Quantification of Transition Metals in Water

- Versatile and efficient ion chromatography analyses
- Superior performance and reliability
- Flexible detector configurations
- EPA/600/4-90/025

Heavy and transition metals are of special importance from an ecotoxicological point of view, both because of the high toxicity of compounds containing these metals and because of their accumulation in various organisms. Inorganic forms of most heavy metals form strong bonds with proteins and other biological tissue, thus increasing bioaccumulation and inhibiting excretion. Tissues often exhibit a significant selectivity when binding to these metals. Lead, for example, tends to accumulate in bone tissue, while cadmium and mercury predominantly accumulate in the kidneys. The donor groups that are most available for in vivo binding to metal ions are amino and carboxyl groups. Binding is especially strong for many heavy metals to thiol or thiolate groups. This feature is particularly significant because –SH groups are a common component of the active sites of many important enzymes, including those involved in energy output and oxygen transport. Information on their content in plants and animals is of great botanical, nutritional and environmental interest. Some of the heavy and transition metals are toxic when their concentrations exceed certain values. As a result, the need to develop methods of precise determination of transition metals in fluids has grown.

The ion chromatography method was developed to simultaneously analyze the transition metals Cu, Ni, Zn, Co, Mn, and Fe with low detection limits, at low cost and with easy handling. The possibility of using small sample volumes was also desired. Ion chromatography allows the determination of oxidation state speciation (i.e., Fe^{2+} and Fe^{3+}) and thus is a useful tool for bioavailability studies of toxic metals in the environment. Transition metals are traditionally analyzed by cation-exchange or ion-pair chromatography. Transition metals are separated as both cationic and anionic complexes using a mixed bed ion-exchange column (a bifunctional quaternary ammonium-sulfonate ion exchanger) and carboxylic acid chelating agent (oxalic acid and pyridine-2,6-dicarboxylic acid (PDCA)) as eluent. Hydrated and weakly complexed metals are separated as cations on cation exchange sites, while the metals that form strong anionic complexes are separated then by anionic exchange. In some cases, divalent metal ions are separated on sulfonic acid cation stationary phase using various eluents along with conductivity detection. An alternative method is reversed-phase ion-pair chromatography coupled with conductivity detection. This method of detection is not very sensitive for transition metals. For better separation

sensitivity, UV-Vis detection along with pre- or post-column derivatization with an absorbing ligand is the most common method applied[1].

The **Transition Metal Analyser** from **ISS** is ideal for the common accepted method in determination of transition metals (EPA/600/4-90/025) in water.

Results:

A representative chromatogram of a solution containing Cobalt, Copper, Iron, Nickel and Zinc at a concentration of 80 µg/L and Cadmium at 250 µg/L is shown in Fig. 1.

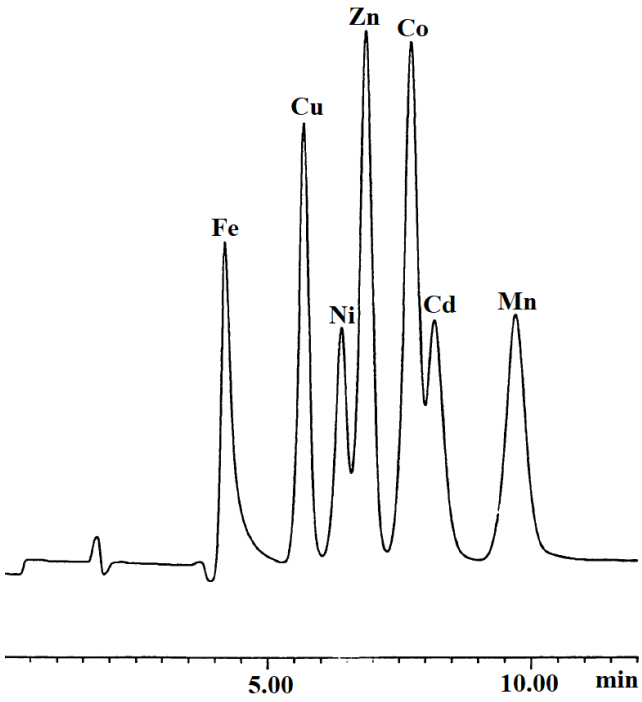

Fig. 1. Chromatogram of a solution containing some transition metals

[1] J. Chromatography A, 671, 1994, 43-49; J. Chromatography A, 857, 1999, 343-349; J. Agric. Food Chem. 2002, 50, 1, 59–65;