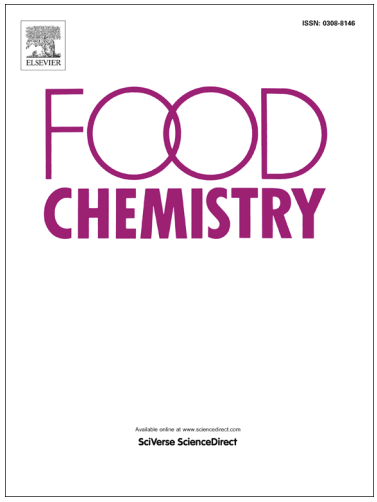

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Chromium speciation in foodstuffs: a review

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Keywords

Chromium, speciation, foodstuffs, review, hexavalent

Highlights

- **A comprehensive review of chromium speciation in foodstuffs is presented in this article**
- **Cr(VI) concentrations from off-line extraction and analytical techniques should be questioned**
- **Isotope dilution techniques can monitor species interconversions during extraction**
- **New speciation techniques should also focus on the measurement of Cr(III)**

Abstract

Numerous critical reviews have evaluated exposure to toxic and carcinogenic hexavalent chromium (Cr(VI)) from a number of pathways; including workplace air, cement and packaging materials. The contribution of foodstuffs to dietary Cr(VI) has been increasingly under investigation, however no summary of this work has been carried out. The objective of this article is to review the last twenty years of chromium speciation research in foodstuffs. Alkaline extraction, used for chromium speciation in other solids, is the most widely-reported procedure. Previous measurement of Cr(VI) in foodstuffs is questionable due to the reducing power of organic matter and antioxidants, leading to the development of speciated isotope dilution mass spectrometry (SIDMS) techniques to monitor interconversions. Evaluation of the genotoxicity of trivalent chromium (Cr(III)), which acts through a different pathway to that of Cr(VI), requires reconsideration towards measurement of Cr(III), which is present at higher concentrations in foodstuffs following reduction of the more-bioavailable Cr(VI).

1.0 Introduction

1.1 Background

Chromium (Cr) is a transition metal that exists in the environment as Cr(III) (trivalent) and Cr(VI) (hexavalent) forms. These naturally occurring oxidation states differ significantly in their mobility, bioavailability and toxicity (Oliveira, 2012). Trivalent Cr is present as cationic species and is considered to be essential for insulin regulation and glucose metabolism (Office of Dietary Supplements: National Institute of Health, 2013), whereas Cr(VI), which is largely anthropogenic in origin and exists as anionic species, is toxic and a known carcinogen through inhalation (McCarroll, Keshava, Chen, Akerman, Kligerman, & Rinde, 2010). The EH40/2005 Workplace Exposure Limit (WEP) assigned for Cr(VI) is 0.05 milligrams per cubic metre of air averaged over an 8-hour period (Health and Safety Executive, 2013). However, there is evidence of genotoxicity of Cr(III) compounds