(76)

Adaptation and Optimisation of Cloud Point Extraction Procedure to Determine Aluminium Content in Aqueous Solutions

Amarasena D.W.P.U.*, Cooray A.T.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**prasadiniamarasena@gmail.com*

Abstract

Due to the adverse effects (high risk of Alzheimer's disease, encephalopathy/dialysis dementia, Parkinson's disease, and osteomalacia) of Aluminium on all living beings, monitoring the concentration of Aluminium in water is very important to ensure water quality. A pre-concentration step is required, because of the complexity of matrices and low concentration of trace metal, before doing the instrumental detection. Cloud point extraction (CPE) has been used for the pre-concentration step for the determination of Aluminium in aqueous solutions prior to its detection from Atomic Absorption Spectrometry and UV Visible Spectrometry. In this method, Eriochrome Cyanine-R (ECR) and non-ionic surfactant Polyethylene glycol tert-octylphenyl ether (Triton X-114) used as the complexing agent and surfactant respectively. The main objectives of this study are to develop a cloud point extraction method for the pre-concentration of trace Aluminium prior to its determination, Optimisation of the developed method by changing variables. Mainly two CPE methods were developed. The developed methods are based on the complexation of Aluminium ions with ECR and then entrapped in Triton X-114 at a higher temperature (70^o C) and room temperature. As Method 1; general CPE procedure was followed according to literature. Since the expected recovery percentage was not obtained, as Method 2, the general cloud point extraction procedure which used previously was carried out with minor changes. The minor changes are omitted heating step, increased concentration of Triton X-114, and except 0.2 M sodium sulfate other solutions were added in a different order. In Method 1 at 70^o C, the recovery percentage was in the range of 7.5%-31.0%, but in method 2 at room temperature, the recovery percentage was in the range of 12.0%-58.0%. Since method 2 obtained the maximum recovery percentage values, chemical variables affecting the method 2 cloud point extraction procedure optimised in order to find the optimum operating conditions. Optimum conditions were pH=6.5, Triton X-114 volume=10 mL, and Triton X-114 concentration=0.25% (v/v). In these methods, the Aluminium ion concentration was investigated in the range of 4-15 ppm. Under the optimisation of ECR concentration maximum recovery percentage was obtained, when a neutral metal-ligand complex is formed in the medium which is Al (ECR) 3. In order to form that complex, excess ECR concentration is needed in the medium. The obtained method needs to be further improved by optimising factors such as salt concentration, centrifugation rate, and diluting agent.

Keywords: Cloud point extraction, Aluminium, ECR, Recovery percentage