SEPARATION/PRECONCENTRATION OF TRACE METALS BY YEAST (Yamadazyma spartinae) IMMOBILIZED ON TiO₂ NANOPARTICLES IN WATER SAMPLES BY ICP-AES

Sıtkı BAYTAK¹ and Zikri ARSLAN²

¹Department of Chemistry, Faculty of Science and Arts, Nevşehir University, 50300, Nevşehir, Turkey
²Department of Chemistry, Jackson State University, Jackson, MS, 39217-0510, USA

Key Words: Nano TiO₂, Yeast, Preconcentration, Trace metals, ICP-AES

Microorganism immobilized on inorganic and organic support materials enable preconcentration of trace metals from numerous samples (1-3). Such processes involve a combination of active and passive transport mechanisms, and are generally classified into two divisions as biosorptive (passive) uptake by non-living biomass and bioaccumulation by living cells. Metal ion uptake by biosorption may involve the contribution of diffusion, adsorption, chelation, complexation, coordination or micro-precipitation mechanisms, depending on the specific substrate (biomass).

In this study, a solid phase extraction procedure based on biosorption of Cr, Cu, Fe, Mn, Ni and Zn on yeast (Yamadazyma spartinae, ATCC 18866™) immobilized on a solid support of TiO₂ nanoparticles. Column contained 100 mg of nano TiO₂ with average particle size of 100 nm. Determinations were made by ICP-AES. The optimum conditions for the quantitative recovery of the analytes, including pH, amount of solid-phase, flow rate of the sample solution, and eluent type were examined. The effect of interfering ions on the recovery of the analytes was also investigated. Cr, Cu, and Fe retained at pH 6 while Mn, Ni and Zn were retained at pH 8. Elution was performed with 2 mL of 5% HNO₃.

Under the optimum conditions, recoveries of Cr, Cu, Fe, Mn, Ni and Zn by Yamadazyma spartinae immobilized on TiO₂ were 99 ± 2%, 99 ± 2%, 100 ± 2%, 99 ± 2%, 99 ± 2% and 100 ± 2% at 95% confidence level, respectively for spiked water samples. The enrichment factor when using a sample volume of 500 mL was 250 for all metal ions studied. The analytical detection limits for Cr, Cu, Fe, Mn, Ni and Zn were 1.7, 1.5, 0.5, 1.2, 2.0, 0.7, ng/mL, before enrichment respectively. The method was validated by analysis of the standard reference material of water. Application was performed in tap water and lake water samples to determine the concentration of Cr, Cu, Fe, Mn, Ni and Zn.

REFERENCES

* This work has been examined at Jackson State University, Jackson, MS, USA.