

Application Note

The Quantification of Aluminium in water using a Fluorescence Spectrophotometer

KEYWORDS

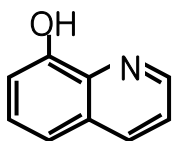
Fluorescence spectrophotometer, Aluminium, Water

INTRODUCTION

When a small quantity of aluminium in water is absorbed into the human body, this aluminium would be a origin of disease like a failing of memory, stomachache and paralysis etc. Currently, the amount of aluminium in tap water is restricted within 200ppb under the law related to water in Korea. In this experiment, measuring the amount of aluminium in water is made on EP using the 8-Hydroxyquinoline as a chelating reagent, and we read the value of FL intensity at 528nm as the highest of the fluorescence peak for the calculating concentration of aluminium in water. This application note describes the quantification of an aluminium in water using a Scinco Fluorescence spectrophotometer with Fluoromastersoftware.

REAGENT & APARATUS

1. 8-Hydroxyquinoline:Dilute the 8-Hydroxyquinoline with Chloroform(5g/L).



2. 4M Acetate buffer solution(pH 6.0):Dilute the sodium acetate with DI water. The concentration of solution is adjusted by Sodium acetate solution.

3. Standard solution : Dilute the aluminium potassium sulfate dodecahydrate with DI water

4. Deionized water

5. FS-1 Fluorescence spectrophotometer

6. Fluoromaster S/W

7. Fluorescence cell (10mm pathlength)

8. Separatory funnel

PROCEDURE

1. Prescribed solution : Mixing the 100ml of the tap water with 10ml of acetate buffer solution(pH 6.0).

2. Reference solution : Dilute each 2ml of prepared standard solution with 10ml of buffer solution. Then dilute again with 98ml of DI water.

3. Take 20ml of sample from each prepared sample & standard solution.

4. Dilute each sample & solution with 10ml of prepared HQ in chloroform(5g/L) into the separatory funnel.

5. Shake these solutions to mix fully.

6. Wait a few minutes until when the separated between chloroform class with water class.

7. Take a chloroform class as sample using separatory funnel.

8. In Quantification Standard mode, measure the emission spectrum of standards & sample at 528nm.

INSTRUMENT PARAMETER

Experiment set up

Scan mode : Emission
 Data mode : Fluorescence
 Ex. Wavelength : 392nm
 Em. Wavelength range : 420~620nm
 Interval : 1nm
 PMT set up – Voltage : 800V
 – Exposure time : 20ms
 Monochromator set up – Speed : 1000nm/min

Experimental mode

Curve order : 1
 Origin value(0,0) : No
 Concentration unit : ppb
 Quant wavelength : 528nm

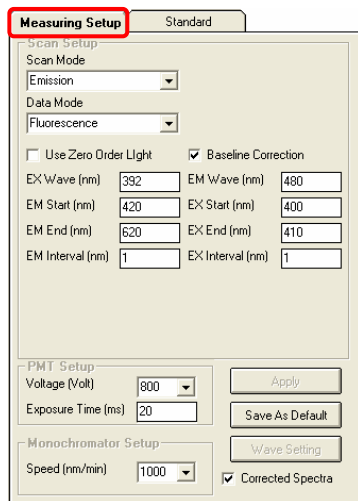


Figure 1. Measuring set up window

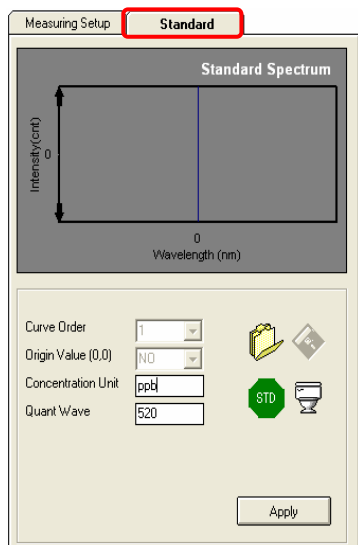


Figure 2. Measuring set up(Standard) window

RESULT

Standard curve & spectra of STD samples

Figure 3 and 4. show a standard curve and spectra of STD samples. And table 1 shows the Absorption value at 528nm and concentration. The excellent calibration curve ($R^2 : 0.9816$) demonstrates the feasibility of quantifying aluminium concentration of less than 1ppm in samples.

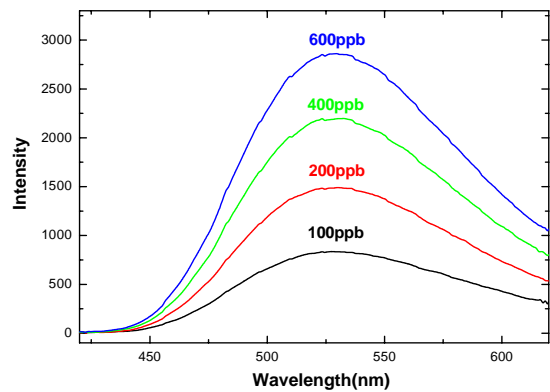


Figure 3. spectra of STD samples

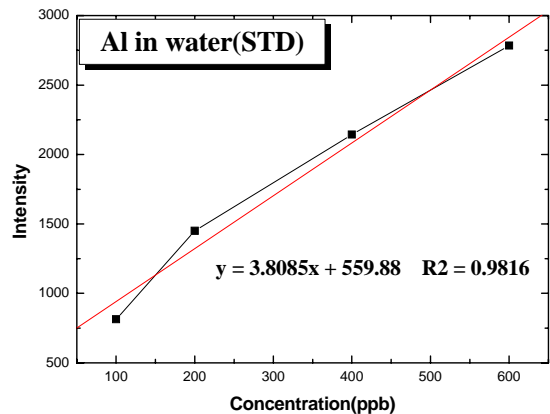


Figure 4. Standard curve of STD samples

Table 1. Concentration and FL intensity value

$R^2 = 0.9816$

Function : $Y = 3.8085X + 559.88$

Name	Concentration (ppb)	FL intensity (528nm)
STD1	100	835
STD2	200	1485
STD3	400	2189
STD4	600	2858

The spectrum and Aluminium concentraion of tap water

Figure 5, 6 and table 2 show the spectrum and aluminium concentration of the tap water.

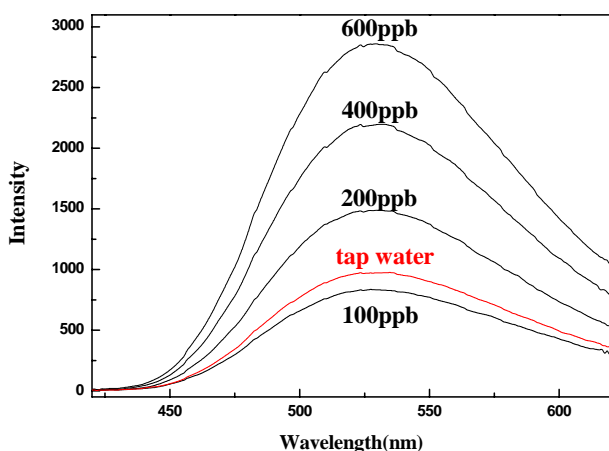


Figure 5. Fluorescence spectrum of tap water

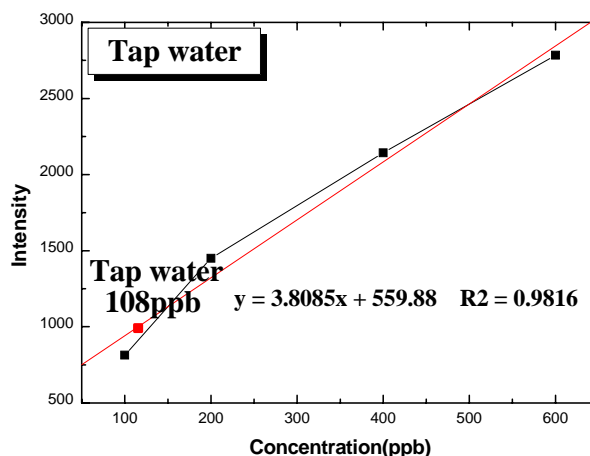


Figure 6. Al concentration of tap water

table 2. Aluminium concentration of the tap water

Name	Concentration (ppb)	FL intensity (528nm)
Tap water	108	971

CONCLUSION

Using Scinco the FS-1 fluorescence spectrophotometer and the fluoromaster software, quantification of aluminium in water was performed. The fluorescence spectrophotometer has higher sensitivity than the UV-vis spectrophotometer. The FS-1 can measure up to ppb scale. In this experiment, we measured the aluminium concentration of tap water. The concentration value of tap water is 108ppb. This concentration value is in permissible range under the law related to water in Korea.

REFERENCE

1. R. Player, J. Gleed, R Jonasson and J. R. Kramer, (1981) Comparison of atomic absorption spectrometric, spectrophotometric, and fluorimetric methods for determination of aluminium in water, *Analytica Chimica Acta*, 134(1982) 369-373
2. F. Zehra Kucukbay and Mustafa Demir, (2002) Aluminium fraction in the water of karakaya dam lake (Malatya, Turkey), *Turk. J. Chem.* 27(2003) 375-382