Development of a dispersive liquid–liquid microextraction combined with flame atomic absorption spectrometry using a microinjection system for the enrichment, separation, and determination of nickel in water samples

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ABSTRACT

A simple, rapid dispersive liquid–liquid microextraction procedure was combined with flame atomic absorption spectrometry and has been established for the determination of trace amounts of nickel. A mixture of carbon tetrachloride, 2-(5-bromo-2-pyridylazo)-5-diethylamino-phenol (5-Br-PADAP), and acetonitrile was swiftly injected with a syringe into a sample containing nickel(II) resulting in the formation of a cloudy solution. The cloudy solution was centrifuged and fine droplets settled at the bottom of the test tube. After centrifuging, the settled organic phase was dissolved to a total volume of 250 μL in concentrated nitric acid, from which 25 μL was introduced into the flame atomic absorption spectrometer using the microinjection system. The effect of parameters such as pH, the amount of 5-Br-PADAP, the volume and types of the extraction, and dispersion solvents have been examined. The limit of detection, the preconcentration factor, and enhancement factors were 0.13 μg L⁻¹, 200, and 99, respectively. The calibration graph was linear in the range of 5–186 μg L⁻¹. The developed method was validated by analyzing certified reference materials (TMDA-25.3, TMDA-51.3). The microextraction method was satisfactorily used for the determination of nickel(II) in various environmental waters.

Keywords: Preconcentration; Microextraction; Nickel; Water; Atomic absorption spectrometry