Analysis of Effect on Water Quality due to Leaching from Water Works Equipment Materials using the TOC-VCSH

Along with the revision of the drinking water quality standard of the Water Works Law, a part of the Japanese Ministry of Health, Labour and Welfare ordinance providing the technical standards for water works facilities was revised. This revision specifies the total organic carbon (TOC) instead of the potassium permanganate consumption quantity as the measurement method for determining the quantity of organic substance leaching from water supply materials in contact with purified water or water in the process of being purified. (Standard value is 0.5mg/L or less)

We introduce here an example of TOC analysis of effused liquid from drinking water supply equipment polyvinyl chloride pipe using the total organic carbon analyzer TOC-VCSH.

■ Test Solution Preparation Method

900mL of pure water was transferred to a beaker, and after adding suitable amounts of the aqueous solutions sodium hypochlorite (effective chlorine concentration 0.3mg/L), sodium bicarbonate (0.04mol/L) and calcium chloride (0.04mol/L), respectively, pure water was added to bring the volume to 1L.

The pH of this aqueous solution was adjusted using hydrochloric acid (1 + 99) and a 10-fold dilution of this solution, in addition to sodium hydroxide aqueous solution (0.1mol/L) and a 10-fold dilution of this solution, so that the final water sample had a pH7.0 ± 0.1, hardness 45 ± 5mg/L, alkalinity 35 ± 5mg/L and residual chlorine 0.3 ± 0.1mg/L.

■ Test Method for Effect on Water Quality

Using leached liquid at about 23˚C, polyvinyl chloride pipes A and B were filled with the leached liquid and were then sealed. After 24 hours, the leached liquids were collected and transferred to glass bottles to be used as sample solutions.

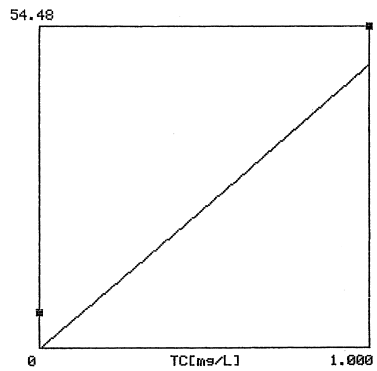
■ Measurement Method

The sample solutions were analyzed using the Shimadzu Total Organic Carbon Analyzer TOC-VCSH. The instrument was calibrated using 0mgC/L and 1mgC/L (carbon concentration 1mg/L) aqueous solutions of potassium hydrogen phthalate. The calibration curve data is shown in Fig. 1.

<Analytical Conditions>

Analyzer : Shimadzu Total organic carbon analyzer TOC-VCSH

Analysis method : TOC by acidification and sparging method




```
CALIBRATION CURVE : TC8          2-POINTS
[CONDITION]
 CATALYST          : C-H
 INJECTION VOLUME  : 500 uL
 DILUTION RATE     : 1
 SPARGE TIME       : 0.0 min
 ACID RATIO        : 0.0 %
 NO OF WASHES      : 2
[DATA]
   STD     (   ORG / DL )  AREA  SD  CV %
 0.000mg/L(  0.000/1.00) 6.240 0.12 1.86
 1.000mg/L(  1.000/1.00) 54.48 0.53 0.98
 PROTECT           : ON
 CAL CURVE FORM    : LINEAR REGRESSION
 SHIFT OPTION      : SHIFT TO ORIGIN
 R^2               : ------
```

Fig.1 Calibration Curve

■ Results

The TOC measurement results of the leached sample liquids from the polyvinyl chloride pipes A and B and a blank (leached liquids) are shown in Table 1 and Fig.2.

The TOC values of the leached sample liquid corrected by the blank value were within 0.5mg/L, satisfying the standard value.

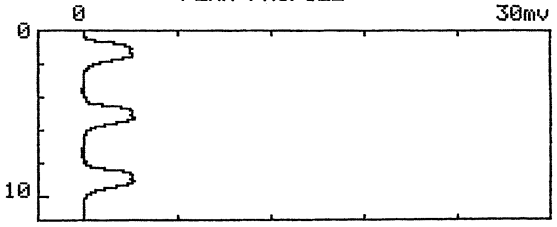
Table 1 Measurement Data

Sample Name	Analysis Result TOC Value (mgC/L)	Blank-subtracted TOC Value (mgC/L)
Polyvinyl chloride pipe A	0.450	0.170
Polyvinyl chloride pipe B	0.505	0.225
Blank	0.280	-

```
TYPE : NPOC
 [INJ  500uL,C# TC8     ,DL  1,SP 1.5min,
  ACID  1.5%,#WASH 2                     ]

   #   AREA     mg/L        C#     INJ  DL
   1  21.22    0.440       TC8    500   1
   2  22.00    0.456       TC8    500   1
   3  21.93    0.455       TC8    500   1
 ----------------------------------------
  MN  21.72    0.450
  SD   0.43     0.01
  CV   1.99 %   1.99 %
```

PEAK PROFILE

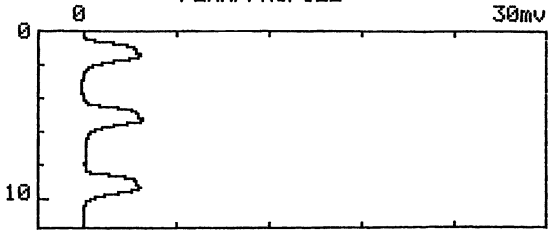


Polyvinyl chloride pipe A

```
TYPE : NPOC
 [INJ  500uL,C# TC8     ,DL  1,SP 1.5min,
  ACID  1.5%,#WASH 2                     ]

   #   AREA     mg/L        C#     INJ  DL
   1  24.25    0.503       TC8    500   1
   2  24.80    0.514       TC8    500   1
   3  24.07    0.499       TC8    500   1
 ----------------------------------------
  MN  24.37    0.505
  SD   0.38     0.01
  CV   1.56 %   1.56 %
```

PEAK. PROFILE

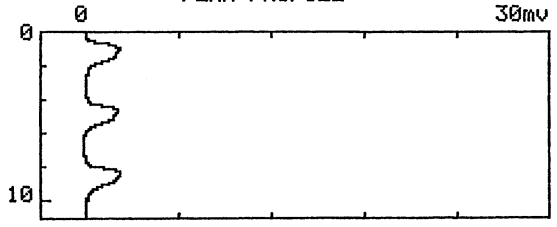


Polyvinyl chloride pipe B

```
TYPE : NPOC
 [INJ  500uL,C# TC8     ,DL  1,SP 1.5min,
  ACID  1.5%,#WASH 2                     ]

   #   AREA     mg/L        C#     INJ  DL
   1  13.32    0.276       TC8    500   1
   2  13.74    0.285       TC8    500   1
   3  13.43    0.278       TC8    500   1
 ----------------------------------------
  MN  13.50    0.280
  SD   0.22     0.00
  CV   1.61 %   1.61 %
```

PEAK PROFILE



Blank

Fig.2 Measurement Data

SHIMADZU

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