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Determination of ultra-trace Pt, Pd and Rh in seawater using an off-line pre-concentration method and inductively coupled plasma mass spectrometry

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Abstract: A method was modified for the preconcentration of platinum (Pt), palladium (Pd) and rhodium (Rh) from seawater by a solid phase extraction using a commercially available resin Nobias-chelate PA1®. All the determination was conducted using inductively coupled plasma mass spectrometry (ICP-MS) which had a low detection limit for Pt, Pd and Rh, about 16.53, 16.41 and 26.88 pg L^{-1}, respectively. It was found that the adsorption performance of the resin was closely related to the matrix, ligands and pH of the samples. Significant difference in recovery was found in various samples: seawater ≈ artificial seawater > ultra-pure deionized water. This method had low method blank in the range of 5.51 to 8.89 pg L^{-1} and high enrichment factor of up to 180~200. The recoveries of Pt and Pd were 93±4.2% in the spiked real seawater. However, the recovery of Rh on the resin was below 70% but stable in the range of 65-68%. It indicated that the Rh recovery seemed to be reproducible and higher volumes of seawater must be processed in order to obtain the lower limit of quantification and excellent recovery.

Keywords: Platinum group elements; Seawater; ICP-MS; Pre-concentration; Chelating resin