Ionic liquid based solvent micro-extraction of Ag and Cd from marine waters

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Cadmium and silver are naturally occurring metals in saline natural waters, which may present toxic effects even at trace level. Membrane technology has been widely applied for their extraction, including hollow fiber supported liquid membranes. However, their application to saline waters is limited by the interferences due to sample matrix.

A hollow fiber liquid micro-extraction (HFLPME) system, with a configuration of 2 phase solvent bar micro-extraction (2SBME), using the ionic liquid N-methyl-N,N,N-trioctylammonium chloride (Aliquat® 336), as extractant is proposed to overcome the limitations of existing HFLPME of Ag and Cd in saline waters.

The use of an ionic liquid solution in the 2SBME leaded to higher stability of the organic solution in the fiber. Extraction of Cd and Ag with Aliquat® 336 was enhanced by Cl⁻ in the sample, but it was independent of the concentration of organic matter. Extraction yield varied in the range 65–80% for Ag, and 45–95% for Cd, depending on the salinity of samples. The highest extraction was obtained in seawater samples for 75% Aliquat® 336 dissolved in kerosene with 18% dodecan-1-ol, after 45 min, and 800 rpm stirring rate in the sample. Efficacy of the proposed system when applied to real samples was 88.10 ± 4.14% for Cd, and 61.47 ± 3.00% for Ag in seawater, and 92.73 ± 5.37% for Cd and 64.23 ± 2.85% for Ag in a hyper-saline lagoon (70 g L⁻¹ NaCl).

In conclusion, the proposed methodology allowed a miniaturization of Ag and Cd extraction in short times, requiring lower amount of reagents and solvents, less energy as well as reducing operational cost and wastes if compared with existing liquid membrane based methods.

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