Application News

No.A503

Spectrophotometric Analysis

Quality Analysis of Environmental Water

- Using a Water Analysis Program Designed for the UV-1280 -

In the environmental sector, regulations are in place and monitoring is performed on the quantities of specific substances present in industrial wastewater and river water. An increase in the concentration of phosphorus and nitrogen in river water can cause abnormal growth of algae and phytoplankton.[1)] Japan uses river water among other sources for its tap water, which is treated to make it potable.[2)] There are 51 "water quality criteria" and 26 "water control targets" prescribed for tap water in Japan.[3)] These criteria and targets include prescriptions for parameters such as residual chlorine and hardness, which are items of relatively common concern.
We developed a water analysis program designed for use with the UV-1280 UV-VIS spectrophotometer, which provides easy analysis of 22 substances and 39 items (including phosphoric acid and residual chlorine) by mainly using the "PACKTEST" water quality testing kits from Kyoritsu Chemical-Check Lab., Corp.
We describe using this UV-1280 water analysis program to analyze day-to-day changes in phosphate-phosphorus levels in river water and residual chlorine, iron, and total hardness levels in tap water.

Fig. 1 UV-1280 and PACKTEST

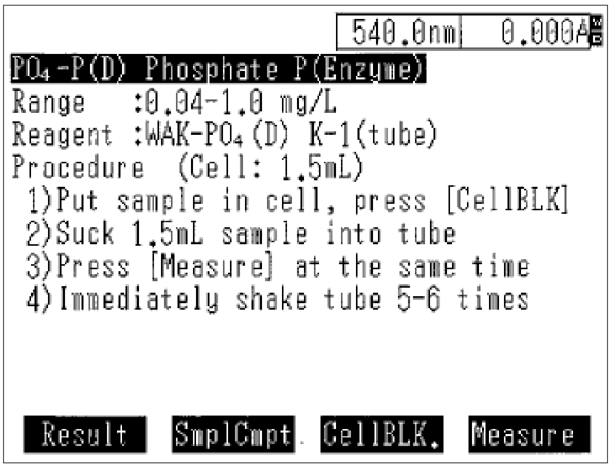

Fig. 2 Phosphate Phosphorus Measurement Procedure (Enzymatic Method)

Analysis of Phosphate Phosphorus in River Water

The UV-1280 and a Kyoritsu Chemical-Check Lab., Corp. PACKTEST are shown in Fig. 1. The water analysis program displays the measurement procedure on-screen. An example procedure is shown in Fig. 2. The program also has built-in calibration curves created with standard samples, so concentration measurements can be made simply by following the on-screen instructions. New measurement items can also be added using a User-Defined Items function, and a trend graphing function can be used to show day-to-day changes in a single view.
River water (hereinafter river water A) was taken from a local river alongside weather recordings between February 15 and 26, 2016, and phosphate phosphorus measurements were made using the measurement conditions shown in Table 1.
The trend graph shown in Fig. 3 allows the user to understand day-to-day changes in the phosphate phosphorus concentration in river water A at a single glance. The phosphate phosphorus concentration was below the lower limit of detection (0.04 mg/L) on most days, while a maximum concentration of 0.398 mg/L was detected on February 16. Rainfall was observed close to the river water collection point on February 14 and 20, which probably caused the low levels of phosphate phosphorus detected on February 15, 16, and 22.
A photograph of the river water collection point is shown in Fig. 4. The photograph shows the water was clean and the riverbed was fully visible on sunny days.

Table 1 Measurement Conditions

Instruments used	: UV-1280 Water analysis program PACKTEST Phosphate-Phosphorus (Low Range)
Items measured	: Phosphate phosphorus (enzymatic method)

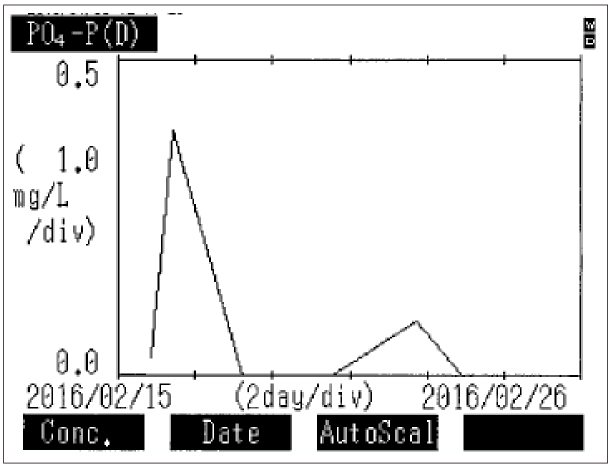

Fig. 3 Phosphate Phosphorus over Time (Trend Graph)

Quality Analysis of Tap Water

Tap water contains substances such as residual chlorine, mineral content in the form of calcium and magnesium that is represented as total hardness, and iron. The prescribed water quality criteria levels for these items are ≥ 0.1 mg/L for residual chlorine, ≤ 300 mg/L for total hardness, and ≤ 0.3 mg/L for iron in Japan.

We collected tap water from a normal tap, a tap with water purifier attached, and a tap that is rarely used, and measured the above three items under the measurement conditions shown in Table 2.

The water samples before and after testing are shown in Fig. 5, and the test results are shown in Table 3. A small amount of residual chlorine was found in tap water that passed through a water purifier, but no residual chlorine was detected in tap water taken from the tap that was rarely used. We suspected some degradation of the water purifier. Probable reasons that residual chlorine was not detected in water taken from the tap that is rarely used are stagnation of water in the pipes and aging of the pipes themselves. Total hardness concentrations were within the water quality criteria levels and within the target levels (10 to 100 mg/L) in water taken from all three taps. Iron was only detected at 0.165 mg/L in water taken from the tap that was rarely used. Water taken from the tap that was rarely used appeared colored compared to other tap waters, and we inferred the iron present in the water originated from the pipes.

Table 2 Measurement Conditions

Instruments used	: UV-1280 Water analysis program PACKTEST Residual Chlorine (free), Total Hardness, Iron (low range)
Items measured	: Residual chlorine (free), total hardness, iron (low range)

Fig. 4 River at Collection Point

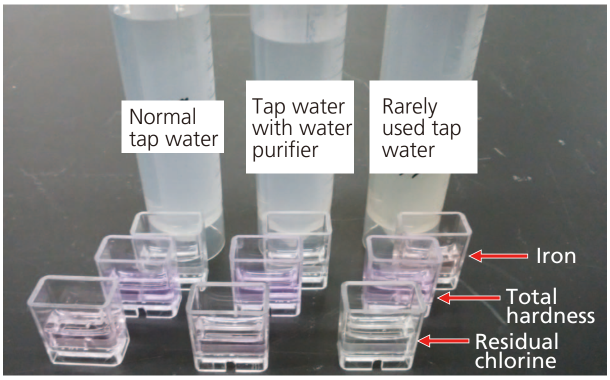

Fig. 5 Left: Normal Tap Water, Middle: Tap Water with Water Purifier, Right: Rarely Used Tap Water

Table 3 Measurement Results

	Normal	With water purifier	Rarely used tap water
Residual chlorine (free)	0.18 mg/L	0.07 mg/L	< 0.05 mg/L
Total hardness	40 mg/L	48 mg/L	34 mg/L
Iron (low range)	< 0.05 mg/L	< 0.05 mg/L	0.17 mg/L

Conclusion

We easily performed water quality analysis of environmental water and tap water using the water analysis program designed for the UV-1280 and the PACKTEST series of products from Kyoritsu Chemical-Check Lab., Corp. We also used the trend graphing function to observe day-to-day changes in a single view.

[References]
1) Kyoritsu Chemical-Check Lab., Corp. PACKTEST water analysis kit
2) Kyoto City Waterworks and Sewerage Bureau website
3) Japan's Ministry of Health, Labour and Welfare website

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