

Analysis of Non-ionic Surfactants by Solid-phase Extraction - High-performance Liquid Chromatography (SPE-HPLC)

Introduction

Non-ionic surfactant, having hydrophilic group which does not ionize when it is dissolved in water, has chemical property such that it is hardly affected by water hardness or electrolyte, and it can be used together with any other kind of surfactants. Since it is easy to use with high detergency and excellent emulsification/dispersibility, while it has low stimulation, the amount of its production and consumption has recently been increased drastically.

According to Japanese Water Supply Law, the water quality standard was established in 2004 so that the concentration of non-ionic surfactant may be lower than 0.02 mg/L.

As an analysis method, Solid-phase Extraction - Absorption Spectrophotometry was announced in which absorbance was to be measured when a complex formed by non-ionic surfactant with Co(II) was reacted with a coloring reagent such as a solution of 4-(2-pyridylazo)resorcinol (PAR). Then in 2012, SPE-HPLC method was newly added as a new analysis method for non-ionic surfactant. Regarding the measurement of non-ionic surfactant when implementing water quality testing, it is described that it is necessary to measure the sample of one-tenth concentration of water quality standards and the coefficient of variation of such measured values is required to be maintained to be lower than 20% as criteria of measurement quality.

This time, according to this SPE-HPLC method, non-ionic surfactant was analyzed and the results are reported as below.

Keyword: SPE-HPLC, Non-ionic surfactant, Heptaoxyethylene dodecyl ether, 5 μm , C18 column

Experimental

[Equipment]		[Conditions]	
Pump:	PU-2080	Column:	YMC-Triart C18 (4.6 mmI.D. x 150 mmL, 5 μm)
Degasser:	DG-2080-53	Eluent :	10 mM Sodium tetraborate/Methanol (62/38)
Column oven:	CO-2065	Flow rate:	1.0 mL/min
Autosampler:	AS-2057	Column temp.:	40 $^{\circ}\text{C}$
Detector:	UV-2070	Wave length:	510 nm
		Injection volume:	20 μL
		Standard sample:	Heptaoxyethylene dodecyl ether

Results

Fig. 1 shows the flowchart of sample preparation.

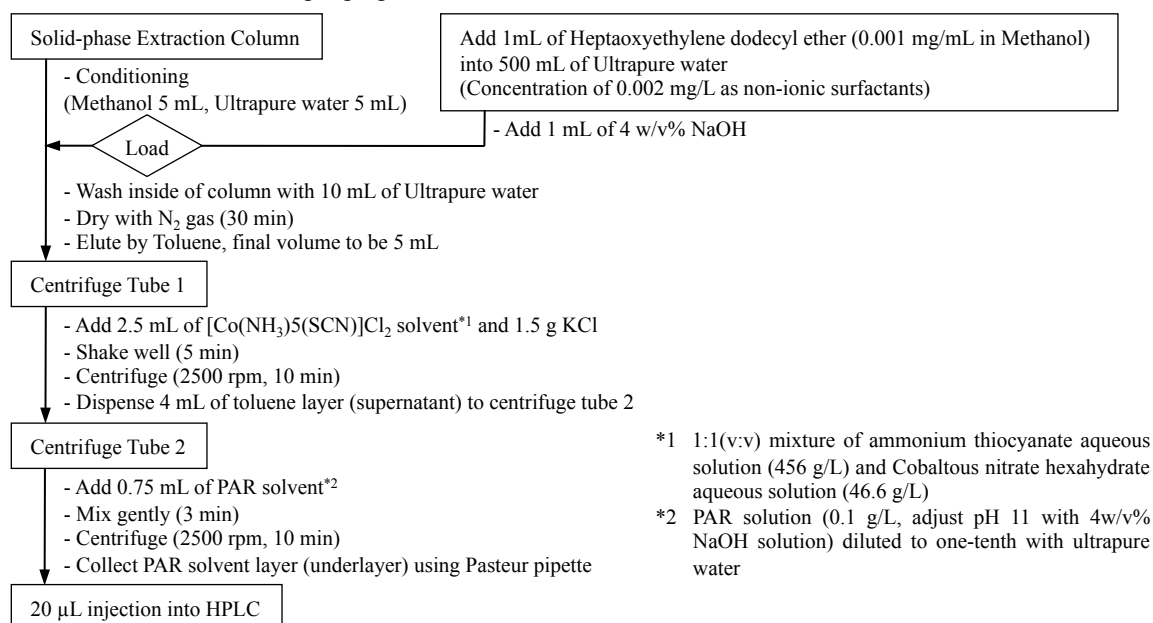


Fig. 1. Flowchart for Preparation of Sample Added with Non-ionic Surfactant

Fig. 2 shows the chromatogram of sample added with non-ionic surfactant, and table 1 shows the peak area. This result satisfies the criteria of measurement quality which is that coefficient of variation of measured values is lower than 20% when measuring the sample of one-tenth concentration of water quality standards.

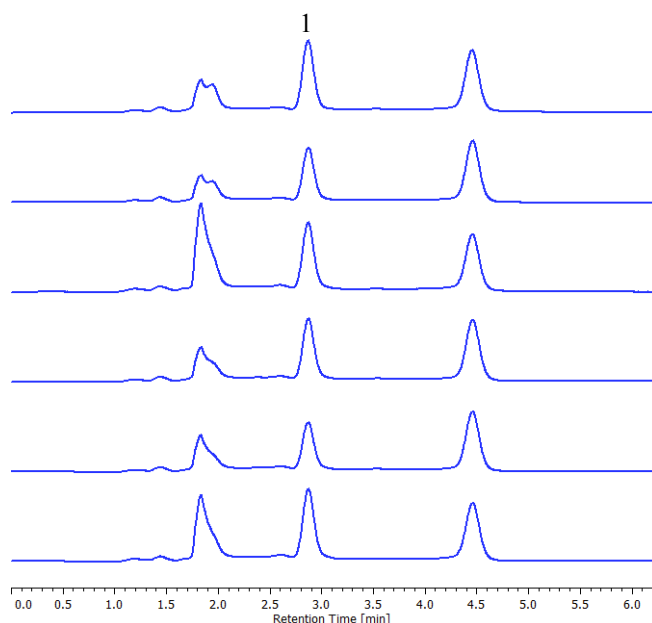


Table 1. Result of Sample Added with Non-ionic Surfactant

Peak Area	
1	28974
2	22078
3	28057
4	25492
5	19989
6	29604
AVE	25699
SD	3931.7
C.V.%	15.3

Fig. 2. Chromatogram of Sample Added with Non-ionic Surfactants* (n=6)

1: Heptaoxyethylene dodecyl ether (0.002 mg/L)

*Sample preparation is described on Fig. 1.

Fig. 3 shows a linearity of sample added with non-ionic surfactant. Four standard samples were measured with different concentrations ranging from 0.002 to 0.01 mg/L specified in Japanese official analytical method and as a result, good linearity was obtained as $R^2=0.985$.

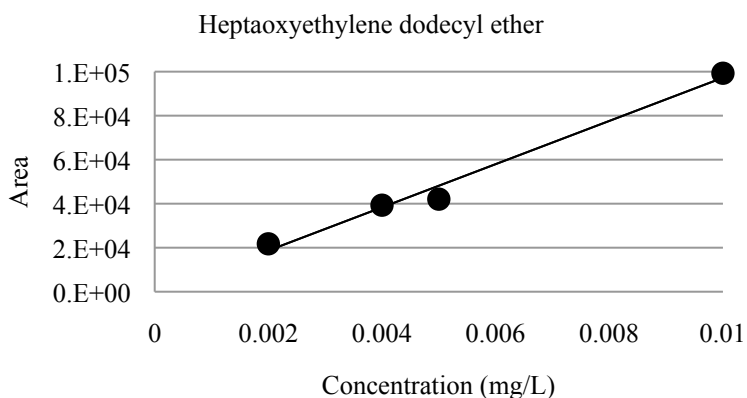


Fig. 3. Linearity of Sample Added with Non-ionic Surfactant (0.002 ~ 0.01 mg/L)