

QUANTIFICATION OF TOTAL CHROMIUM AND HEXAVALENT CHROMIUM IN WATER BY ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY

B.S. JAYASINGHE¹, M.I.F.P. JAYAWARDENE¹ and K.A.S.PATHIRATNE²

¹Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka, ²Department of Chemistry, University of Kelaniya, e-mail: sumith@sjp.ac.lk

EXTENDED ABSTRACT

Procedures for the quantification of total chromium and hexavalent chromium in water samples are presented. For the quantification of total chromium and hexavalent chromium in water Chromabond NH₂ columns (aminopropyl phase with a 3 ml volume and 500 mg of sorbent) obtained from Machery- Nagel (Duren, Germany) were used.

The pH value of the water sample was adjusted to 5.5 using acetic acid or sodium acetate and sample was aspirated through the previously conditioned column. The column contents were dried under vacuum and the hexavalent chromium selectively linked was eluted with nitric acid and quantification was performed by electrothermal atomic absorption spectrometry (ETAAS). For the detection of total chromium, Cr(III) was transformed into Cr(VI) by oxidizing the sample with 1% K₂S₂O₈ solution and AgNO₃ at 100°C for 15 min. Oxidized solution was eluted through a Chromabond column and total Cr level was quantified by ETAAS using the same instrumental conditions used for the quantification of hexavalent chromium. Total chromium was also quantified directly in the water samples using ETAAS.

The detection limits were 0.4 µg/l and 0.5 µg/l for total chromium and hexavalent chromium respectively. The linear dynamic ranges under the optimized conditions were 0.4–50 µg/l and 0.5–50 µg/l and the relative standard deviations were less than 3.5%. The validation of both procedures was performed by the standard addition method and the recoveries higher than 96% were found in all the cases and it was found that chemical modifiers had no effect. It is proved that the method can be successfully employed as an alternative to the commonly used preconcentration and speciation analytical techniques. The direct procedure was adopted for the estimation of total chromium in water samples, because both procedures applied for total chromium gave similar results. The methods were applied to the determination of total chromium and hexavalent chromium in 40 drinking water samples.

Key words: chromium speciation, chromium(III) oxidation, solid-phase extraction, electrothermal atomic absorption spectrometry,