····×1.3
4. The pH of the measured sample is about 5.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} ,SO_4^{2-} , Anionic Surfactant , Phenol
≤10 mg/L,	:	Residual Chlorine
≤5 mg/L,	:	Formaldehyde
Sub-ppm level	:	I^-

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Cr^{3+} , Cr(Ⅵ) , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mo(Ⅵ) , Zn^{2+}
≤5 mg/L,	:	Mn^{2+}
≤1 mg/L,	:	Ba^{2+} , Co^{2+}
Sub-ppm level	:	Ni^{2+} , SCN^-

It is admitted that thiocyanide and some kinds of ethylene amin (tetraethylene-pentamine, penta ethylen-hexamine) may show stronger color developement.
Strong oxidizing substances (ex. Residual Chlorine) and reductive substances (ex. Sulfite) can make negative error.
For the industrial wastewater samples in which interfering substances are expected, a pretreatment like distillation method or aeration method is required before the measurement.
Not suitable for seawater samples.

CN^T Total Cyanide

Color change : Yellow → Orange → Brown
Method : Picric acid
Range : 0.10 - 3.00 mg/L (ppm)
Reagent : LR-CN^T No.46 R-1(Powder), R-2 (Pack)
Reaction time : 0 min.
Additional tool : Water Analysis Set: Total Cyanide (Model: WA-CN^T)
Instruction manual : Refer to the instruction manual which is attached to WA-CN^T.

Procedure

1. Select <CN^T> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with pure water. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Take out the cell and pour out the pure water.
   Pour 1.5 mL of the sample into the cell; the sample is distilled and color developed by WA-CN^T, and adjusted with 25mL. (Fig.3)
6. Insert the cell into the cell box and press <Start>. (Fig.4)
7. The measurement value is displayed automatically.
   The result will be printed out when the printer is connected.

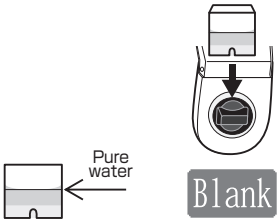


Fig.1 Fig.2

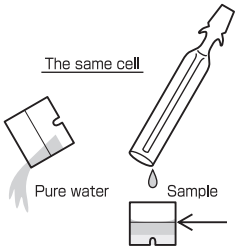


Fig.3

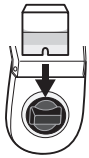


Fig.4

Cautions

1. The distiller parts becomes hot, be careful not to scald.
2. Well ventilate the room during distillation.
3. The sample after adding R-1 is about pH2.
   The sample after adding R-2 is about pH12.
   In case that high concentration of cyanide is detected, the neutralized wastewater should be prevented from generating the cyanide gas.

Interferences

Refer to the instruction manual which is attached to WA-CN^{T}.

CN^T-D Total Cyanide (Low Range)

Color change : None → (Red) → Blue
Method : 4-Pyridinecarboxylic Acid - Pyrazolone
Range : 0.005 - 0.150 mg/L (ppm)
Reagent : LR-CN-B No.14B R-1(Pack), R-2 (Pack)
Reaction time : 20 min. after R-2 reagent is added.
Additional tool : Water Analysis Set: Total Cyanide (Low Range) (Model: WA-CN^T(L))
Instruction manual : Refer to the instruction manual which is attached to WA-CN^T(L).

Procedure

1. Select <CN^T-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with pure water. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2) Take out the cell and pour out the pure water.
5. The vial is filled with the sample distilled by WA-CN^T(L). (Fig.3)
6. Add R-1 reagent to the vial, cap the vial tightly and shake 10 times, then and let it sit for 3 minutes. (Fig.4)
7. Add R-2 reagent and press <Start>. Cap the vial tightly and shake over 60 times for 30 seconds. (Fig.5)
8. Before 20 minutes pass, return the sample into the cell gently, and insert the cell into the cell box. (Fig.6)
9. After 20 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

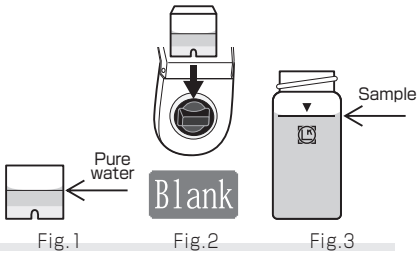


Fig.1 Fig.2 Fig.3

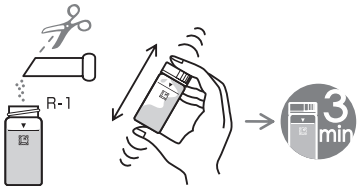


Fig.4

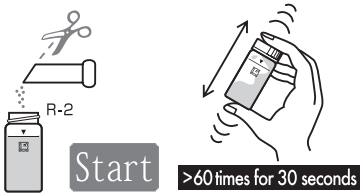


Fig.5

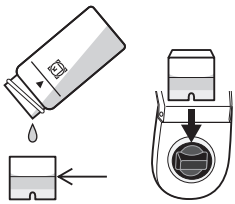


Fig.6

Cautions

1. Keep sample temperature in the range of 15 - 30℃ .
2. R-2 reagent is not dissolved complettely.
3. Measured sample is about pH 8.

Interferences

Refer to the instruction manual which is attached to WA-CN^{T}(L).

COD Chemical oxygen demand with $KMnO_4$

Color change : Red purple → Green
Method : Oxidation by potassium permanganate in alkaline
Range : 2.0 - 10.0 mg/L (ppm)
Reagent : LR-COD-B No.44 R-1 (Liquid), R-2 (Pack), COD neutralizer (Dropper)
Reaction time : 10 min. after R-2 reagent is added.

Procedure

1. Select <COD> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Add 0.5 mL of R-1 reagent with the attached syringe into the vial. Put the cap tightly and shake the vial 5 - 6 times. (Fig.2)
5. Fill the cell up to the line (1.5 mL) with sample from the vial. (At this time, rinse the cell with sample of procedure 4.) (Fig.3)
6. Insert the cell into the cell box and press <Blank>. Pour out the sample of the cell. (Fig.4)
7. Add R-2 Reagent into the vial and press <Start>. (Fig.5)
8. Put the cap tightly and shake the vial 5 - 6 times. (Fig.6)
9. Before 10 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box (At this time, rinse the cell with sample of the vial.) (Fig.7)
10. After 10 minutes, the measurement value will be displayed.
    The result will be printed out when the printer is connected.
11. Measured sample in the vial must be adjusted to neutral pH levels by adding 8 drops (0.5mL) of COD neutralizer.

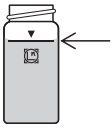


Fig.1

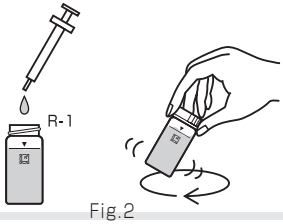


Fig.2


Fig.3

Fig.4

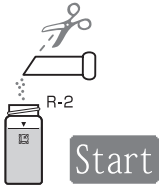


Fig.5


Fig.6

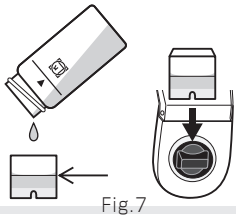


Fig.7

Cautions

1. For acid sample, adjust the pH to over 6 with diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 25℃ .
3. At the procedure 5. and 9., rinse the cell with sample 2-3 times before filling the cell with the sample.
4. The ratio of Potassium permanganate in R-1solution is less than 1%.
5. The pH of the measured sample is about 12.
6. The final sample after adding COD neutralizer is about pH7.
   Check the pH before the disposal of waste.

The potassium permanganate method (COD-Mn) is generally used for COD measurement in Japan, according to the standard procedure JIS K 0102 17 defined by the Japanese Industrial Standards Committee.
(See http://www. jisc.go.jp/eng/index.html).
The method used in this COD method is based on a different standard procedure, JIS K 0102 19, using an alkaline medium (COD-OH).
This method has been calibrated on potassium permanganate consumption in an alkaline medium at ambient temperature for a time depending on the temperature.
This procedure presents the advantage to be fast and simple.
However, standard protocol uses glucose (dextroglucose) for Standard Solutions.
The samples usually contain different components and the oxidation kinetic and ratio may differ of from standards.

Color Chromaticity

Measuring yellow color of sample
Calibration : Platinum Cobalt Color standard
Range : 100 - 1000°
Reagent : Unnecessary
Reaction time : 0 min.

Procedure

1. Select <Color> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with pure water. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Take out the cell from the cell box and pour out the pure water.
   Fill the cell up to the line (1.5 mL) with sample. (Fig.3)
6. Insert the cell into the cell box and press <Start>. (Fig.4)
7. The measurement value is displayed automatically.
   The result will be printed out when the printer is connected.

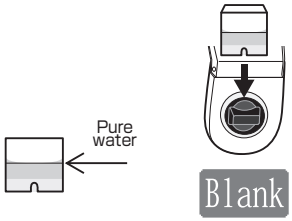


Fig.1 Fig.2

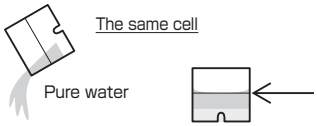


Fig.3

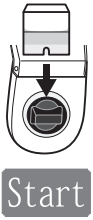


Fig.4

Cautions

Turbidity and other colors than pale yellow - yellowish brown can interfere the measurement.

Cr^{6+} Chromium (Hexavalent)

Color change : None → Light red → Red → Red purple
Method : Diphenylcarbazide
Range : 0.050 - 1.400 mg/L (ppm)
Reagent : WAK-Cr^{6+} Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <Cr^{6+}> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube and press <Start>. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

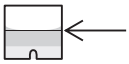


Fig.1

Fig.2

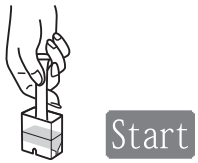


Fig.3

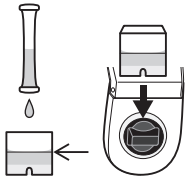


Fig.4

Cautions

1. Hexavalent Chromium can be determined in this method.
   In case of measuring Total Chromium including Trivalent Chromium Cr^{3+}, refer to "Cr^{T} Total Chromium".
2. The sample exceeding pH 9 must be neutralized with diluted Sulfuric Acid.
   Be more careful in the measurement of ready - mixed concrete wastewater.
3. Keep sample temprature in the range of 15 - 30℃ .
4. The pH of the measured sample is ≤ 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	Ca^{2+} , Cl^{-} , I^{-} , K^{+} , Mg^{2+} , Na^{+} , NH_4^{+} , NO_3^{-} , PO_4^{3-} , SO_4^{2-} , Phenol
≤500 mg/L,	:	F^{-}
≤250 mg/L,	:	B(Ⅲ)
≤25 mg/L,	:	NO_2^{-}
≤1 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Ba^{2+} , CN^{-} , Co^{2+} , Mn^{2+} , Zn^{2+}
≤500 mg/L,	:	Al^{3+} , Ni^{2+}
≤5 mg/L,	:	Cu^{2+} , Mo(Ⅵ) , V(Ⅴ)
≤2 mg/L,	:	Ag^{+} , Fe^{3+}

Suitable for seawater samples.
Reductive substances may reduce of Cr(Ⅵ) to Cr^{3+} .
In this case, measure Total Chromium.

Cr^{T} Total Chromium

Color change : None → Light red → Red → Red purple
Method : Oxydation and Diphenylcarbazide
Range : 0.050 - 1.400 mg/L (ppm)
Reagent : Cr-RA R-1(Dropper), R-2(Dropper), R-3(Dropper)
WAK-Cr^{6+} Tube
Reaction time : 2 min. after drawing sample into the tube.

Pretreatment Procedure

1. Fill the beaker with 15 mL of sample and add 5 drops of R-1 reagent. (Fig.1)

Fig.1

2. Heat the sample to boiling lightly. Stir the sample and add R-2 reagent until the reddish purple color does not disappear. (Fig.2)

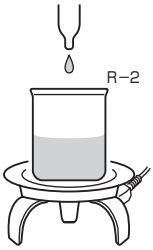


Fig.2

3. Stop the heating and add one drop of R-3 reagent to be disappeared the reddish purple color.
If the color does not disappear, add one more drop of R-3 reagent. (Fig.3)
Add pure water for loss of water by heating.

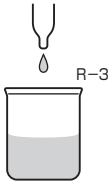


Fig.3

4. Let the sample of beaker cool down to the room temperature.
Fill the cell up to the line (1.5 mL) with sample. (Fig.4)

Go on the following "Procedure" on the next page.

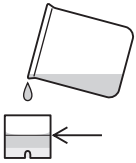


Fig.4

Procedure

1. Select <Cr^T> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Insert the cell into the cell box and press <Blank>. (Fig.5)
4. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.6)
5. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.7)
6. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.5

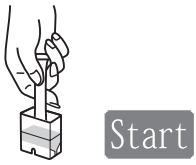


Fig.6

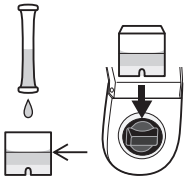


Fig.7

Cautions

1. Total Chromium (Cr^{3+} and Cr(Ⅵ)) can be determined in this method.
2. R-2 reagent contains Potassium permanganate less than 1%.
3. R-1 reagent contains a diluted Sulfuric Acid of less than 10%.
4. R-1 reagent and measured sample is about ≤ pH 2.

Interferences

Refer to "Cr^{6+} Chromium Hexavalent".

Cu Copper

Color change : None → Light orange → Orange
Method : Bathocuproine
Range : 0.10 - 5.00 mg/L (ppm)
Reagent : WAK-Cu Tube
Reaction time : 1 min. drawing sample into the tube.

Procedure

1. Select <Cu> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 1 minute, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

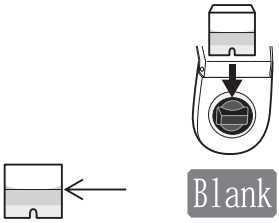


Fig.1 Fig.2

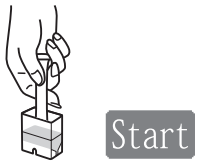


Fig.3

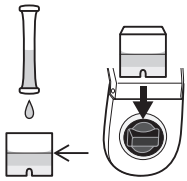


Fig.4

Cautions

1. Monovalent, Divalent Copper ions (Cu^{+} , Cu^{2+}) can be determined in this method.
   For measurement of Total Copper fraction including suspended particles, a pretreatment is needed.
2. The optimum pH is 6 in the reaction.
   When pH level exceed pH 2 -10, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temprature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 6.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^{-} , F^{-} , I^{-} , K^{+} , Mg^{2+} , Na^{+} , NH_4^{+} , NO_2^{-} , NO_3^{-} , PO_4^{3-} , SO_3^{2-} , SO_4^{2-} , Phenol , Residual Chlorine

≤50 mg/L, : Anionic Surfactant

Heavy metal ions:

≤1000 mg/L, : Mo(Ⅵ) , Ni^{2+}

≤250 mg/L, : Co^{2+} , Mn^{2+}

≤100 mg/L, : Ba^{2+}

≤50 mg/L, : Zn^{2+}

≤20 mg/L, : Cr^{3+} , Cr(Ⅵ)

≤10 mg/L, : Ag^{+}

≤5 mg/L, : Fe^{2+} , Fe^{3+}

≤2 mg/L, : Al^{3+}

≤1 mg/L, : CN^{-}

Suitable for seawater samples.
Oxidizing substances can interfere.

DET Anionic Surfactants

Color change : None → Light blue → Blue
Method : Methylene Blue - Anion surfactant Complex
Range : 0.05 - 1.20 mg/L (ppm)
Reagent : Water Analysis Set: Anionic Surfactants (Model: WA-DET) R-1 (Dropper), R-2 (Liquid)
Reaction time : 0 min.
Instruction manual : Refer to the instruction manual which is attached to WA-DET.

Preparation of sample

1. At the step 4 of "How to use" of WA-DET, add 1.5 mL of R-2 reagent with the attached plastic pipette into the tube of WA-DET.
   (The addition volume of R-2 reagent is different to visual test procedure.)
   (Fig. 1)

2. Put the cap tightly and shake the tube in order to spread R-2 reagent over the surface of tube.
   Go on the following "Procedure". (Fig.2)

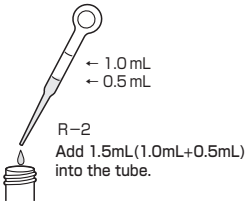


Fig.1


Fig.2

Procedure

1. Select <DET> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with pure water (or tap water). (Fig.3)
4. Insert the cell into the cell box and press <Blank>. (Fig.4)
5. Take out the cell from the cell box and pour out the pure water. Pour the whole prepared sample into the cell. (Fig.5)
6. Insert the cell into the cell box. Press <Start>. (Fig.6)
7. The measurement value is displayed automatically. The result will be printed out when the printer is connected.

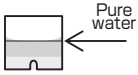


Fig.3

Fig.4


Fig.5

Fig.6

Cautions

1. Even the slightest Cationic surfactant, Nonionic surfactant and Oil can make negative error.
   In case of high concentrations of these ions, dilute the sample water 10 times before the measurement and multiply the measurement result by 10.
   ※Dilution : Pour 2mL of sample water into the tube. Add pure water (or tap water) up to the line.
   ※In case of river water containing Nonionic surfactant higher than 1mg/L, it foams as it is shaken before adding the reagent.
2. In case of river water which results higher than 0.5mg/L, a lot of interferences supposed to coexist. The actual result of Anionic Surfactant may become higher.
3. The optimum pH is 7 in the reaction.
   When pH level exceed pH 3 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample water temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.

   10℃ ·····×0.75　　15℃ ·····×0.85
   25℃ ·····×1.25　　30℃ ·····×1.85
5. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : Ca^{2+} , Cl^{-} , F^{-} , K^{+} , Mg^{2+} , Na^{+} , NH_4^{+} , NO_2^{-} , NO_3^{-} , PO_4^{3-} , SO_4^{2-} , Residual Chlorine

Heavy metal ions:

≤100 mg/L, : Cu^{2+}

≤10 mg/L, : Fe^{2+} , Fe^{3+}

Not suitable for seawater samples.
Oxidizing substances can interfere.

DO Dissolved Oxygen

Color change : None → Blue
Method : Indigo Carmine
Range : 2.0 - 11.0 mg/L (ppm)
Reagent : Dissolved Oxygen Test Kit Economy Package (Mode: AZ-DO-30)
Reaction time : 2 min.
Specified tool : DO Adapter for DIGITALPACKTEST·MULTI (Model : DPM-MTADO)

Procedure

1. Insert the DO Adapter into the cell box with ▼ of the DO Adapter facing ▲ of the cell box. (Fig.1)
2. Select <DO> on the screen.
3. Press <Enter> to display the measurement procedure.
4. Press <Blank> without putting anything in. (Fig.2)

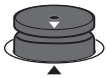


Fig.1

Fig.2

Fig.3

5. Insert the ampoule into the specified snapper. (Fig.3)

6. Immerse the snapper into the sample and push the ampoule in order to snap off the tip. The ampoule will fill with the sample then press <Start>. (Fig.4)

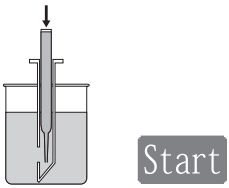


Fig.4

7. Cover the hole of tip with your finger and tilt the ampoule up and down so the bubble in the ampoule travels from end to end. (Fig.5)

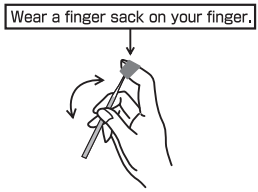


Fig.5

8. Wipe off water drops of the ampoule and place it in the cell box of DO measurement adapter. (Fig.6)

9. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.6

Cautions

1. Dissolved Oxygen can be determined in this method.
2. The normal pH range is pH 2 - 10.
   ≤pH2 : The measure value is obtained low.
   ≥pH10 : The development color is became green.
3. Keep sample temperature in the range of 15 - 30℃ .
4. At Procedure 4, do not set the ampoule into the cell holder.
5. For your safety, be sure to wear a finger sack on your finger whenever you tilt the ampoule which is filled with sample.
6. The measurement range is different to a visual comparison method.
7. The ampoule is made of glass. Take care that you do not get hurt in preservation, handling and disposal of it.
8. The pH of the measured sample is about 4.

F Fluoride (Free)

Color change : Red → Purple
Method : Lanthanum-Alizarin Complexon
Range : 0.40 - 1.50 mg/L (ppm)
Reagent : WAK-F Tube
Reaction time : 15 min. after drawing sample into the tube.

Procedure

1. Select <F> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 10 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4) (Fig.5)
7. After 15 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

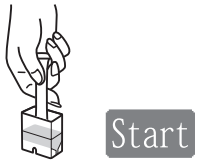


Fig.3

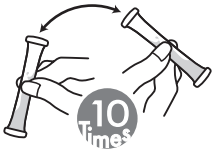


Fig.4

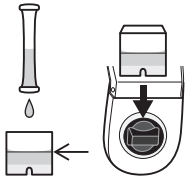


Fig.5

Cautions

1. Only Free Fluoride (in sample containing few interferences, like a pretreated sample or natural water etc.) can be determined in this method.
   Borofluoride (BF_4^-) can not be measured.
   For measurement of Total Fluoride, the sample must be pretreated by distillation.
2. The optimum pH is 5 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The result becomes low when fluoride concentration is higher than 100mg/L. In this case, dilute the sample with the pure water.
5. The pH of the measured sample is about 5.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤50 mg/L,	:	Residual Chlorine
≤10 mg/L,	:	Ca^{2+}

Heavy metal ions:

≤10 mg/L,	:	Ba^{2+} , CN^- , Cr^{3+} , Cr(Ⅵ) , Mn^{2+}
≤1 mg/L,	:	Fe^{2+} , Fe^{3+} , Mo(Ⅵ)
Sub-ppm level	:	Al^{3+} , Co^{2+} , Cu^{2+} , Ni^{2+} , Zn^{2+}

Not suitable for seawater samples.
Fluoride can form a fluoro-complex and precipitate when metal elements like aluminum, iron and alkaline earth metals coexist. In this case, this method is not suitable.

Fe Iron

Color change : None → Light orange → Orange
Method : Reduction and *o*-Phenanthroline
Range : 0.20 - 5.00 mg/L (ppm)
Reagent : WAK-Fe Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <Fe> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

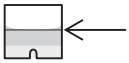


Fig.1

Fig.2

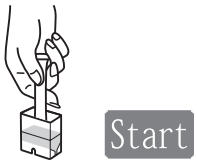


Fig.3

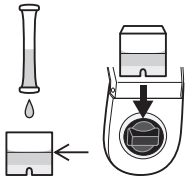


Fig.4

Cautions

1. Dissolved Iron ions (Fe^{2+} , Fe^{3+}) can be determined in this method.
   The pH of sample will affect the dissolved iron state, and some of iron can be as suspended particles .
   The sample must be pretreated in accordance with its state before the measurement.
2. The optimum pH is 6 in the reaction. Adjust the sample pH, if the sample after drawing into the tube is not pH 6.
3. For measurement of Total iron, the following pretreatment is needed.
   〔Pretreatment〕
   Add 0.13mL of 10% dilute Sulfuric Acid into 20mL of sample and heat it to boiling.
   After cooling down, fill the cell with 1.5mL of it.(Procedure 3)
4. This method can also measure EDTA iron ions which are utilized in the hydroponics.
5. Keep sample temperature in the range of 15 - 30℃ .
6. The pH of the measured sample is about 6.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol

≤10 mg/L, : Anionic Surfactant , Residual Chlorine

Heavy metal ions:

≤10 mg/L, : Ba^{2+} , Co^{2+} , Cr^{3+} , Cr(Ⅵ) , Cu^{2+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}

≤1 mg/L, : Al^{3+} , CN^-

Suitable for seawater samples.
Oxidizing substances can interfere.

Fe-D Iron (Low Range)

Color change : None → Light red → Red
Method : Reduction and Bathophenatholine
Range : 0.05 - 2.00 mg/L (ppm)
Reagent : WAK-Fe(D) Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <Fe-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

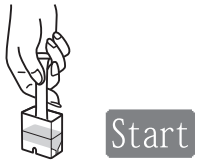


Fig.3

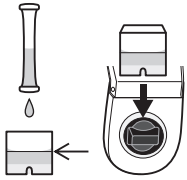


Fig.4

Cautions

1. Dissolved Iron ions (Fe^{2+} , Fe^{3+}) can be determined in this method.
   The pH of sample will affect the dissolved iron state and some of iron can be as suspended particles.
   The sample must be pretreated in accordance with its state before the measurement.
2. The optimum pH is 7 in the reaction. Adjust the sample pH, if the sample after drawing into the tube is not pH 7.
3. For measurement of Total iron, the following pretreatment is needed.
   〔Pretreatment〕
   Add 0.13mL of 10% dilute Sulfuric Acid into 20mL of sample and heat it to boiling.
   After cooling down, fill the cell with 1.5mL of it.(Procedure 3)
4. This method can also measure EDTA iron ions which are utilized in the hydroponics.
5. Keep sample temperature in the range of 15 - 30℃ .
6. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , SO_4^{2-}
≤500 mg/L,	:	Phenol
≤50 mg/L,	:	NO_2^-
≤5 mg/L,	:	PO_4^{3-}
≤2 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Mn^{2+}
≤50 mg/L,	:	Cr(Ⅵ) , Mo(Ⅵ) , Ni^{2+}
≤10 mg/L,	:	Zn^{2+}
≤2 mg/L,	:	Cr^{3+}
≤1 mg/L,	:	Ba^{2+} , CN^-
Sub-ppm level	:	Al^{3+} , Co^{2+} , Cu^{2+}

Not suitable for seawater samples.
Oxidizing substances can interfere.

Fe^{2+} Iron (Divalent)

Color change : None → Light orange → Orange
Method : *o*-Phenanthroline
Range : 0.20 - 5.00 mg/L (ppm)
Reagent : WAK-Fe^{2+} Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <Fe^{2+}> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

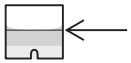


Fig.1

Fig.2

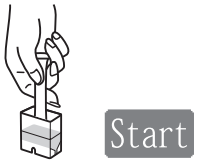


Fig.3

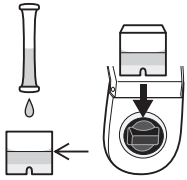


Fig.4

Cautions

1. Divalent Iron ion (Fe^{2+}) can be determined in this method.
2. The pH of sample will affect the dissolved iron state and some of iron can be as suspended particles.
   For measurement of Total iron, refer to "Fe Iron" or "Fe-D Iron (Low Range)".
3. The optimum pH is 5 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 5.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol
≤10 mg/L,	:	Anionic Surfactant
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , Cr^{3+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}
≤1 mg/L,	:	CN^- , Co^{2+} , Cu^{2+}
Sub-ppm level	:	Cr(Ⅵ)

Suitable for seawater samples.
Oxidizing substances (Residual Chlorine, Cr(Ⅵ) etc.) convert Fe^{2+} into Fe^{3+}.

Fe^{2+}-D Iron (Divalent) (Low Range)

Color change : None → Light red → Red
Method : Bathophenanthroline
Range : 0.05 - 2.00 mg/L (ppm)
Reagent : WAK-Fe^{2+}(D) Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <Fe^{2+}-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

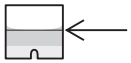


Fig.1

Fig.2

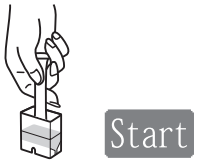


Fig.3

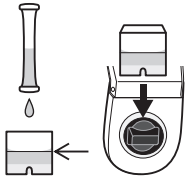


Fig.4

Cautions

1. Divalent Iron ion (Fe^{2+}) can be determined in this method.
2. The pH of sample will affect the dissolved iron state and some of iron can be as suspended particles.
   For measurement of Total iron, refer to "Fe Iron" or "Fe-D Iron (Low Range)".
3. The optimum pH is 5 in the reaction. Adjust the sample pH, if the sample after drawing into the tube is not pH 5.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 5.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol
≤500 mg/L,	:	Ca^{2+}
≤50 mg/L,	:	Anionic Surfactant
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , Cr^{3+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+}
≤5 mg/L,	:	Zn^{2+}
≤1 mg/L,	:	Co^{2+} , Cu^{2+}
Sub-ppm level	:	CN^- , Cr(Ⅵ)

Not suitable for seawater samples.
Oxidizing substances (Residual Chlorine, Cr(Ⅵ) etc.) convert Fe^{2+} into Fe^{3+}.

FOR Formaldehyde

Color change : Yellow → Yellow green → Green
Method : MBTH
Range : 0.20 - 1.00 mg/L (ppm)
Reagent : WAK-FOR K-1(Small Pack), Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <FOR> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Add K-1 reagent. Put the cap and shake the cell 5 - 6 times to dissolve.
   Then And let it sit for 3 minutes. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 10 times. (Fig.5)
8. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.6)
9. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

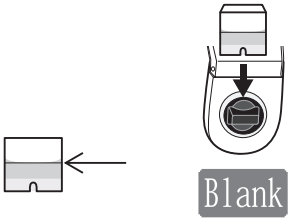


Fig.1 Fig.2

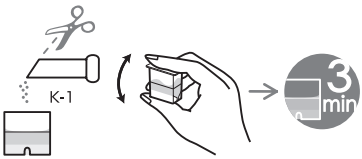


Fig.3

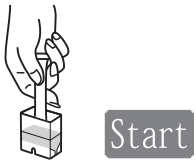


Fig.4

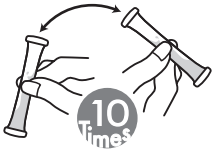


Fig.5

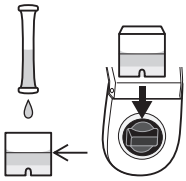


Fig.6

Cautions

1. The optimum pH is 2 in the reaction.
   When pH level exceed pH 5 - 8, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   10℃ ·····×1.30 30℃ ·····×0.60
3. The pH of the measured sample is about 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-}
≤50 mg/L, : I^- , SO_4^{2-} , Phenol
≤20 mg/L, : Anionic Surfactant , Residual Chlorine
≤1 mg/L, : NO_2^-

Heavy metal ions:

≤10 mg/L, : Al^{3+} , Ba^{2+} , Co^{2+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+}
≤5 mg/L, : Cr(Ⅵ)
≤1 mg/L, : CN^-

Not suitable for seawater samples.
Oxidizing substances and Reductive substances can interfere.

H_2O_2-C Hydrogen Peroxide (High Range)

Color change : None → Yellow → Orange → Red brown
Method : Potassium Iodide
Range : 3 - 200 mg/L (ppm)
Reagent : WAK-H_2O_2(C) Tube
Reaction time : 1 min. after drawing sample into the tube.

Procedure

1. Select <H_2O_2-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 1 minute, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

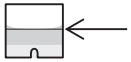


Fig.1

Fig.2

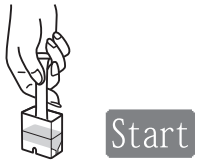


Fig.3

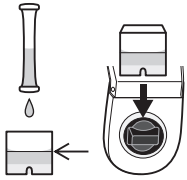


Fig.4

Cautions

1. The optimum pH is 4 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The pH of the measured sample is about 4.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}

≤50 mg/L, : Anionic Surfactant

Heavy metal ions:

≤1000 mg/L, : Al^{3+} , Mn^{2+} , Ni^{2+} , Zn^{2+}

≤500 mg/L, : Ba^{2+}

≤50 mg/L, : Cr(Ⅵ)

≤20 mg/L, : Fe^{3+}

≤5 mg/L, : Cu^{2+}

Suitable for seawater samples.

Fe^{2+} , NO_2^- and other Reductive substances can consume Hydrogen Peroxide.

Residual Chlorine and other oxidizing substances can make positive error.

H_2O_2 Hydrogen Peroxide

Color change : None → Light purple → Purple
Method : 4-Aminoantipyrine with enzyme
Range : 0.10 - 2.50 mg/L (ppm)
Reagent : WAK-H_2O_2 Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <H_2O_2> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

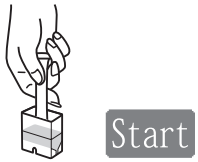


Fig.3

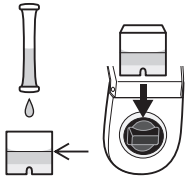


Fig.4

Cautions

1. The optimum pH is 7 in the reaction.
   When pH level exceed pH 6 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. In case of higher concentration than 25 mg/L, the reaction color is not correlative to the H_2O_2 concentration.
   When the sample is expected to be very high conc., compare the result with diluted value.
4. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}
≤500 mg/L,	:	F^- , NO_2^-
≤250 mg/L,	:	Phenol
≤50 mg/L,	:	Anionic Surfactant
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Ag^+ , Ba^{2+} , Ni^{2+} , Zn^{2+}
≤500 mg/L,	:	Fe^{3+}
≤50 mg/L,	:	Cr^{3+} , Cr(Ⅵ) , Cu^{2+}
≤20 mg/L,	:	Al^{3+} , Co^{2+} , Mn^{2+}
≤2 mg/L,	:	Mo(Ⅵ)
≤1 mg/L,	:	CN^-
Sub-ppm level	:	Fe^{2+}

Suitable for seawater samples.
Fe^{2+} , NO_2^- and other reductive substances can consume Hydrogen Peroxide. Residual Chlorine, Ozone and other oxidizing substances can make positive error.

K Potassium

Color change : Transparent → White turbidity
Method : Kalibor turbidimetry
Range : 2.00 - 8.00 mg/L (ppm)
Reagent : LR-K No. 36 R-1(Pack)
Reaction time : 5 min. after R-1 reagent is added.

Procedure

1. Select <K> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add R-1 Reagent into the vial and press <Start>. (Fig.3)
6. Put the cap tightly and shake the vial strongly for 10 sec. (Fig.4)
7. Before 5 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

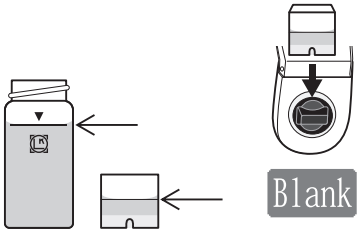


Fig.1 Fig.2

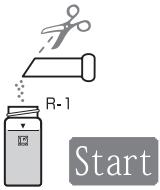


Fig.3


Fig.4

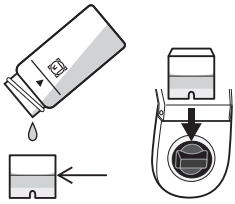


Fig.5

Cautions

1. Potassium ion (K^+) can be determined in this method.
   For measurement of Total Potassium fraction including suspended particles, a pretreatment is needed.
2. The optimum pH is 7 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 7.
   Measured sample contains about 2 mg/L of Boron.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , Mg^{2+} , Na^+ , NO_2^- , Anionic Surfactant , Phenol

≤10 mg/L, : Residual Chlorine

Sub-ppm level : NH_4^+

Heavy metal ions:

≤10 mg/L, : Al^{3+} , Ba^{2+} , Co^{2+} , Cr^{3+} , Cu^{2+} , Ni^{2+} , Zn^{2+}

For measurement of seawater samples, dilute the sample because of high Potassium content.

$KMnO_4$ Potassium permanganate consumption

Color change : Red purple → Green
Method : Oxidation by potassium permanganate in alkaline
Range : 2.0 - 10.0 mg/L (ppm)
Reagent : LR-COD-B No.44 R-1(Liquid), R-2 (Pack), COD neutralizer (Dropper)
Reaction time : 10 min. after R-2 reagent is added.

Procedure

1. Select <$KMnO_4$> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Add 0.5 mL of R-1 reagent with the attached syringe into the vial. Put the cap tightly and shake the vial 5 - 6 times. (Fig.2)
5. Fill the cell up to the line (1.5 mL) with sample from the vial. (At this time, rinse the cell with sample of procedure 4.) (Fig.3)
6. Insert the cell into the cell box and press <Blank>. Pour out the sample of the cell. (Fig.4)
7. Add R-2 reagent and press <Start>. (Fig.5)
8. Put the cap tightly and shake the vial 5 - 6 times. (Fig.6)
9. Before 10 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box (At this time, rinse the cell with sample of the vial.) (Fig.7)
10. After 10 minutes, the measurement value will be displayed.
    The result will be printed out when the printer is connected.
11. Measured sample in the vial must be adjusted to neutral pH levels by adding 8 drops (0.5mL) of COD neutralizer.

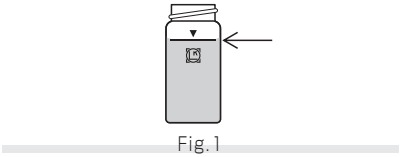


Fig.1

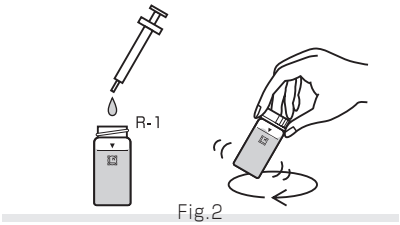


Fig.2

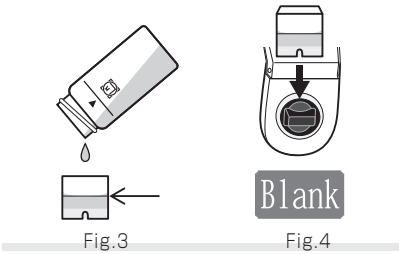


Fig.3 Fig.4

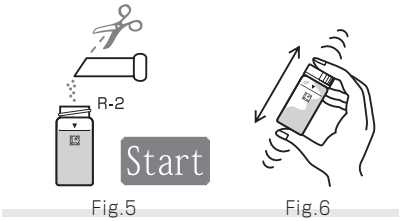


Fig.5 Fig.6

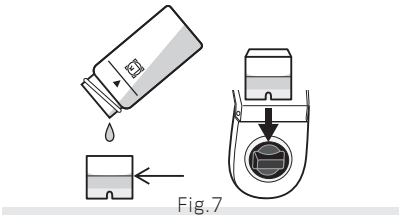


Fig.7

Cautions

1. For acid sample, adjust the pH to over 6 with diluted Sodium Hydroxide solution.
2. Keep sample temprature in the range of 15 - 30℃ .
3. At the procedure 5. and 9., rinse the cell with sample 2-3 times before filling the cell with the sample.
4. R-1 reagent contains Potassium Permanganate is less than 1%.

C. The pH of the measured sample is about 12.
   The final pH of waste liquid after adding COD neutralizer is about 7.
   Check the pH before the disposal of waste.

Mn Manganese

Color change : None → Light red → Red
Method : Potassium Periodate
Range : 0.6 - 20.0 mg/L (ppm)
Reagent : WAK-Mn Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <Mn> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

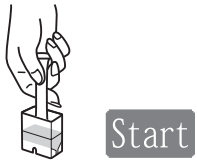


Fig.3

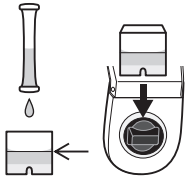


Fig.4

Cautions

1. Dissolved Manganese ions (from divalent up to hexavalent) can be determined in this method.
   For measurement of Total Manganese fraction including suspended particles, a pretreatment is needed.
2. For measurement of heptavalent manganese ion, the following reducing procedure is needed.
   〔Procedure〕
   Add a lot of reductant into sample in order to counteract red color, and measure blank.
   Pour out the blank sample from cell.
   Take the sample into the cell again after rinsing the cell well.
   Make the measurement by ordinary procedure (from the procedure 7 on the previous page).
3. The optimum pH is 7 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Residual Chlorine , Formaldehyde
≤50 mg/L,	:	NO_2^-
≤5 mg/L,	:	I^- , Phenol

Heavy metal ions:

≤1000 mg/L,	:	Mo(Ⅵ)
≤500 mg/L,	:	Ni^{2+}
≤200 mg/L,	:	Al^{3+} , Ba^{2+} , Zn^{2+}
≤100 mg/L,	:	Cu^{2+} , Fe^{2+} , Fe^{3+}
≤50 mg/L,	:	Cr(Ⅵ)
≤20 mg/L,	:	CN^- , Co^{2+}
≤5 mg/L,	:	Cr^{3+}

Suitable for seawater samples.
A lot of reductive substances can make negative error.
For example, sodium hydrogen sulfite coexist higher than 10g/L, it can interfere.

NH_4 Ammonium

Color change : None → Light blue → Blue
Method : Indophenol Blue
Range : 0.20 - 5.00 mg/L (ppm)
Reagent : WAK-NH_4 Tube
Reaction time : 10 min. after drawing sample into the tube.

Procedure

1. Select <NH_4> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 30 times for 30 seconds. (Fig.4)
7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 10 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

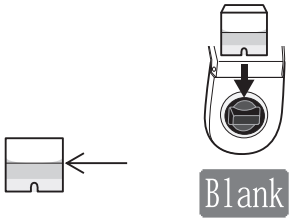


Fig.1 Fig.2

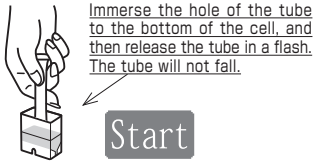


Fig.3

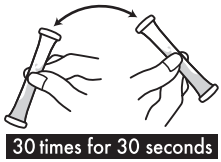


Fig.4

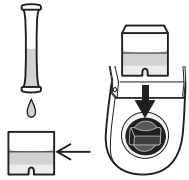


Fig.5

Cautions

1. The optimum pH is 12 in the reaction.
   When pH level exceed pH 5 -12, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The results vary according to tube handling. For accurate results, keep the following points.
   (1) Release the tube with the hole on the bottom of the cell in order to draw the sample instantly.
   (2) Shake the tube immediately after drawing the sample.
   (3) Invert the tube, allowing the sample in the tube to travel from end to end. Shake the tube 30 times for 30 seconds.
4. The pH of the measured sample is about 12.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Na^+ , NO_3^- , SO_4^{2-} , Anionic Surfactant , Residual Chlorine
≤500 mg/L,	:	Phenol
≤250 mg/L,	:	PO_4^{3-}
≤100 mg/L,	:	Ca^{2+}
≤50 mg/L,	:	Mg^{2+} , NO_2^-
≤5 mg/L,	:	Formaldehyde

Heavy metal ions:

≤250 mg/L,	:	Zn^{2+}
≤100 mg/L,	:	Ba^{2+} , Cr(Ⅵ) , Ni^{2+}
≤50 mg/L,	:	Al^{3+}
≤25 mg/L,	:	Cr^{3+} , Mo(Ⅵ)
≤10 mg/L,	:	Ag^+ , Cu^{2+}
≤5 mg/L,	:	Mn^{2+}
≤1 mg/L,	:	Co^{2+}
Sub-ppm level	:	Fe^{2+} , Fe^{3+}

Not suitable for seawater samples.

Samples containing a significant amount of interferences or sea water samples could make result error due to turbidity and abnormal reaction color.

In this case, a pretreatment like distillation to separate ammonium ion is required before measurement. As the distillation method, we recommend to use the following apparatus.

Water Analysis Set: Ammonium (Low Range) (Model: WA-NH_4(L)).

NH_4-N Ammonium-Nitrogen

Color change : None → Light blue → Blue
Method : Indophenol Blue
Range : 0.20 - 4.00 mg/L (ppm)
Reagent : WAK-NH_4 Tube
Reaction time : 10 min. after drawing sample into the tube.

Procedure

1. Select <NH_4-N> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 30 times for 30 seconds. (Fig.4)
7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 10 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

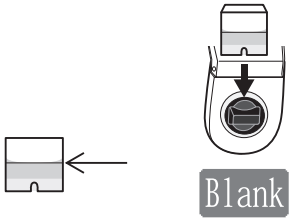


Fig.1 Fig.2

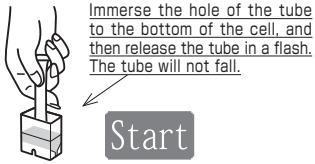


Fig.3

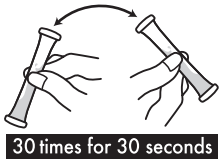


Fig.4

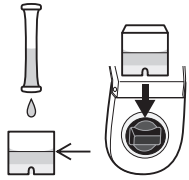


Fig.5

Cautions

1. The optimum pH is 12 in the reaction.
   When pH level exceed pH 5 -12, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The results vary according to tube handling. For accurate results, keep the following points.
   (1) Release the tube with the hole on the bottom of the cell in order to draw the sample instantly.
   (2) Shake the tube immediately after drawing the sample.
   (3) Invert the tube, allowing the sample in the tube to travel from end to end. Shake the tube 30 times for 30 seconds
4. The pH of the measured sample is about 12.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Na^+ , NO_3^- , SO_4^{2-} , Anionic Surfactant , Residual Chlorine
≤500 mg/L,	:	Phenol
≤250 mg/L,	:	PO_4^{3-}
≤100 mg/L,	:	Ca^{2+}
≤50 mg/L,	:	Mg^{2+} , NO_2^-
≤5 mg/L,	:	Formaldehyde

Heavy metal ions:

≤250 mg/L,	:	Zn^{2+}
≤100 mg/L,	:	Ba^{2+} , Cr(Ⅵ) , Ni^{2+}
≤50 mg/L,	:	Al^{3+}
≤25 mg/L,	:	Cr^{3+} , Mo(Ⅵ)
≤10 mg/L,	:	Ag^+ , Cu^{2+}
≤5 mg/L,	:	Mn^{2+}
≤1 mg/L,	:	Co^{2+}
Sub-ppm level	:	Fe^{2+} , Fe^{3+}

Not suitable for seawater samples.

Samples containing a significant amount of interferences or sea water samples could make result error due to turbidity and abnormal reaction color.

In this case, a pretreatment like distillation to separate ammonium ion is required before measurement. As the distillation method, we recommend to use the following apparatus.

Water Analysis Set: Ammonium (Low Range) (Model: WA-NH_4(L)).

NH_4-D Ammonium (Low Range)

Color change : None → Light blue → Blue
Method : Indophenol Blue
Range : 0.05 - 2.00 mg/L (ppm)
Reagent : LR-NH_4-A No.17A R-1(Liquid), R-2 (Pack), R-3 (Pack)
Reaction time : 5 min. after R-3 reagent is added.
Additional tool : Water Analysis Set: Ammonium (Low Range) (Model: WA-NH_4(L))
Instruction manual : Refer to the instruction manual which is attached to WA-NH_4(L).

Procedure

1. Select <NH_4-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the vial with 25 mL of sample (the sample is distilled by WA-NH_4(L). Fill the cell up to the line (1.5 mL) with pure water. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2) Take out the cell and pour out the pure water.
5. Add 3 mL of R-1 reagent with the plastic pipette into the vial. (Fig.3)
6. Add R-2 reagent to the vial. Cap the vial tightly and shake strongly for 10 seconds, and let it sit for 3 minutes. (Fig.4)
7. Add R-3 reagent and press <Start>. Cap the vial tightly and shake strongly for 10 seconds. (Fig.5)
8. Before 5 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box. (Fig.6)
9. After 5 minutes, the measurement value will be displayed. The result will be printed out when the printer is connected.

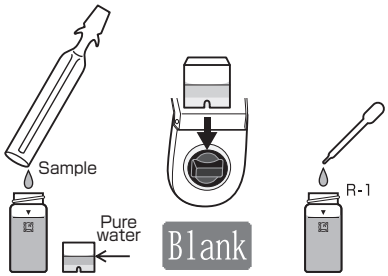


Fig.1 Fig.2 Fig.3

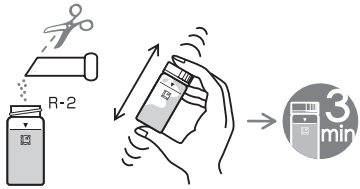


Fig.4

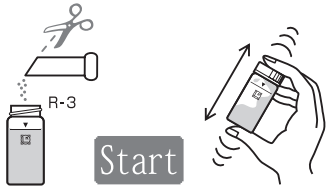


Fig.5

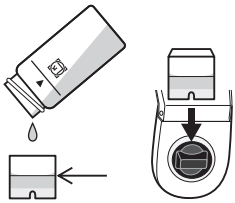


Fig.6

Cautions

1. The distiller parts becomes hot, be careful not to scald.
2. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.2　　25℃ ·····×0.75　　30℃ ·····×0.65
3. The pH of the measured sample is about 12.

Interferences

Refer to the instruction manual which is attached to WA-NH_4(L).

NH_4-N-D Ammonium-Nitrogen (Low Range)

Color change : None → Light blue → Blue
Method : Indophenol Blue
Range : 0.05 - 1.50 mg/L (ppm)
Reagent : LR-NH_4-A No.17A R-1(Liquid), R-2 (Pack), R-3 (Pack)
Reaction time : 5 min. after R-3 reagent is added.
Additional tool : Water Analysis Set: Ammonium (Low Range) (Model: WA-NH_4(L))
Instruction manual : Refer to the instruction manual which is attached to WA-NH_4(L).

Procedure

1. Select <NH_4-D-N> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the vial with 25 mL of sample (the sample is distilled by WA-NH_4(L). Fill the cell up to the line (1.5 mL) with pure water. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2) Take out the cell and pour out the pure water.
5. Add 3 mL of R-1 reagent with the plastic pipette into the vial. (Fig.3)
6. Add R-2 reagent to the vial. Cap the vial tightly and shake 10 seconds, and let it sit for 3 minutes. (Fig.4)
7. Add R-3 reagent and press <Start>. Cap the vial tightly and shake 10 seconds. (Fig.5)
8. Before 5 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box. (Fig.6)
9. After 5 minutes, the measurement value will be displayed. The result will be printed out when the printer is connected.

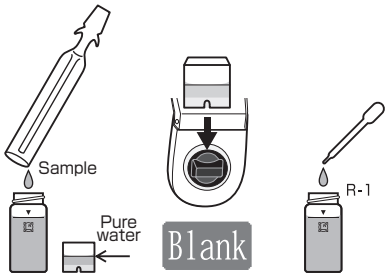


Fig.1 Fig.2 Fig.3

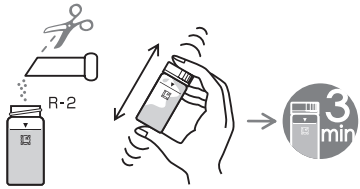


Fig.4

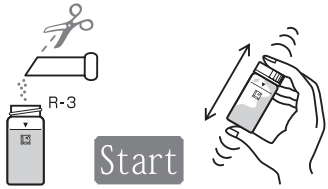


Fig.5

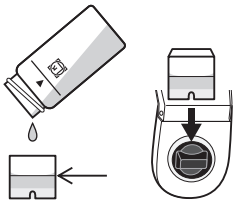


Fig.6

Cautions

1. The distiller parts becomes hot, be careful not to scald.
2. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.2　　25℃ ·····×0.75　　30℃ ·····×0.65
3. The pH of the measured sample is about 12.

Interferences

Refer to the instruction manual which is attached to WA-NH_4(L).

Ni Nickel

Color change : None → Light pink → Pink
Method : Dimethylglyoxime
Range : 1.00 - 8.00 mg/L (ppm)
Reagent : LR-Ni No. 27 R-1(Pack)
Reaction time : 5 min. after R-1 reagent is added.

Procedure

1. Select <Ni> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add R-1 Reagent into the vial and press <Start>. (Fig.3)
6. Put the cap tightly and shake the vial 5 - 6 times. (Fig.4)
7. Before 5 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

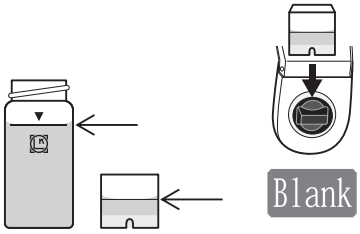


Fig.1 Fig.2

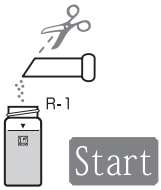


Fig.3

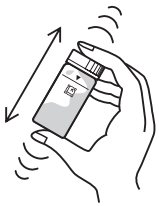


Fig.4

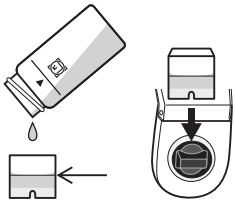


Fig.5

Cautions

1. Nickel ion (Ni^{2+}) can be determined in this method.
   For measurement of Total Nickel fraction including suspended particles, a pretreatment is needed.
2. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 9.
   Measured sample contains about 20mg/time of Boron.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol , Residual Chlorine

Heavy metal ions:

≤10 mg/L, : Al^{3+} , Ba^{2+} , Co^{2+} , Cr(Ⅵ) , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Zn^{2+}

≤1 mg/L, : CN^- , Cr^{3+}

Suitable for seawater samples.

Ni-D Nickel (DPM)

Color change : None → Light pink → Pink
Method : Nioxime
Range : 0.30 - 5.00 mg/L (ppm)
Reagent : WAK-Ni(D) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <Ni-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 60 times for 1 minute. (Fig.4)
7. Return the sample into the cell gently at once.
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

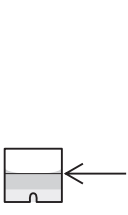


Fig.1

Fig.2

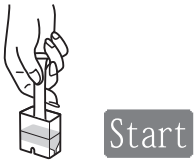


Fig.3

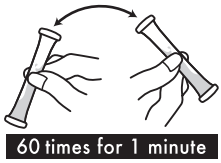


Fig.4

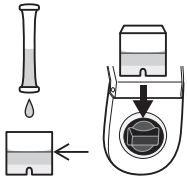


Fig.5

Cautions

1. Nickel ion (Ni^{2+}) can be determined in this method.
   For measurement of Total Nickel fraction including suspended particles, a pretreatment is needed.
2. The optimum pH is 4 in the reaction.
   When pH level exceed pH 4 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 4.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol
≤500 mg/L,	:	Residual Chlorine
≤100 mg/L,	:	F^-
≤20 mg/L,	:	Anionic Surfactant

Heavy metal ions:

≤1000 mg/L,	:	Cr^{3+} , Mn^{2+} , Mo(Ⅵ) , Zn^{2+}
≤50 mg/L,	:	Cr(Ⅵ)
≤20 mg/L,	:	Al^{3+} , Co^{2+}
≤5 mg/L,	:	Ba^{2+} , Fe^{3+}
≤3 mg/L,	:	Cu^{2+} , Fe^{2+}
≤1 mg/L,	:	CN^-

Suitable for seawater samples.

NO_2-C Nitrite (High range)

Color change : None → Light yellow → Red brown
Method : Griess Romijin
Range : 5 - 100 mg/L (ppm)
Reagent : WAK-NO_2(C) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_2-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   And let it sit for 4 minutes. (Fig.4)
7. After 4 minutes passed, return the sample into the cell gently.
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

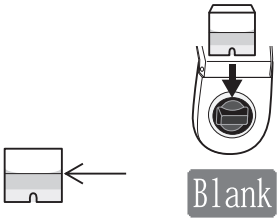


Fig.1 Fig.2

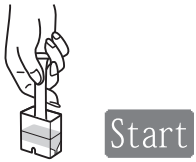


Fig.3

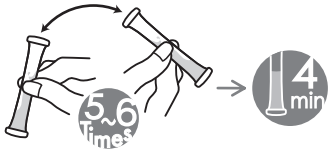


Fig.4

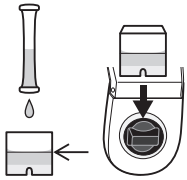


Fig.5

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 3 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temprature in the range of 15 - 30℃ .
3. During the reaction, a lot of bubbles will be formed and stick on the cell wall.
   In that case, remove bubbles by snapping the cell with fingers.
4. The pH of the measured sample is about 3.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤50 mg/L,	:	NH_4^+
≤5 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , CN^- , Co^{2+} , Cr^{3+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}
≤1 mg/L,	:	Cr(Ⅵ)

Suitable for seawater samples.
Generally Nitrite ions do not coexist with such oxidizing substances as Residual Chlorine etc., but without existence of nitrite ions, the reagent reacts on Residual Chlorine or chloramines and could present reaction color. This is a result error due to misconception.

NO_2-N-C Nitrite-Nitrogen (High range)

Color change : None → Light yellow → Red brown
Method : Griess Romijin
Range : 2.0 - 30.0 mg/L (ppm)
Reagent : WAK-NO_2(C) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_2-N-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   And let it sit for 4 minutes. (Fig.4)
7. After 4 minutes passed, return the sample into the cell gently .
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

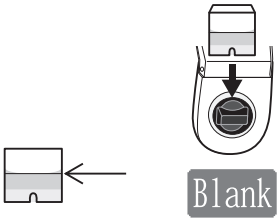


Fig.1 Fig.2

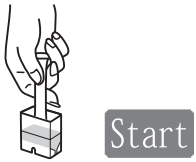


Fig.3

Fig.4

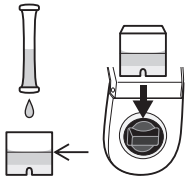


Fig.5

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 3 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. During the reaction, a lot of bubbles will be formed and stick on the cell wall. In that case, remove bubbles by snapping the cell with fingers.
4. The pH of the measured sample is about 3.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤50 mg/L,	:	NH_4^+
≤5 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , CN^- , Co^{2+} , Cr^{3+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}
≤1 mg/L,	:	Cr(Ⅵ)

Suitable for seawater samples.
Generally Nitrite ions do not coexist with such oxidizing substances as Residual Chlorine etc., but without existence of nitrite ions, the reagent reacts on Residual Chlorine or chloramines and could present reaction color. This is a result error due to misconception.

NO_2 Nitrite

Color change : None → Light red → Red
Method : Naphthylethylenediamine
Range : 0.020 - 1.000 mg/L (ppm)
Reagent : WAK-NO_2 Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <NO_2> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

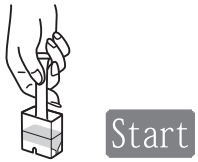


Fig.3

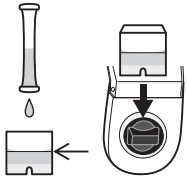


Fig.4

Cautions

1. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. Nitrite could be contained in the air and also dissolved into pure water. Therefore be careful especially for the measurement of low concentrations.
4. The pH of the measured sample is about 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Mn^{2+}
≤500 mg/L,	:	Co^{2+}
≤250 mg/L,	:	CN^- , Cr^{3+}
≤100 mg/L,	:	Cu^{2+} , Mo(Ⅵ) , Zn^{2+}
≤50 mg/L,	:	Ni^{2+}
≤25 mg/L,	:	Fe^{2+}
≤10 mg/L,	:	Al^{3+} , V(Ⅴ)
≤2 mg/L,	:	Cr(Ⅵ) , Fe^{3+}
Sub-ppm level	:	Ag^+ , Ba^{2+}

Suitable for seawater samples.
Generally Nitrite ions do not coexist with such oxidizing substances as Residual Chlorine etc., but without existence of nitrite ions, the reagent reacts on Residual Chlorine or chloramines and could present red reaction color. This is a result error due to misconception.

NO_2-N Nitrite-Nitrogen

Color change : None → Light red → Red
Method : Naphthylethylenediamine
Range : 0.010 - 0.300 mg/L (ppm)
Reagent : WAK-NO_2 Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <NO_2-N> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

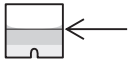


Fig.1

Fig.2

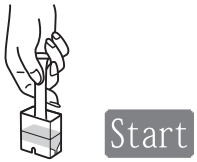


Fig.3

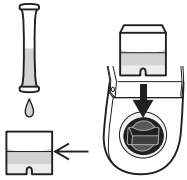


Fig.4

Cautions

1. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. Nitrite could be contained in the air and also dissolved into pure water. Therefore be careful especially for the measurement of low concentrations.
4. The pH of the measured sample is about 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Mn^{2+}
≤500 mg/L,	:	Co^{2+}
≤250 mg/L,	:	CN^- , Cr^{3+}
≤100 mg/L,	:	Cu^{2+} , Mo(Ⅵ) , Zn^{2+}
≤50 mg/L,	:	Ni^{2+}
≤25 mg/L,	:	Fe^{2+}
≤10 mg/L,	:	Al^{3+} , V(Ⅴ)
≤2 mg/L,	:	Cr(Ⅵ), Fe^{3+}
Sub-ppm level	:	Ag^+ , Ba^{2+}

Suitable for seawater samples.
Generally Nitrite ions do not coexist with such oxidizing substances as Residual Chlorine etc., but without existence of nitrite ions, the reagent reacts on Residual Chlorine or chloramines and could present red reaction color. This is a result error due to misconception.

NO_3-C Nitrate (High range)

In this analyte the procedure should be divided into 2 methods according to the sample state.
Be careful that each method uses their specified reagent.

1. NO_3-C_1 Nitrate (High range) (NO_2 ≤ 1 mg/L)

Range : 200 - 2000 mg/L (ppm)
Reagent : WAK-NO_3(C)
Perform the regular Nitrate (High range) measurement procedure.

2. NO_3-C_2 Nitrate (High range) (NO_2 1 - 10 mg/L)

Range : 200 - 2000 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA), WAK-NO_3(C)
It is necessary to remove Nitrite by pretreatment reagent before the regular Nitrate (High range) measurement procedure.

Cautions

On the line of reagent "WAK-NO_3(C)" will be displayed.
The measurement should be carried out following each method with each reagent.

NO_3-C_1 Nitrate (High range) (NO_2 ≤1 mg/L)

Color change : None → Light yellow → Brown
Method : Reduction and Griess Romijin
Range : 200 - 2000 mg/L (ppm)
Reagent : WAK-NO_3(C) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_3-C_1> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 60 times for 1 minute. And let it sit for 3 minutes. (Fig.4)
7. After 4 minutes passed, return the sample into the cell gently.
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

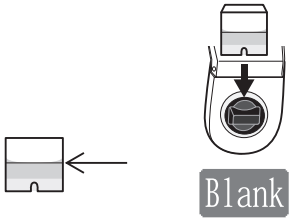


Fig.1 Fig.2

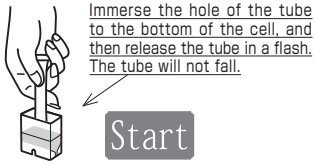


Fig.3

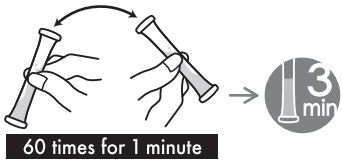


Fig.4

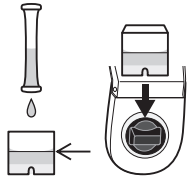


Fig.5

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 3 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature at 20℃ . If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   10℃ ·····×0.80 30℃ ·····×1.1
3. The results vary according to tube handling. For accurate results, keep the following points.
   (1)Release the tube with the hole on the bottom of the cell in order to draw the sample instantly.
   (2)Shake the tube immediately after drawing the sample.
   (3)Invert the tube, allowing the sample in the tube to travel from end to end. Shake the tube 60 times for 1minute.
   (4)If shake the tube strongly, the measurement value is lower.
4. In case of the nitrite highly coexisting, strong reaction color of nitrite ion interferes with nitrate ion.
   For the measurement of Nitrate highly coexisting Nitrite, refer to each section as follows. "NO_3-C_2 Nitrate (High range) (NO_2 1 - 10 mg/L)"
5. During the reaction, a lot of bubbles will be formed and stick on the cell wall. In that case, remove bubbles by snapping the cell with fingers.
6. The pH of the measured sample is about 3.
   Measured sample contains about 1mg/time of Zinc.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤10 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , CN^- , Cr^{3+} , Mn^{2+} , Mo(Ⅵ) , Zn^{2+}
≤1 mg/L,	:	Cr(Ⅵ), Fe^{3+} , Ni^{2+}
Sub-ppm level	:	Co^{2+} , Cu^{2+} , Fe^{2+}

Suitable for seawater samples.
Oxidizing substances and Reductive substances can interfere.

NO_3-C_2 Nitrate (High range) (NO_2 1-10 mg/L)

Color change : None → Light yellow → Brown
Method : Reduction and Griess Romijin
Range : 200 - 2000 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA) (Pack),
WAK-NO_3(C) Tube
Specified tool : Beaker, Heater
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a pretreatment, remove the coexisting Nitrite from the sample with NO_3-RA.

1. Fill the beaker with 30mL of sample and add one pack of NO_3-RA.
   Stir the sample 5 - 6 times. (Fig.1)

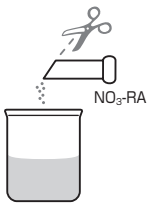


Fig.1

2. Heat the sample up to boiling for about 2 minutes.
   Then cool down the beaker till the room temperature. (Fig.2)
   If the sample boiled down and decreases, add a pure water.


Fig.2

3. Pour the sample in the beaker into the cell with 1.5mL (up to the line). (Fig.3)

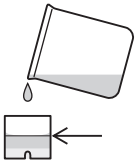


Fig.3

Procedure

1. Select <NO_3-C_2> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Insert the cell into the cell box and press <Blank>. (Fig.4)

Fig.4

4. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.5)

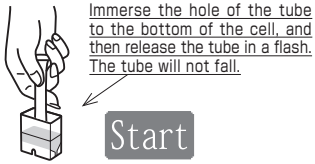


Fig.5

5. Shake the tube 60 times for 1 minute. And let it sit for 3 minutes. (Fig.6)

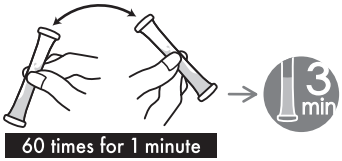


Fig.6

6. After 4 minutes passed, return the sample into the cell gently.
   Insert the cell into the cell box. (Fig.7)

7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

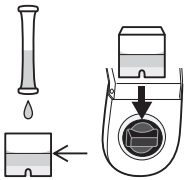


Fig.7

Cautions

Refer to "NO_3-C_1 Nitrate (High range) ($NO_2 \leq 1$ mg/L)".

NO_3-N-C Nitrate-Nitrogen (High range)

In this analyte the procedure should be divided into 2 methods according to the sample state.
Be careful that each method uses their specified reagent.

1. NO_3-N-C_1 Nitrate-Nitrogen (High range) (NO_2-N ≤ 0.3 mg/L)

Range : 45 - 450 mg/L (ppm)
Reagent : WAK-NO_3(C)
Perform the regular Nitrate-Nitrogen (High range) measurement procedure.

2. NO_3-N-C_2 Nitrate-Nitrogen (High range) (NO_2 0.3 - 3 mg/L)

Range : 45 - 450 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA), WAK-NO_3(C)
It is necessary to remove Nitrite by pretreatment reagent before the regular Nitrate-Nitrogen (High range) measurement procedure.

Cautions

On the line of reagent "WAK-NO_3(C)" will be displayed.
The measurement should be carried out following each method with each reagent.

NO_3-N-C_1 Nitrate-Nitrogen (High range) (NO_2-N ≤0.3 mg/L)

Color change : None → Light yellow → Brown
Method : Reduction and Griess Romijin
Range : 45 - 450 mg/L (ppm)
Reagent : WAK-NO_3(C) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_3-N-C_1> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 60 times for 1 minute. And let it sit for 3 minutes. (Fig.4)
7. After 4 minutes passed, return the sample into the cell gently.
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

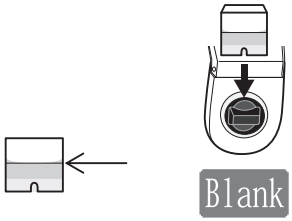


Fig.1 Fig.2

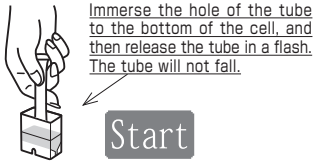


Fig.3

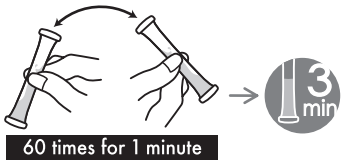


Fig.4

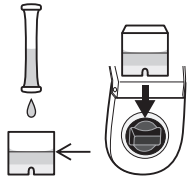


Fig.5

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 3 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range 20℃ . If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   10℃ ·····×0.80 30℃ ·····×1.1
3. The results can vary according to tube handling. For accurate results, keep the following points.
   (1)Release the tube with the hole on the bottom of the cell in order to draw the sample instantly.
   (2)Shake the tube immediately after drawing the sample.
   (3)Invert the tube, allowing the sample in the tube to travel from end to end. Shake the tube 60 times for 1minute.
   (4)If shake the tube strongly, the measurement value is lower.
4. In case of the nitrite highly coexisting, strong reaction color of nitrite ion interferes with nitrate ion.
   For the measurement of Nitrate highly coexisting Nitrite, refer to each section as follows. "NO_3-N-C_2 Nitrate-Nitrogen (High range) (NO_2-N 0.3 - 3 mg/L)"
5. During the reaction, a lot of bubbles will be formed and stick on the cell wall. In that case, remove bubbles by snapping the cell with fingers.
6. The pH of the measured sample is about 3.
   Measured sample contains about 1mg/time of Zinc.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤10 mg/L,	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , CN^- , Cr^{3+} , Mn^{2+} , Mo(Ⅵ) , Zn^{2+}
≤1 mg/L,	:	Cr(Ⅵ) , Fe^{3+} , Ni^{2+}
Sub-ppm level	:	Co^{2+} , Cu^{2+} , Fe^{2+}

Suitable for seawater samples.
Oxidizing substances and Reductive substances can interfere..

NO_3-N-C_2 Nitrate-Nitrogen (High range) (NO_2-N 0.3 - 3 mg/L)

Color change : None → Light yellow → Brown
Method : Reduction and Griess Romijin
Range : 45 - 450 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA) (Pack),
WAK-NO_3(C) Tube
Specified tool : Beaker, Heater
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a pretreatment, remove the coexisting Nitrite from the sample with NO_3-RA.

1. Fill the beaker with 30mL of sample and add one pack of NO_3-RA.
   Stir the sample 5 - 6 times. (Fig.1)

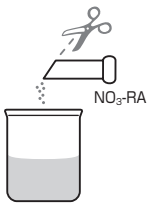


Fig.1

2. Heat the sample up to boiling for about 2 minutes.
   Then cool down the beaker till the room temperature. (Fig.2)
   If the sample boiled down and decreases, add a pure water.


Fig.2

3. Pour the sample in the beaker into the cell with 1.5mL (up to the line). (Fig.3)

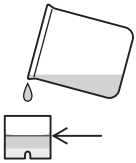


Fig.3

Procedure

1. Select <NO_3-N-C_2> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Fill the cell up to the line (1.5 mL) with sample.
   Insert the cell into the cell box and press <Blank>. (Fig.4)

4. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.5)

5. Shake the tube 60 times for 1 minute. And let it sit for 3 minutes. (Fig.6)

6. After 4 minutes passed, return the sample into the cell gently.
   Insert the cell into the cell box. (Fig.7)

7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.4

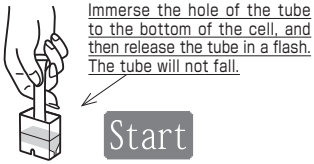


Fig.5

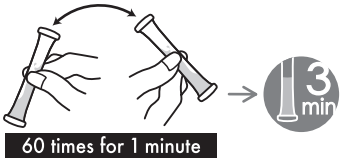


Fig.6

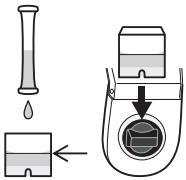


Fig.7

Cautions

Refer to "NO_3-N-C_1 Nitrate-Nitrogen (High range) (NO_2-N ≤ 0.3 mg/L)".

NO_3 Nitrate

In this analyte the procedure should be divided into 3 methods according to the sample state.
Be careful that each method uses their specified reagent.

1. NO_3_1 Nitrate (NO_2 = 0 mg/L)

Range : 1.0 - 25.0 mg/L (ppm)
Reagent : WAK-NO_3
Perform the regular Nitrate measurement procedure.

2. NO_3_2 Nitrate (NO_2 ≤ 0.2 mg/L)

Range : 1.0 - 25.0 mg/L (ppm)
Reagent : WAK-NO_2, WAK-NO_3
It is necessary to zero adjustment with the color-developed sample with reagent for Nitrite (WAK-NO_2) before the regular Nitrate measurement procedure.

3. NO_3_3 Nitrate (NO_2 0.2 - 5 mg/L)

Range : 1.0 - 25.0 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA), WAK-NO_3
It is necessary to remove Nitrite by pretreatment reagent before the regular Nitrate measurement procedure.

Cautions

On the line of reagent "WAK-NO_3" will be displayed.
The measurement should be carried out following each method with each reagent.

NO_3_1 Nitrate (NO_2 = 0 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 1.0 - 25.0 mg/L (ppm)
Reagent : WAK-NO_3 Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_3_1> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

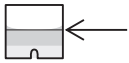


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)

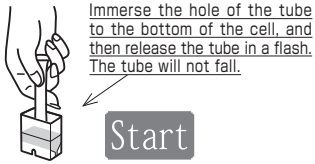


Fig.3

6. Shake the tube 60 times for 1 minute. (Fig.4)

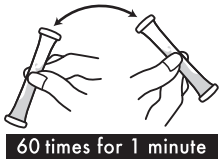


Fig.4

7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)

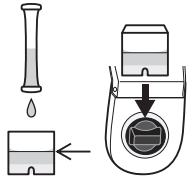


Fig.5

8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The results vary according to tube handling. For accurate results, keep the following points.
   (1) Release the tube with the hole on the bottom of the cell in order to draw the sample instantly.
   (2) Shake the tube immediately after drawing the sample.
   (3) Invert the tube, allowing the sample in the tube to travel from end to end. Shake the tube 60 times for 1minute.
4. In case of the nitrite highly coexisting, strong reaction color of nitrite ion interferes with nitrate ion.
   For the measurement of Nitrate highly coexisting Nitrite, refer to each section as follows.
   "NO_3_2 Nitrate (NO_2 ≤ 0.2 mg/L)", "NO_3_3 Nitrate (NO_2 0.2 - 5 mg/L)"
5. The pH of the measured sample is about 3.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , K^+ , Mg^{2+} , Na^+ , NH_4^+ , PO_4^{3-} , Phenol
≤800 mg/L,	:	Cl^-
≤200 mg/L,	:	Ca^{2+} , F^-
≤5 mg/L,	:	I^-
≤1 mg/L,	:	Residual Chlorine
≤0.5 mg/L,	:	SO_3^{2-}
Sub-ppm level	:	NO_2^-

Heavy metal ions:

≤1000 mg/L,	:	Mn^{2+}
≤200 mg/L,	:	Al^{3+} , Ni^{2+}
≤100 mg/L,	:	CN^- , Fe^{3+}
≤50 mg/L,	:	Co^{2+} , Cr^{3+} , Fe^{2+} , Zn^{2+}
≤5 mg/L,	:	Ba^{2+}
≤1 mg/L,	:	Cu^{2+} , Mo(Ⅵ) , Sn^{2+}
≤0.5 mg/L,	:	Cr(Ⅵ)

Not suitable for seawater samples.

Oxidizing substances and Reductive substances can interfere.

NO_3_2 Nitrate (NO_2 ≤ 0.2 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 1.0 - 25.0 mg/L (ppm)
Reagent : WAK-NO_2 Tube, WAK-NO_3 Tube
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a preparation for the measurement procedure, the color-developed sample should be obtained from Nitrite in the sample with WAK-NO_2.

1. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

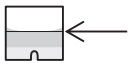


Fig.1

2. Draw the whole cell sample into the tube of WAK-NO_2.
   Shake the tube 5 - 6 times. (Fig.2)

Fig.2

3. Return the sample into the cell, and And let it sit for 3 minutes. (Fig.3)

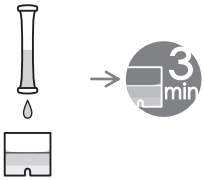


Fig.3

Procedure

1. Select <NO_3_2> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Insert the cell filled with color-developed sample into the cell box. Press <Blank>. (Fig.4)

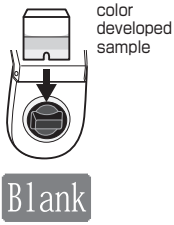


Fig.4

4. Take out the cell from the cell box and pour out the color-developed sample.
   Rinse the cell with pure water. (Fig.5)

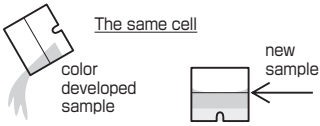


Fig.5 Fig.6

5. Fill the cell with 1.5 mL of new sample (up to the line). (Fig.6)

6. Immerse the hole of the tube of WAK-NO_3 in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.7)

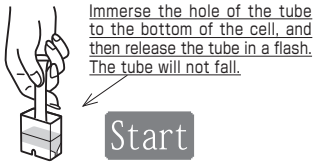


Fig.7

7. Shake the tube 60 times for 1 minute. (Fig.8)

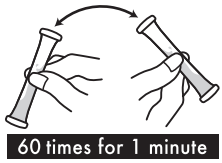


Fig.8

8. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.9)

9. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

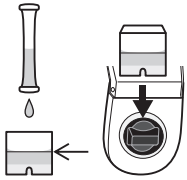


Fig.9

Cautions

Refer to "NO_3_1 Nitrate (NO_2 = 0 mg/L)".

NO_3_3 Nitrate (NO_2 0.2 - 5 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 1.0 - 25.0 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA) (Pack)
WAK-NO_3 Tube
Specified tool : Beaker, Heater
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a pretreatment, remove the coexisting Nitrite from the sample with NO_3-RA.

1. Fill the beaker with 30 mL of sample and add one pack of NO_3-RA.
   Stir the sample 5 - 6 times. (Fig.1)

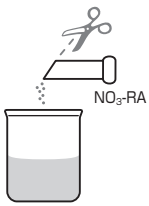


Fig.1

2. Heat the sample up to boiling for about 2 minutes.
   Then cool down the beaker till the room temperature. (Fig.2)
   If the sample boiled down and decreases, add a pure water.


Fig.2

3. Pour the sample in the beaker into the cell with 1.5mL (up to the line). (Fig.3)

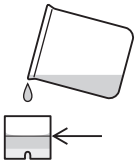


Fig.3

Procedure

1. Select <NO_3_3> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Insert the cell filled with pretreated sample into the cell box and press <Blank>. (Fig.4)

Fig.4

4. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.5)

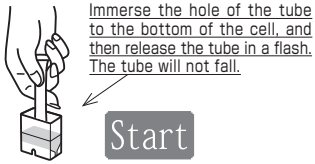


Fig.5

5. Shake the tube 60 times for 1 minute. (Fig.6)

6. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.7)

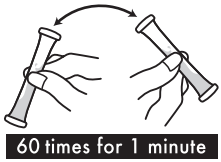


Fig.6

7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

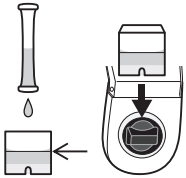


Fig.7

Cautions

Refer to "NO_3_1 Nitrate (NO_2 = 0 mg/L)".

NO_3-N Nitrate-Nitrogen

In this analyte the procedure should be divided into 3 methods according to the sample state.
Be careful that each method uses their specified reagent.

1. NO_3-N_1 Nitrate-Nitrogen (NO_2-N = 0 mg/L)

Range : 0.20 - 5.80 mg/L (ppm)
Reagent : WAK-NO_3
Perform the regular Nitrate-Nitrogen measurement procedure.

2. NO_3-N_2 Nitrate-Nitrogen (NO_2-N ≤ 0.06 mg/L)

Range : 0.20 - 5.80 mg/L (ppm)
Reagent : WAK-NO_2, WAK-NO_3
It is necessary to zero adjustment with the color-developed sample with reagent for Nitrite (WAK-NO_2) before the regular Nitrate-Nitrogen measurement procedure.

3. NO_3-N_3 Nitrate-Nitrogen (NO_2-N 0.06 - 1.5 mg/L)

Range : 0.20 - 5.80 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA), WAK-NO_3
It is necessary to remove Nitrite by pretreatment reagent before the regular Nitrate-Nitroegen measurement procedure.

Cautions

On the line of reagent "WAK-NO_3" will be displayed.
The measurement should be carried out following each method with each reagent.

NO_3-N_1 Nitrate-Nitrogen (NO_2-N = 0 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 0.20 - 5.80 mg/L (ppm)
Reagent : WAK-NO_3 Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <NO_3-N_1> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)

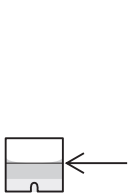


Fig.1

Fig.2

5. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.3)

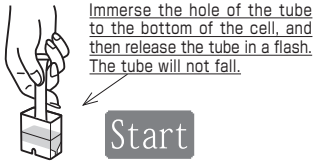


Fig.3

6. Shake the tube 60 times for 1 minute. (Fig.4)

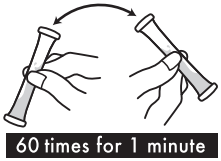


Fig.4

7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

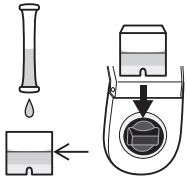


Fig.5

Cautions

1. The optimum pH is 3 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The results vary according to tube handling. For accurate results, keep the following points.
   (1) Release the tube with the hole on the bottom of the cell in order to draw the sample at once.
   (2) Shake the tube immediately after drawing the sample.
   (3) Tilt the tube up and down so the sample in the tube ravels from end to end. Shake the tube for 1minute. (At a speed of 1 time per second.)
4. In case of the nitrite highly coexisting, strong reaction color of nitrite ion interferes with nitrate ion.
   For the measurement of Nitrate highly coexisting Nitrite, refer to each section as follows.
   "NO_3-N_2 Nitrate-Nitrogen (NO_2-N ≤0.06 mg/L)"
   "NO_3-N_3 Nitrate-Nitrogen (NO_2-N 0.06-1.5 mg/L)"
5. The pH of the measured sample is about 3.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , K^+ , Mg^{2+} , Na^+ , NH_4^+ , PO_4^{3-} , Phenol
≤800 mg/L,	:	Cl^-
≤200 mg/L,	:	Ca^{2+} , F^-
≤5 mg/L,	:	I^-
≤1 mg/L,	:	Residual Chlorine
≤0.5 mg/L,	:	SO_3^{2-}
Sub-ppm level	:	NO_2^-

Heavy metal ions:

≤1000 mg/L,	:	Mn^{2+}
≤200 mg/L,	:	Al^{3+} , Ni^{2+}
≤100 mg/L,	:	CN^- , Fe^{3+}
≤50 mg/L,	:	Co^{2+} , Cr^{3+} , Fe^{2+} , Zn^{2+}
≤5 mg/L,	:	Ba^{2+}
≤1 mg/L,	:	Cu^{2+} , Mo(Ⅵ) , Sn^{2+}
≤0.5 mg/L,	:	Cr(Ⅵ)

Not suitable for seawater samples.
Oxidizing substances and Reductive substances can interfere.

NO_3-N_2 Nitrate-Nitrogen (NO_2-N ≤ 0.06 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 0.20 - 5.80 mg/L (ppm)
Reagent : WAK-NO_2 Tube, WAK-NO_3 Tube
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a preparation for the measurement procedure, the color-developed sample should be obtained from Nitrite-Nitrogen in the sample with WAK-NO_2.

1. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

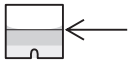


Fig.1

2. Draw the whole cell sample into the tube of WAK-NO_2.
   Shake the tube 5 - 6 times. (Fig.2)

Fig.2

3. Return the sample into the cell, and And let it sit for 3 minutes. (Fig.3)

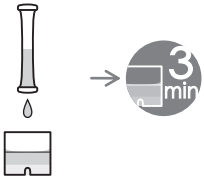


Fig.3

Procedure

1. Select <NO_3-N_2> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Insert the cell filled with color-developed sample into the cell box. Press <Blank>. (Fig.4)

4. Take out the cell from the cell box and pour out the color-developed sample. Rinse the cell with pure water. (Fig.5)

5. Fill the cell up to the line (1.5 mL) with new sample. (Fig.1)

6. Immerse the hole of the tube of WAK-NO_3 in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.7)

7. Shake the tube 60 times for 1 minute. (Fig.8)

8. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.9)

9. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

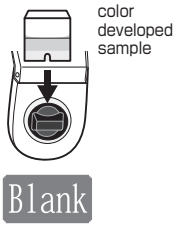


Fig.4

Fig.5

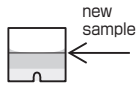


Fig.6

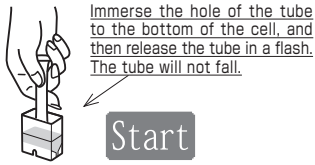


Fig.7

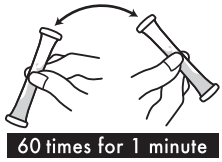


Fig.8

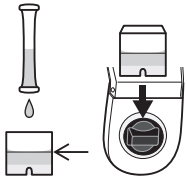


Fig.9

Cautions

Refer to "NO_3-N_1 Nitrate-Nitrogen (NO_2-N = 0 mg/L)".

NO_3-N_3 Nitrate-Nitrogen (NO_2-N 0.06 - 1.5 mg/L)

Color change : None → Light red → Red
Method : Reduction and Naphthylethylenediamine
Range : 0.20 - 5.80 mg/L (ppm)
Reagent : Pretreatment Reagent for Nitrate (NO_3-RA) (Pack)
WAK-NO_3 Tube
Specified tool : Beaker, Heater
Reaction time : 5 min. after drawing sample into the tube.

Before the regular Nitrate measurement procedure

As a pretreatment, remove the coexisting Nitrite-Nitrogen from the sample with NO_3-RA.

1. Fill the beaker with 30 mL of sample and add one pack of NO_3-RA.
   Stir the sample 5 - 6 times. (Fig.1)

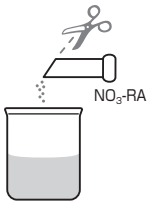


Fig.1

2. Heat the sample up to boiling for about 2 minutes.
   Then cool down the beaker till the room temperature. (Fig.2)
   If the sample boiled down and decreases, add a pure water.


Fig.2

3. Pour the sample in the beaker into the cell with 1.5mL (up to the line). (Fig.3)

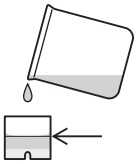


Fig.3

Procedure

1. Select <NO_3-N_3> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Insert the cell filled with pretreated sample into the cell box.
   Press <Blank>. (Fig.4)

4. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.5)

5. Shake the tube 60 times for 1 minute. (Fig.6)

6. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.7)

7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.4

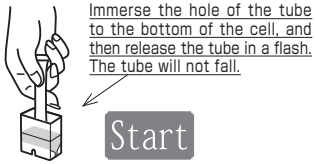


Fig.5

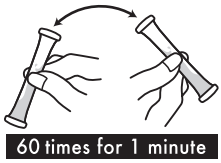


Fig.6

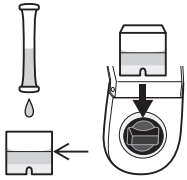


Fig.7

Cautions

Refer to "NO_3-N_1 Nitrate-Nitrogen (NO_2-N = 0 mg/L)".

O_3 Ozone

Color change : None → Light purple → Purple
Method : 4-Aminoantipyrine with enzyme
Range : 0.25 - 6.00 mg/L (ppm)
Reagent : WAK-O_3 Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <O_3> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

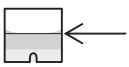


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)

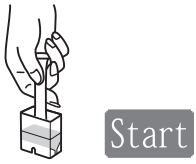


Fig.3

6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)

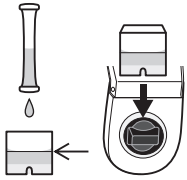


Fig.4

7. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. The optimum pH is 7 in the reaction.
   When pH level exceed pH 6 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-}
≤500 mg/L,	:	F^- , NO_2^-
≤250 mg/L,	:	Phenol
≤50 mg/L,	:	Anionic Surfactant
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Ag^+ , Ba^{2+} , Ni^{2+} , Zn^{2+}
≤500 mg/L,	:	Fe^{3+}
≤50 mg/L,	:	Cr^{3+} , Cr(Ⅵ) , Cu^{2+}
≤20 mg/L,	:	Al^{3+} , Co^{2+} , Mn^{2+}
≤2 mg/L,	:	Mo(Ⅵ)
≤1 mg/L,	:	CN^-
Sub-ppm level	:	Fe^{2+}

Suitable for seawater samples.
Fe^{2+}, NO_2^- and other reductive substances can consume Ozone.
Residual Chlorine, Hydrogen Peroxide and other oxidizing substances can make positive error.

Pb-SPK　Lead (SPK)

Color change : Yellow → Orange → Red
Method : Separation and Preconcentration of lead by MetaSEP AnaLig® and 4-(2-Pyridylazo) resorcinol
Range : 0.03 - 0.50 mg/L (ppm)
Reagent : PACKTEST Lead (SPK-Pb) K-1(Liquid), K-2(Liquid), K-3(Liquid), K-4(Liquid), Tube
Reaction time : 3 min. after drawing eluate into the tube.
Instruction manual : Refer to the instruction manual which is attached to PACKTEST Lead (optional, Model: SPK-Pb).

Procedure

1. Select <Pb-SPK> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Following the instruction of PACKTEST Lead, fill the cell with the eluate. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 30 times. (Fig.4)
7. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.


Fig.1

Fig.2

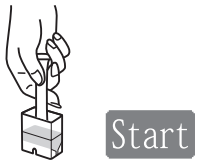


Fig.3

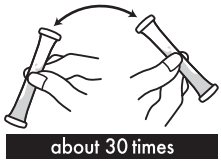


Fig.4

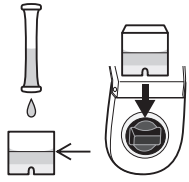


Fig.5

Cautions

1. Eluate of PACKTEST Lead can be determined in this method.
   Refer to the instruction of PACKTEST Lead.
2. Keep sample temperature in the range of 15 - 30℃ .
3. The pH of the measured sample is about 9.

Interferences

Refer to the instruction manual which is attached to PACKTEST Lead.

Phenol Phenol

Color change : Light yellow → Orange → Red
Method : 4-Aminoantipyrine with enzyme
Range : 0.20 - 5.00 mg/L (ppm)
Reagent : WAK-PNL K-1(Dropper) , Tube
Reaction time : 8 min. after drawing sample into the tube.

Procedure

1. Select <Phenol> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

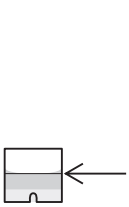


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Add 1 drop of K-1 reagent.
   Put the cap and shake the cell 2-3 times. (Fig.3)

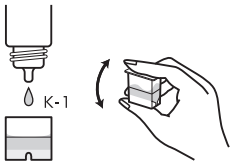


Fig.3

6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)

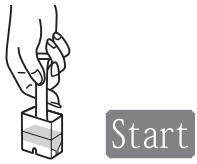


Fig.4

7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)

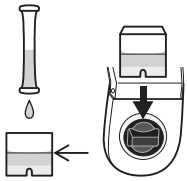


Fig.5

8. After 8 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. Only Phenols can be determined in this method. *p*-Cresols can not be determined.
2. The optimum pH is 8 in the reaction.
   When pH level exceed pH 5 - 10, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 8.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NO_2^- , NO_3^- , SO_4^{2-}
≤500 mg/L,	:	Ca^{2+} , NH_4^+
≤200 mg/L,	:	PO_4^{3-} , Anionic Surfactant
≤20 mg/L,	:	Residual Chlorine
≤10 mg/L,	:	SO_3^{2-}

Heavy metal ions:

≤1000 mg/L,	:	Ba^{2+} , Zn^{2+}
≤500 mg/L,	:	Cd^{2+}
≤200 mg/L,	:	As(Ⅲ)
≤100 mg/L,	:	Mo^{6+} , SCN^-
≤50 mg/L,	:	Ag^+ , Cr(Ⅵ)
≤20 mg/L,	:	Co^{2+} , Cr^{3+} , Cu^{2+} , Fe^{3+} , Ni^{2+}
≤10 mg/L,	:	Mn^{2+}
≤5 mg/L,	:	CN^- , Pb^{2+}
≤1 mg/L,	:	Al^{3+} , Fe^{2+}

Suitable for seawater samples.
Oxidizing substances and reductive substances can interfere.

PO_4-C Phosphate (High range)

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 2.0 - 30.0 mg/L (ppm)
Reagent : WAK-PO_4(C) K-1(Liquid) , Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <PO_4-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Take 0.2 mL of sample in the cell with the plastic pipette (small). (Fig.1)
4. Add 1.5 mL of K-1 reagent with the plastic pipette (large) into the cell. Put the cap and shake the cell 2-3 times. (Fig.2)
5. Insert the cell into the cell box and press <Blank>. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

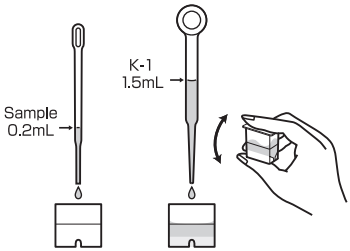


Fig.1 Fig.2

Fig.3

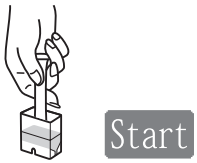


Fig.4

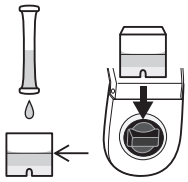


Fig.5

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.05 25℃ ·····×0.95
4. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤5000 mg/L,	:	B(Ⅲ) , Cl^- , K^+ , Na^+ , NH_4^+ , NO_3^- , SO_3^{2-} , SO_4^{2-}
≤2500 mg/L,	:	Mg^{2+} , NO_2^-
≤500 mg/L,	:	SiO_2 , Phenol
≤250 mg/L,	:	F^- , I^- , Residual Chlorine
≤100 mg/L,	:	Ca^{2+}

Heavy metal ions:

≤5000 mg/L,	:	CN^- , Zn^{2+}
≤4000 mg/L,	:	Al^{3+} , Mn^{2+}
≤500 mg/L,	:	Cr^{3+} , Fe^{2+} , Fe^{3+} , Ni^{2+}
≤250 mg/L,	:	Co^{2+} , Cu^{2+}
≤100 mg/L,	:	Cr(Ⅵ), Mo(Ⅵ)
Sub-ppm level	:	As(Ⅴ) , Ba^{2+}

Not suitable for seawater samples.

PO_4-P-C Phosphate-Phosphorus (High range)

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 0.70 - 10.00 mg/L (ppm)
Reagent : WAK-PO_4(C) K-1(Liquid) , Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <PO_4-P-C> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Take 0.2 mL of sample in the cell with the plastic pipette (small). (Fig.1)
4. Add 1.5 mL of K-1 reagent with the plastic pipette (large) into the cell. Put the cap and shake the cell 2-3 times. (Fig.2)
5. Insert the cell into the cell box and press <Blank>. (Fig.3)
6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

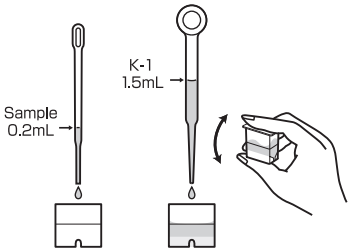


Fig.1 Fig.2

Fig.3

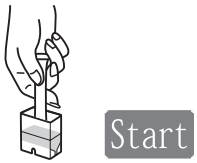


Fig.4

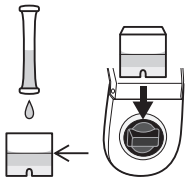


Fig.5

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.05 25℃ ·····×0.95
4. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤5000 mg/L,	:	B(Ⅲ) , Cl^- , K^+ , Na^+ , NH_4^+ , NO_3^- , SO_3^{2-} , SO_4^{2-}
≤2500 mg/L,	:	Mg^{2+} , NO_2^-
≤500 mg/L,	:	SiO_2 , Phenol
≤250 mg/L,	:	F^- , I^- , Residual Chlorine
≤100 mg/L,	:	Ca^{2+}

Heavy metal ions:

≤5000 mg/L,	:	CN^- , Zn^{2+}
≤4000 mg/L,	:	Al^{3+} , Mn^{2+}
≤500 mg/L,	:	Cr^{3+} , Fe^{2+} , Fe^{3+} , Ni^{2+}
≤250 mg/L,	:	Co^{2+} , Cu^{2+}
≤100 mg/L,	:	Cr(Ⅵ) , Mo(Ⅵ)
Sub-ppm level	:	As(Ⅴ) , Ba^{2+}

Not suitable for seawater samples.

PO_4 Phosphate

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 0.10 - 5.00 mg/L (ppm)
Reagent : WAK-PO_4 K-1(dropper) , Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <PO_4> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

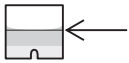


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Add 4 drops of K-1 reagent.
   Put the cap and shake the cell 2-3 times. (Fig.3)

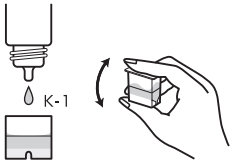


Fig.3

6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)

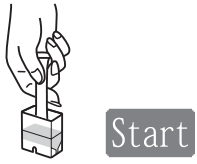


Fig.4

7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)

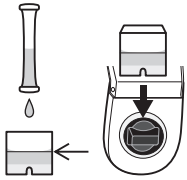


Fig.5

8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.05 25℃ ·····×0.95
4. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , K^+ , Na^+ , NH_4^+ , NO_3^- , SO_4^{2-}
≤500 mg/L,	:	Mg^{2+} , NO_2^-
≤100 mg/L,	:	SiO_2 , Phenol
≤50 mg/L,	:	F^- , I^- , Residual Chlorine
≤20 mg/L,	:	Ca^{2+}

Heavy metal ions:

≤1000 mg/L,	:	CN^- , Zn^{2+}
≤800 mg/L,	:	Al^{3+} , Mn^{2+}
≤100 mg/L,	:	Cr^{3+} , Fe^{2+} , Fe^{3+} , Ni^{2+}
≤50 mg/L,	:	Co^{2+} , Cu^{2+}
≤20 mg/L,	:	Cr(Ⅵ) , Mo(Ⅵ)
Sub-ppm level	:	As(Ⅴ) , Ba^{2+}

Not suitable for seawater samples.

PO_4-P Phosphate-Phosphorus

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 0.030 - 1.500 mg/L (ppm)
Reagent : WAK-PO_4 K-1(dropper) , Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <PO_4-P> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

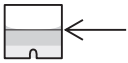


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Add 4 drops of K-1 reagent.
   Put the cap and shake the cell 2-3 times. (Fig.3)

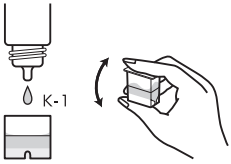


Fig.3

6. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.4)

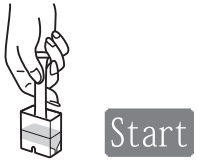


Fig.4

7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)

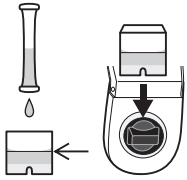


Fig.5

8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature at 20℃ .
   If sample temperature is out of 20℃ , multiply the results by the appropriate multiplier.
   15℃ ·····×1.05 25℃ ·····×0.95
4. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Cl^- , K^+ , Na^+ , NH_4^+ , NO_3^- , SO_4^{2-}
≤500 mg/L,	:	Mg^{2+} , NO_2^-
≤100 mg/L,	:	SiO_2 , Phenol
≤50 mg/L,	:	F^- , I^- , Residual Chlorine
≤20 mg/L,	:	Ca^{2+}

Heavy metal ions:

≤1000 mg/L,	:	CN^- , Zn^{2+}
≤800 mg/L,	:	Al^{3+} , Mn^{2+}
≤100 mg/L,	:	Cr^{3+} , Fe^{2+} , Fe^{3+} , Ni^{2+}
≤50 mg/L,	:	Co^{2+} , Cu^{2+}
≤20 mg/L,	:	Cr(Ⅵ) , Mo(Ⅵ)
Sub-ppm level	:	As(Ⅴ) , Ba^{2+}

Not suitable for seawater samples.

PO_4-D Phosphate (Low range)

Color change : None → Light purple → Purple
Method : 4-Aminoantipyrine with enzyme
Range : 0.10 - 3.00 mg/L (ppm)
Reagent : WAK-PO_4(D) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <PO_4-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Fig.1

Fig.2

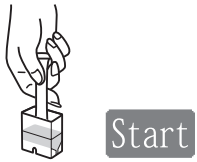


Fig.3

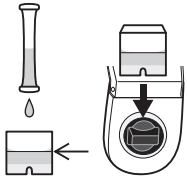


Fig.4

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 7 in the reaction.
   When pH level exceed pH 6 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	Ca^{2+} , Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^-
≤500 mg/L,	:	B(Ⅲ)
≤250 mg/L,	:	Phenol
≤50 mg/L,	:	SO_4^{2-}
≤20 mg/L,	:	Mg^{2+}
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Ba^{2+}
≤100 mg/L,	:	Zn^{2+}
≤50 mg/L,	:	Cu^{2+} , Ni^{2+}
≤10 mg/L,	:	Al^{3+} , Cr^{3+} , Cr(Ⅵ)
≤5 mg/L,	:	Fe^{3+} , Mn^{2+}
≤1 mg/L,	:	CN^-
Sub-ppm level	:	Fe^{2+}

Not suitable for seawater samples.
Residual Chlorine, Hydrogen Peroxide and other oxidizing substances can make positive error.
For example, 1mg/L of Residual Chlorine causes the equivalent color development of 0.15 mg/L of Phosphate.
Reductive substances can make negative error.

PO_4-P-D Phosphate-Phosphorus (Low range)

Color change : None → Light purple → Purple
Method : 4-Aminoantipyrine with enzyme
Range : 0.030 - 1.000 mg/L (ppm)
Reagent : WAK-PO_4(D) Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <PO_4-P-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

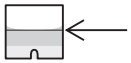


Fig.1

Fig.2

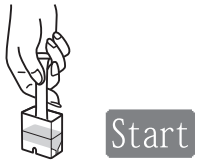


Fig.3

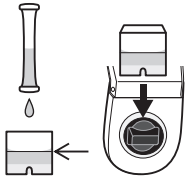


Fig.4

Cautions

1. Dissolved Phosphate ion (PO_4^{3-}) can be determined in this method.
   Hydrolyzable Phosphorus or Total Phosphorus can not be measured.
   A pretreatment is required for the measurement of these parameters.
2. The optimum pH is 7 in the reaction.
   When pH level exceed pH 6 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 7.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	Ca^{2+} , Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^-
≤500 mg/L,	:	B(Ⅲ)
≤250 mg/L,	:	Phenol
≤50 mg/L,	:	SO_4^{2-}
≤20 mg/L,	:	Mg^{2+}
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤1000 mg/L,	:	Ba^{2+}
≤100 mg/L,	:	Zn^{2+}
≤50 mg/L,	:	Cu^{2+} , Ni^{2+}
≤10 mg/L,	:	Al^{3+} , Cr^{3+} , Cr^{6+}
≤5 mg/L,	:	Fe^{3+} , Mn^{2+}
≤1 mg/L,	:	CN^-
Sub-ppm level	:	Fe^{2+}

Not suitable for seawater samples.
Residual Chlorine, Hydrogen Peroxide and other oxidizing substances can make positive error.
For example, 1mg/L of Residual Chlorine causes the equivalent color development of 0.05 mg/L of Phosphate-Phosphorus.
Reductive substances can make negative error.

S Sulfide (Hydrogen Sulfide)

Color change : None → Light Blue → Blue
Method : Methylene blue
Range : 0.050 - 0.800 mg/L (ppm)
Reagent : WAK-S K-1(dropper) , Tube
Reaction time : 3 min. after drawing sample into the tube.

Procedure

1. Select <S> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Add 2 drops of K-1 reagent. (Fig.3)
6. Draw the whole cell sample into the tube at once.
   Press <Start> at the same time. (Fig.4)
7. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.5)
8. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

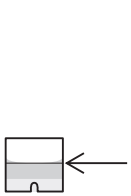


Fig.1

Fig.2

Fig.3

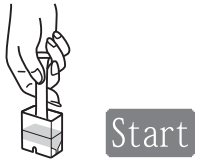


Fig.4

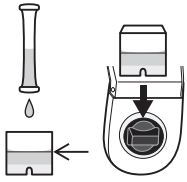


Fig.5

Cautions

1. Hydrogen Sulfide (H_2S), Hydrogen Sulfide ion (HS^-), Sulfide ion (S^{2-}) can be determined in this method.
   The sulfate ion and sulfite ion can not be measured.
2. In the case that Sulfide exists only in the form of sulfide ion (S^{2-}), Hydrogen sulfide concentration can be obtained by multiplying by 1.06 the measured value.
3. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol
≤10 mg/L,	:	I^-
≤1 mg/L,	:	NO_2^- , SO_3^{2-}
Sub-ppm level	:	Residual Chlorine

Heavy metal ions:

≤10 mg/L,	:	Al^{3+} , Ba^{2+} , CN^- , Co^{2+} , Cr^{3+} , Fe^{2+} , Fe^{3+} , Ni^{2+} , Zn^{2+}
≤5 mg/L,	:	Mn^{2+} , Mo(Ⅵ)
≤1 mg/L,	:	Cr(Ⅵ)
Sub-ppm level	:	Cu^{2+}

Suitable for seawater samples.
Oxidizing substances and reductive substances can interfere.
In case of coexisting metal ions, Sulfide ions precipitate with metal ions and this precipitated sulfide can not be detected by this method.
In this case, separate precipitated sulfide by other adequate methods.

SiO_2 Silica

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 3.0 - 60.0 mg/L (ppm)
Reagent : WAK-SiO_2 Distilled Water, K-1(dropper), K-2(dropper), Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <SiO_2> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Take 0.2 mL of sample in the cell with the plastic pipette (small). (Fig.1)
4. Add 1.5 mL of Distilled water with the plastic pipette (large). Put the cap and shake the cell 2 - 3 times. (Fig.2)
5. Insert the cell into the cell box and press <Blank>. (Fig.3)
6. Add 2 drops of K-1 reagent. Put the cap and shake the cell 2 - 3 times. And let it sit for 3 minutes. (Fig.4)
7. Add 1 drop of K-2 reagent. Put the cap and shake the cell 2 - 3 times. And let it sit for 30 seconds. (Fig.5)
8. Draw the whole cell sample into the tube. Press <Start> at the same time. (Fig.6)
9. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.7)
10. After 5 minutes, the measurement value will be displayed.
    The result will be printed out when the printer is connected.

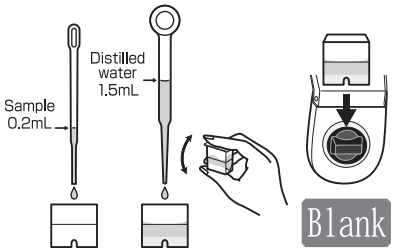


Fig.1 Fig.2 Fig.3

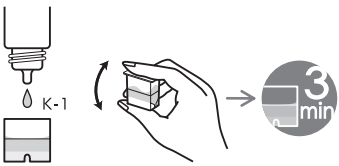


Fig.4

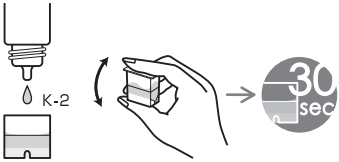


Fig.5

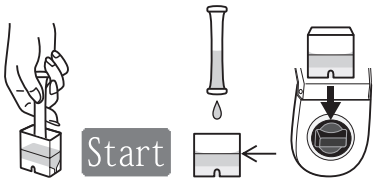


Fig.6 Fig.7

Cautions

1. Only Silica in ion (SiO_3^{2-}) can be determined in this method.
   For measurement of other states of Silica, a pretreatment is needed.
2. Rinse the plastic pipette (small) with pure water or the sample before use.
3. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is ≤ 2. K-1 reagent and K-2 reagent are ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤5000 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , SO_4^{2-} , Anionic Surfactant , Phenol , Residual Chlorine , Formaldehyde

≤1000 mg/L, : F^- , NO_2^-

≤500 mg/L, : PO_4^{3-}

Heavy metal ions:

≤5000 mg/L, : Al^{3+} , CN^- , Co^{2+} , Fe^{2+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}

≤1000 mg/L, : Cr(Ⅵ) , Cu^{2+} , Fe^{3+}

≤100 mg/L, : Ba^{2+} , Cr^{3+}

Suitable for seawater samples.
Oxidizing substances and reductive substances can interfere.
The coexistence of slight amount of Hydrogen Sulfide can interfere with the measurement.
In this case, Hydrogen Sulfide should be removed from the sample before the measurement by acidification and boiling.

SiO_2-D Silica (Low Range)

Color change : None → Light blue → Blue
Method : Molybdenum blue
Range : 0.30 - 7.00 mg/L (ppm)
Reagent : WAK-SiO_2(D) K-1(dropper), K-2(dropper), Tube
Reaction time : 5 min. after drawing sample into the tube.

Procedure

1. Select <SiO_2-D> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

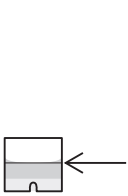


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

Fig.2

5. Add 2 drops of K-1 reagent. Put the cap and shake the cell 2 - 3 times. And let it sit for 3 minutes. (Fig.3)

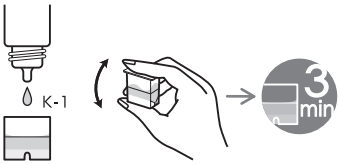


Fig.3

6. Add 1 drop of K-2 reagent. Put the cap and shake the cell 2 - 3 times. And let it sit for 30 seconds. (Fig.4)

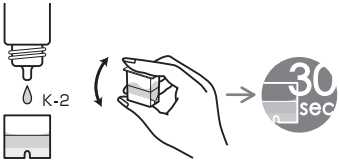


Fig.4

7. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.5)

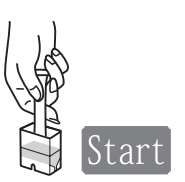


Fig.5

8. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.6)

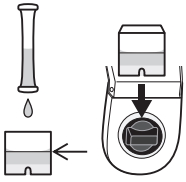


Fig.6

9. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

Cautions

1. Only Silica in ion (SiO_3^{2-}) can be determined in this method.
   For measurement of other states of Silica, a pretreatment is needed.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is ≤ 2. K-1 reagent and K-2 reagent are ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_3^- , SO_4^{2-} , Anionic Surfactant , Phenol , Residual Chlorine , Formaldehyde
≤500 mg/L,	:	NO_2^-
≤100 mg/L,	:	F^-
≤50 mg/L,	:	PO_4^{3-}

Heavy metal ions:

≤1000 mg/L,	:	Al^{3+} , CN^- , Co^{2+} , Fe^{2+} , Mn^{2+} , Mo(Ⅵ) , Ni^{2+} , Zn^{2+}
≤200 mg/L,	:	Cr(Ⅵ)
≤100 mg/L,	:	Cu^{2+} , Fe^{3+}
≤10 mg/L,	:	Ba^{2+} , Cr^{3+}

Suitable for seawater samples.
Oxidizing substances and reductive substances can interfere.
The coexistence of slight amount of Hydrogen Sulfide can interfere with the measurement.
In this case, Hydrogen Sulfide should be removed from the sample before the measurement by acidification and boiling.

SO_4 Sulfate

Color change : Transparent → White Turbidity
Method : Barium sulfate turbidimetry
Range : 10 - 100 mg/L (ppm)
Reagent : DPR-SO_4 R-A(dropper), R-1(dropper), R-2(dropper)
Reaction time : 3 min. after R-2 reagent is added.

Procedure

1. Select <SO_4> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Add 1 drop of R-A reagent. Put the cap and shake the cell 2 - 3 times. (Fig.2)
5. After shaking the R-1 reagent, add 1 drop of R-1 reagent. Put the cap and shake the cell 2 - 3 times. (Fig.3)
6. Insert the cell into the cell box and press <Blank>. (Fig.4)
7. Add 1 drop of R-2 reagent. Put the cap and shake the cell over 30 times for 10 seconds.
   Press <Start>. (Fig.5)
8. Open the cell and insert the cell into the cell box again. (Fig.6)
9. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

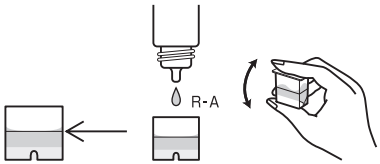


Fig.1 Fig.2

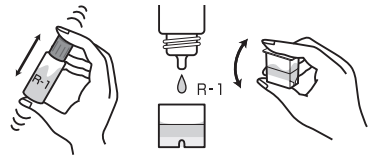


Fig.3

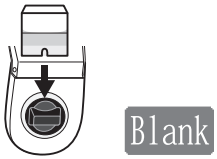


Fig.4

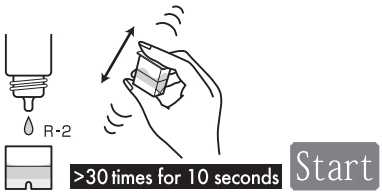


Fig.5

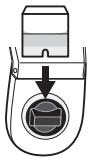


Fig.6

Cautions

1. Sulfate ion (SO_4^{2-}) can be determined in this method.
2. The optimum pH is 2 in the reaction.
   When pH level exceed pH 2 - 9, adjust the pH level with diluted Hydrochloric Acidor Sodium Hydroxide solution. (Be sure not to use Sulfuric Acid.)
3. Keep sample temperature in the range of 15 - 30℃ .
4. The results vary according to handling.
   In "Procedure 7", the cell is shaken uniformly.
   If how to shake is weak, the measurement value is lower.
   If how to shake is strong, the measurement value is higer.
5. Take the cap of cell off when the cell is inserted into the cell box.
   Measured sample can overflow the capped cell. In this case, clean up the cell surface to wipe off water drop before insert the cell into the cell box.
6. After the measurement, the cell should be cleaned up thoroughly because the precipitation adhere to the cell.
7. The pH of the measured sample is ≤ 2. R-1 reagent is ≤ pH 2.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤1000 mg/L,	:	B(Ⅲ) , Ca^{2+} , Cl^- , F^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^- , Phenol
≤500 mg/L,	:	PO_4^{3-}
≤200 mg/L,	:	Residual Chlorine
Sub-ppm level	:	Anionic Surfactant

Heavy metal ions:

≤200 mg/L,	:	Fe^{3+}
≤100 mg/L,	:	Cr(Ⅵ)
≤20 mg/L,	:	Al^{3+}

For measurement of seawater samples, dilute the sample because of high Sulfate ion content.
Sulfite ion oxidizes to Sulfate ion.
Not suitable for samples containing anion which can form with Barium ion insoluble salts (for example Chromate ion).

TH Total Hardness

Color change : Light purple → Purple
Method : Phthalein Complexone
Range : 20 - 100 mg/L (ppm)
Reagent : WAK-TH Tube
Reaction time : 2 min. after drawing sample into the tube.

Procedure

1. Select <TH> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 10 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4) (Fig.5)
7. After 2 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

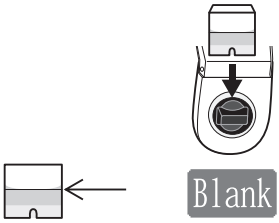


Fig.1 Fig.2

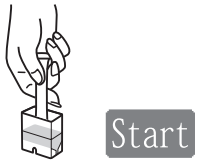


Fig.3

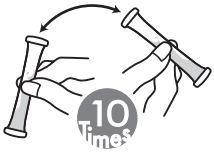


Fig.4

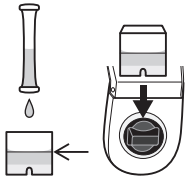


Fig.5

Cautions

1. This method is suitable for the sample in which the ratio of the containing Calcium Hardness and the containing Magnesium Hardness exists between 2:1 and 3:1.
   The built-in calibration curve is based on such a ratio between Calcium hardness and Magnesium hardness as 2.5:1.
2. The measured value will be higher if the ratio of Calcium hardness is high, and the measured value will be lower if the ratio of Magnesium hardness is high.
3. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 - 9, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
4. Keep sample temperature in the range of 15 - 30℃ .
5. The pH of the measured sample is about 9.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤100 mg/L, : B(Ⅲ) , Cl^- , F^- , I^- , K^+ , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol

≤1 mg/L, : Residual Chlorine

Heavy metal ions:

≤10 mg/L, : Ba^{2+} , CN^- , Mo(Ⅵ)

≤5 mg/L, : Al^{3+}

≤1 mg/L, : Co^{2+} , Cr(Ⅵ) , Mn^{2+} , Ni^{2+}

Sub-ppm level : Cr^{3+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Zn^{2+}

Not suitable for seawater samples.

TN Total Nitrogen

Color change : Light red → Red
Method : Potassium peroxodisulfate in alkaline medium - ultraviolet decomposition + Reduction and Naphthylethylenediamine
Range : 0.5 - 7.0 mg/L (ppm)
Reagent : DPR Reagent: Total Nitrogen (Model: DPR-TN) Tube
Reaction time : 5 min.after drawing sample into the tube.
Additional tool : UV Reactor L (Model: WA-UVR-L)
Pretreatment Reagent for Total Nitrogen (Model: UVR-TN-R)
Filter (Model: UVR-SF)
Instruction manual : Refer to the instruction manual which is attached to WA-UVR-L & UVR-TN-R.

Procedure

1. Select <TN> on the screen.
2. Press <Enter> to display the measurement procedure.

3. Insert the cell filled with the pretreated sample (with R-4 reagent, cooled down till the room temperature 20℃) into the cell box.
   Press <Blank>. (Fig.1)

4. Immerse the hole of the tube in the sample.
   Draw the whole cell sample into the tube instantly.
   Press <Start> at the same time. (Fig.2)

5. Shake the tube 60 times for 1 minute. (Fig.3)
6. Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)

7. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

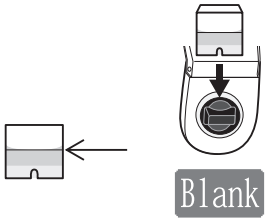


Fig.1

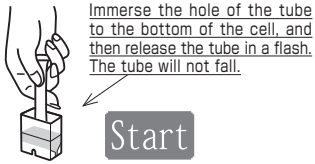


Fig.2

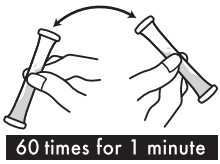


Fig.3

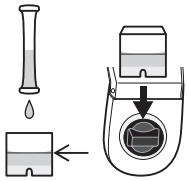


Fig.4

Cautions

1. Nitrate-Nitrogen in pretreated sample can be determined in this method.
2. Make the measurement after cooling down the pretreated sample till room temperature 20℃ .
3. The pH of the measured sample is ≤ 2.

Interferences

Refer to "NO_3-N_1 Nitrate-Nitrogen (NO_2-N = 0 mg/L)" about the interference data.

TP Total Phosphorus

Color change : None → Light blue → Blue
Method : Potassium peroxodisulfate in alkaline medium - ultraviolet decomposition + Molybdenum blue
Range : 0.10 - 2.00 mg/L (ppm)
Reagent : DPR Reagent for TP (Model: DPR-TP) K-1(Dropper), Tube
Reaction time : 3 min. after drawing sample into the tube.
Additional tool : UV Reactor L (Model: WA-UVR-L)
Pretreatment Reagent for Total Phosphorus (Model: UVR-TP-R)
Filter (Model: UVR-SF)
Instruction manual : Refer to the instruction manual which is attached to WA-UVR-L & UVR-TP-R.

Procedure

1. Select <TP> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Insert the cell filled with the pretreated sample (cooled down till the room temperature 20℃) into the cell box. Press <Blank>. (Fig.1)
4. Add 4 drops of K-1 reagent into the cell. Put the cap and shake the cell 2 - 3 times. (Fig.2)
5. Draw the whole cell sample into the tube.
   Press <Start> at the same time. (Fig.3)
6. Shake the tube 5 - 6 times.
   Return the sample into the cell gently, and insert the cell into the cell box. (Fig.4)
7. After 3 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

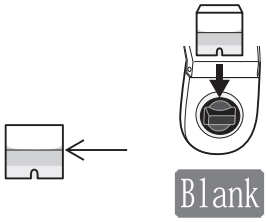


Fig.1

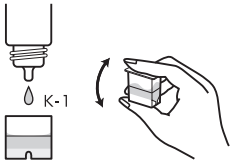


Fig.2

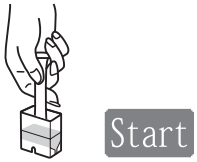


Fig.3

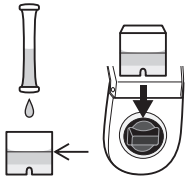


Fig.4

Cautions

1. Phosphate-Phosphorus in pretreated sample can be determined in this method.
2. Make the measurement after cooling down the pretreated sample till room temperature 20℃ .
   For sample of 30 - 40 ℃ , true values should be obtained by multiplying the measurement result and 0.8 together.
3. The pH of the measured sample is ≤ 2. K-1 reagent is ≤ pH 2.

Interferences

Refer to "PO_4- P Phosphate- Phosphorus" about the interference data.

Turbid Turbidity

Measuring the turbidity of the sample
Calibration : Polysthylene standard solution
Range : 10.0 - 100.0˚
Reagent : Unnecessary
Reaction time : 0 min.

Procedure

1. Select <Turbid> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Take out the cell from the cell box and pour out the pure water.
   Fill the cell with 1.5 mL of sample (up to the line). (Fig.3)
6. Insert the cell into the cell box and press <Start>. (Fig. 4)
7. The turbidity is displayed automatically. The result will be printed out when the printer is connected.

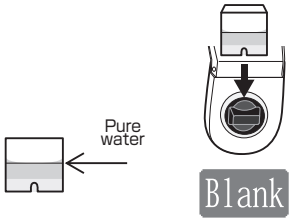


Fig.1

Fig.2

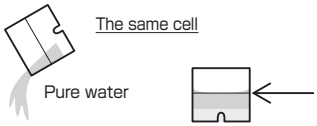


Fig.3

Fig.4

Cautions

1. Shake well the sample to mix it before the measurement.

Zn Zinc

In this analyte the procedure should be divided into 2 methods according to the sample state.
Be careful that each method uses their specified reagent.

1. Zn Zinc (Other metals do not coexist)

Range : 0.10 - 2.00 mg/L (ppm)
Reagent : LR-Zn No.26
Perform the regular Zinc measurement procedure.

2. Zn-KCN Zinc (use of KCN) (Other metals coexist)

Range : 0.15 - 2.00 mg/L (ppm)
Reagent : 5% KCN Solution
LR-ZnB No.26B
Mask other metal ions with KCN before the regular Zinc measurement procedure.

Cautions

The measurement should be carried out following each method with each reagent.

Zn Zinc (Other metals do not coexist)

Color change : Orange → Brown → Blue
Method : Zincon
Range : 0.10 - 2.00 mg/L (ppm)
Reagent : LR-Zn No. 26 R-1(Pack)
Reaction time : 5 min. after R-1 reagent is added.

Procedure

1. Select <Zn> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample of the cell.
5. Add R-1 reagent into the vial and press <Start>. (Fig.3)
6. Put the cap tightly and shake the vial 5 - 6 times. (Fig.4)
7. Before 5 minutes pass, pour 1.5 mL of the sample from the vial into the cell.
   Insert the cell into the cell box. (Fig.5)
8. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

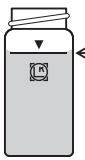


Fig.1

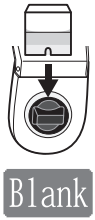


Fig.2

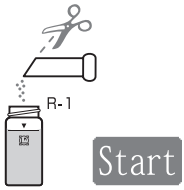


Fig.3


Fig.4

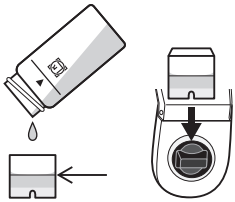


Fig.5

Cautions

1. Dissolved Zinc ion (Zn^{2+}) can be determined in this method.
   If you wish to measure Total Zinc fraction including suspended particles, you must process samples in order to dissolve solid phases.
2. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 -10, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. Most of metals affect the measurement. In case of other metals, may coexist the measurement should be carried out by "Zn-KCN Zinc (use of KCN)".
5. In case of Copper and Nickel coexisting in the sample, remove them with Cu/Ni Removal Reagent (LR-CuNi-RA).
6. The pH of the measured sample is about 9.
   Measured sample contains about 30mg/time of Boron.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 100 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^{-} , F^{-} , I^{-} , K^{+} , Mg^{2+} , Na^{+} , NH_4^{+} , NO_2^{-} , NO_3^{-} , PO_4^{3-} , SO_4^{2-} , Anionic Surfactant , Phenol

≤ 1 mg/L, : Residual Chlorine

Heavy metal ions:

≤ 10 mg/L, : Ba^{2+} , Cr(Ⅵ) , Mo(Ⅵ)

≤ 5 mg/L, : Al^{3+}

Sub-ppm level : Co^{2+} , Cr^{3+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mn^{2+} , Ni^{2+}

Suitable for seawater samples.

Zn-KCN Zinc (use of KCN) (Other metals coexist : KCN Solution should be used.)

Color change : Orange → Brown → Blue
Method : Zincon
Range : 0.15 - 2.00 mg/L (ppm)
Reagent : 5% KCN solution (should be prepared as pretreatment reagent)
LR-ZnB No. 26B Zn-RB (Powder), R-1 (Pack)
Reaction time : 5 min. after R-1 reagent is added.

Procedure

1. Select <Zn-KCN> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample.
   Fill the vial up to the white line (25 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
   Pour out the sample in the cell.
5. Add 0.5 mL of 5% KCN solution into the vial. Put the cap tightly and stir the vial 5 - 6 times.
   And wait for 1 minute. (Fig.3)
6. Add a heaping spoon of Zn-RB reagent with the attached spoon into the vial. Put the cap tightly and stir the vial 5 - 6 times. (Fig.4)
7. Add R-1 reagent into the vial and press <Start>. Put the cap tightly and stir the vial 5 - 6 times. (Fig.5)
8. Before 5 minutes pass, pour 1.5 mL from the vial into the cell. Insert the cell into the cell box. (Fig.6)
9. After 5 minutes, the measurement value will be displayed.
   The result will be printed out when the printer is connected.

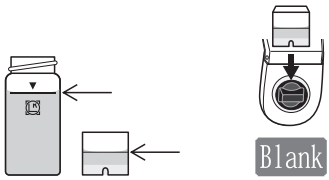


Fig.1 Fig.2

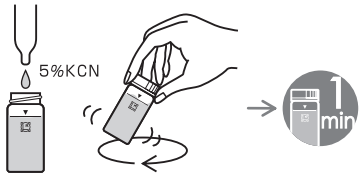


Fig.3

Fig.4

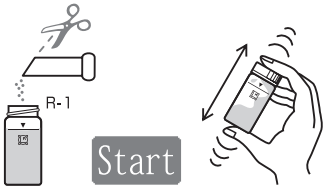


Fig.5

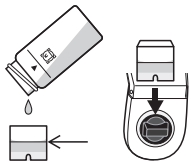


Fig.6

Cautions

1. Zinc ion (Zn^{2+}) can be determined in this method.
   If you wish to measure Total Zinc fraction including suspended particles, you must process samples in order to dissolve solid phases.
   This measurement procedure should be carried out in case of other metal ions coexisting.
2. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 -10, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temprature in the range of 15 - 30℃ .
4. For your safety, be sure to use a Peleus Ball for pipette (safety pipette) in order to avoid inhaling the solution in the procedure 5. (KCN solution is fatal if swallowed)
5. Strict care should be taken in handling and storing KCN solution.
6. KCN solution should be prepared on user's own.
   Comply with local regulations for disposal.
7. In case of Nickel coexisting, remove it from the sample with Ni Removal reagent (LR-Ni-RA).
8. The pH of the measured sample is about 9.
   Measured sample contains about 30 mg/time of Boron. And Cyanide is also contained.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Heavy metal ions:

≤ 10 mg/L, : Al^{3+} , Co^{2+} , Cr(Ⅵ) , Cu^{2+} , Fe^{2+} , Mo(Ⅵ) , Ni^{2+}

Sub-ppm level : Cr^{3+} , Fe^{3+} , Mn^{2+}

Zn-D Zinc (Low range)

Color change : Yellow → Orange → Pink
Method : 5-Br-PAPS
Range : 0.030 - 0.400 mg/L (ppm)
Reagent : WAK-Zn(D) K-1(Powder), K-2(Liquid), Tube
Reaction time : 1 min. after drawing sample into the tube.

Procedure

1. Select <Zn-D> on the screen.
2. Press <Enter> to display the measuring procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)

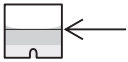


Fig.1

4. Insert the cell into the cell box and press <Blank>. (Fig.2)

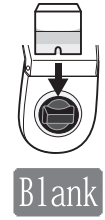


Fig.2

5. Add K-1 reagent. Put the cap on and shake the cell until the added reagent is completely dissolved. (Fig.3)

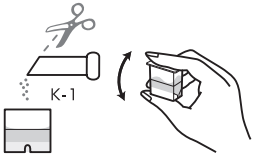


Fig.3

6. Add 0.3 mL of K-2 reagent using the plastic pipette into the cell. Put the cap and shake the cell 2 - 3 times, then open the cap and wait for 5 minutes. (Fig.4)

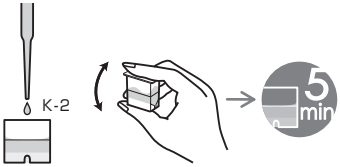


Fig.4

7. Draw the whole sample inside the cell into the tube. Press <Start> on the display at the same time. (Fig.5)

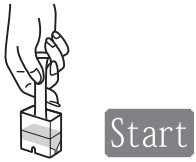


Fig.5

8. Shake the tube about 30 times. (Fig.6)
9. Immediately return the sample into the cell gently, and insert the cell into the cell box. (Fig.7)

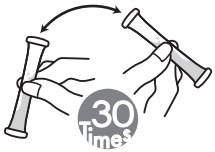


Fig.6

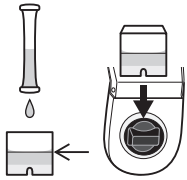


Fig.7

10. After 1 minute, the measurement value will be displayed.
The result will be printed out when the printer is connected.

Cautions

1. Dissolved Zinc ion (Zn^{2+}) will be determined in this method.
   If you wish to measure Total Zinc fraction including suspended particles, you must process samples in order to dissolve the solid phases.
2. The optimum pH is 9 in the reaction.
   When pH level exceed pH 5 - 10, adjust the pH level with diluted Sulfuric Acid or diluted Sodium Hydroxide solution.
3. Keep sample temperature in the range of 15 - 30℃ .
4. The pH of the measured sample is about 9.

Interferences

The built-in calibration curve is programmed based on the standard solution. Below is the list of interference data by adding each of the single substances to the standard solution. A sample which contains over the level of these substances will cause inaccurate result.

Except for Heavy metal ions:

≤ 1000 mg/L, : B(Ⅲ) , Ca^{2+} , Cl^- , F^- , I^- , K^+ , Mg^{2+} , Na^+ , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , Phenol

≤ 50 mg/L, : Anionic Surfactant , Residual Chlorine

Heavy metal ions:

≤ 1000 mg/L, : Ba^{2+} , Mo(Ⅵ)

≤ 20 mg/L, : CN^- , Cr^{3+}

≤ 10 mg/L, : Ag^+ , Al^{3+} , Cr(Ⅵ)

≤ 1 mg/L, : Co^{2+} , Cu^{2+} , Mn^{2+} , Fe^{2+} , Fe^{3+} , Ni^{2+}

Suitable for seawater samples.

ABS Absorbance

Range : Absorbance −3.000 - +3.000
Reaction time : 0 min. - 99 min.
Reagent : Should be prepared by users own
Wavelength : 615nm, 525nm. 470nm
(These 3 wavelengths can be measured simultaneously.)
This measurement procedure should be carried out in order to construct new calibration curves.

Procedure

1. Select <ABS> on the screen.
2. Press <Enter> to display the measurement procedure.
3. Fill the cell up to the line (1.5 mL) with sample. (Fig.1)
4. Insert the cell into the cell box and press <Blank>. (Fig.2)
5. Take out the cell from the cell box. If necessary, add an adequate reagent, and press <Timer>. A count of reaction time will begin. (Fig.3)
6. Insert the cell into the cell box. (Fig.4)
7. On pressing <Start>, measured absorbance is displayed. (Fig.5) The result will be printed out when the printer is connected.

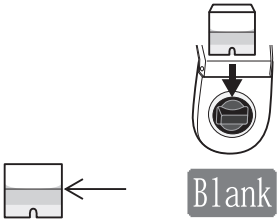


Fig.1 Fig.2

Fig.3

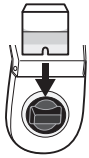


Fig.4

Fig.5

How to construct the calibration curve

1. Prepare some Standard Solutions in which concentrations of objective ions are known.

2. Plot each conc. (C1, C2, - Cn) on the Y-axis and each Abs. (A1, A2, - An) on the X-axis.

3. Draw a best-fit straight line through these plots on the graph.

4. Measure the absorbance of sample in which the concentration is unknown and plot the absorbance (Ax) on the straight line in the graph of calibration curve.

5. Draw a horizontal line from this plot.

6. Read the point on the Y-axis (Cx). This Cx is the unknown concentration of measured sample.

7. The slope of the straight line is K factor, and the intercept is b factor.

   Concentration(Cx)calculation formula

   $$Cx = K \times Ax + b$$

8. When these K factor and b factor are stored at Customized parameters (refer to Operation Manual), the concentration obtained from the measured absorbance can be displayed automatically.