ABSTRACT

An efficient, simple, and rapid cold-induced aggregation microextraction method was applied to preconcentrate copper (II) ions from water and food samples as a prior step to its determination by flame atomic absorption spectrometry. In this method, small amounts of 1-hexyl-3-methylimidazolium hexafluorophosphate [Hmim][PF$_6$] and 1-hexyl-3-methylimidazolium bis (trifluoromethylsulfonyl) imide [Hmim][Tf$_2$N] as hydrophobic ionic liquids (ILs) and extractant solvents were dissolved in the sample solution containing Triton X-114. After dissolving, the solution was cooled in an ice bath and a cloudy solution was formed of IL fine droplets due to the decrease of IL solubility. The effective parameters, such as pH, amount of chelating agent and IL, temperature, and concentration of salt were optimized by a fractional factorial design to identify the most important parameters and their interactions, and central composite methodology was used to achieve the optimum point of effective parameters to the response. Under the optimum conditions, the calibration graph was linear in the range of 2–100 µg L$^{-1}$ with a correlation coefficient of 0.996 and a limit of detection of 0.42 µg L$^{-1}$. The relative standard deviation was 2.61% ($n=6$). The obtained enrichment factor was 75 for copper. The interference effect of anions and cations was also tested. The proposed method was compared with the other methods and applied to the analysis of several real and spiked samples and the satisfactory relative recoveries (96.5–101.3%) were obtained.

Keywords: Cold-induced aggregation microextraction; Flame atomic absorption spectrometry; Central composite design; Trace metal determination; Food samples

1. Introduction

Excessive release of heavy metals into the environment due to industrialization and urbanization has posed a great problem worldwide. Today, with the rapidly increasing urban population and water resources becoming scarcer, there is a strong need to reconsider our consumption patterns and the way we use our water resources. Unlike organic pollutants, the majority of which are susceptible to biological degradation, heavy metal ions do not degrade into harmless end products [1]. The continued intake of copper by human beings leads to necrotic changes in the liver and kidney, mucosal irritation; widespread capillary damage, depression, weakness, lethargy, and anorexia, as well as damage to the...