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Original Research Article

Separation, Preconcentration and determination of Hg (II) Ion in Water Samples by Cloud Point Extraction Technique Coupled with UV-VIS Spectrophotometry using a New Complexing Agent

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ABSTRACT

In this study a cloud-point extraction process using non-ionic surfactant Triton X-114 for extraction of mercury (II) from aqueous solutions was developed. The method is based on the complex formation of Hg (II) with benzyl (pyridin-2-yl) methylcarbamodithioate at pH 5.5. After preconcentration and dilution of the surfactant-rich phase, the enriched analyte was determined by spectrophotometer. The effects of different parameters such as concentration of surfactant, electrolyte, temperature and pH on the cloud point extraction were studied in detail and a set of optimum conditions were established. Under the optimum conditions, the calibration graph was linear in the range of 0.25–3 μg mL^{-1} with detection limit of 0.02 μg mL^{-1}. The precision (R.S.D. %) for 1 μg mL^{-1} of Hg (II) was 1.6% (n=5) and the preconcentration factor was found to be 20. Under the presence of foreign ions, no significant interference was observed. Finally, the proposed method was applied successfully for the determination of Hg (II) in real water samples.

Keywords: Mercury; Cloud point extraction; Spectrophotometry; benzyl (pyridin-2-yl) methylcarbamodithioate; Triton X-114.

Introduction

Heavy metals are of important interest because of having high toxic effects on living organisms so that more stringent regulations have been imposed for controlling their contamination in the environment in recent years [1]. The pollution of natural waters by heavy metals is a great concern nowadays due to their potentially toxic effects on living organisms. Urbanization, industrial development, and heavy traffic lead to contamination of water bodies by heavy metals [1]. One of these toxic metals is mercury, finding in low levels in natural waters in different physical and chemical forms. Mercury can cause birth defects and other undesirable effects on the human body [2-7]. It is a highly toxic element that is found both naturally and as an introduced contaminant in the environment [8,9]. Mercury has no beneficial biological function, and its presence in living organisms is associated with cancer, birth defects, and other undesirable outcomes [10,11]. The United States Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) lists Hg and its compounds in third place on the ‘‘Priority List of Hazardous Substances’’ and the European Water Framework Directive (2000/60/EC) classifies Hg as one of 30 ‘‘precarious dangerous pollutants’’ [12]. Thus, the development of new methods for selective separation, preconcentration and determination of this metal ion in different matrices is of continuing interest. In this manner many methods are still commonly carried out using a preconcentration step to overcome the problems resulting from the low concentration levels of analytes and high levels of matrices prior to their detection [13,14].