

The determination of hexavalent chromium in industrial and environmental samples

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Industrial chromium compounds are widely used in various industrial domains including metallurgy, electronic, chromium plating, dyes and pigments manufacturing, leather and cement. As a consequence, this element is present in several manufactured products and can be released in the environment. Thus, the determination of the different forms of chromium in both industrial and environmental samples is very important as Cr(III) is considered as essential while Cr(VI) is known as a carcinogenic agent.

In order to limit the presence of chromium(VI) in the environment and protect workers of industries using chromium, the European Union sets-up several directives involving the determination of Cr(VI). For example, this compound has to be analysed in samples from car industry (directive 2000/53/EC) or in samples from waste electrical and electronic equipment (directive 2002/96/EC). Furthermore the problem of hexavalent chromium analysis is also present in industrial hygiene, particularly for the determination of Cr(VI) in workplace atmosphere. Despite the implementation of regulation concerning hexavalent chromium, only a few standardised analytical procedure are available and most of the time, there are relative to colorimetric based methods which are not applicable to such samples.

This presentation will describe the analytical tools we have developed for Cr(VI) extraction, detection and quantification for samples from industry (e.g. dust on filter, cements, corrosion preventing coatings) and environment (e.g. water, soil). Among the different analytical methods allowing Cr speciation, HPLC-ICP-MS is the technique of choice for the analysis of such samples and can be used in association with quantification by isotopic dilution for an accurate determination of Cr(VI). However, for solid samples, it is necessary to develop extraction methods for Cr(VI) without reduction into Cr(III). If alkaline extraction generally allows to obtain good results in most samples, it was shown that for corrosion preventing coatings composed with a deposit of Cr(VI) or Cr(III) on a zinc alkaline layer, such a procedure caused reduction of Cr(VI) and only water allows extraction without degradation. When possible, results obtained by HPLC-ICP-MS after wet extraction were compared to solid speciation techniques such as XPS and XANES. For most coatings, a very good agreement was obtained between the different techniques.