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Chromium (VI) speciation through the environment

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Chromium in the environment exists as several chemical species, where oxidation states 0, +3 and +6 are the most common. The characteristics and properties of trivalent and hexavalent chromium is greatly different and chromium's speciation is strongly dependent on the chemical and physical environment. Once chromium enters the environment, its toxicity is to a large extent determined by its chemical from; Cr(VI) is toxic and carcinogenic whereas Cr(III) is considered an essential nutrient, making speciation analysis very important.

Speciation analysis requires a multi-step approach, typically including sample pre-treatment, separation and /or extraction and finally instrumental determination. It is of great importance to choose a technique that maintains the chemical speciation of the sample. Methods for chromium speciation have existed for years, however many of them are complicated and time-consuming in addition to having unsatisfactory detection limits (Kotas and Stasicka, 2000).

In this study, we make use of a simple and in-expensive ion-exchanger as means of separation of Cr(VI); where Cr(III), present as a cation, is retained on the ion-exchanger whereas Cr(VI), present as an anion, is passed to the effluent (USGS 2003). This method was developed as a simple field method for Cr(VI) speciation in natural waters. However, we have found the method suitable for Cr(VI) speciation in a wide range of environmental samples, such as precipitation, soil, sediments, sludge, biological tissue and air samples. Ion-exchange is followed by determination with HR-ICP-MS, which enables a detection limit for Cr(VI) in precipitation and natural waters of 6 ng/l. Here we present results from a large scale screening survey on Cr(VI) speciation in a wide range of environmental compartments in Sweden during spring 2007.

References:

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