DETERMINATION OF TOXIC ARSENIC SPECIES AND ARSENOSUGARS IN EDIBLE SEAWEED BY HPLC-(UV)-HG-AFS

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Arsenic is a toxic element widely distributed in the environment, and the estimation of its toxicity requires knowledge of the individual arsenic species present in biological materials. Marine algae contribute substantial amounts of arsenic to the human diet in Asian countries, and nowadays their popularity in western countries is increasing due to their high mineral content and their recognized therapeutic properties[1]. It is known that marine organisms can accumulate considerable arsenic concentrations, up to $\mu g\ g^{-1}$ level, which may be harmful to human beings. In seaweed, the main arsenic species are usually arsenoribosides (arsenosugars), which are considered to be non-toxic to living organisms and can be present at trace levels, so analysis techniques of high sensitivity are needed to carry out their determination[2,3].

In the present work, an analytical procedure was developed for the determination of toxic and non-toxic (arseobetaine and arsenosugars) arsenic species in edible seaweed. This procedure was applied to 13 marine algae samples from different countries (Spain, France and Japan), as well as to the certified reference material NIES No. 9 (Sargasso). Arsenic species were extracted by microwave-assisted extraction with deionised water[4]. The method allowed us to achieve an arsenic extracted recovery between 49 and 93%, depending on the kind of alga analysed.

An analytical method based on the hyphenated technique HPLC-(UV)-HG-AFS was optimised for the determination of arsenic species. The separation was performed on a Hamilton PRP-X100 anion exchange column, with phosphate buffer at pH 9.0 as mobile phase and using a concentration gradient from 5 to 100 mmol L^{-1}. The chromatographic system was coupled to the atomic fluorescence spectrometer via hydride generation, with 1.4% (w/v) $NaBH_4$ and 8.0 M HCl, with a previous photo-oxidation step, which employs a UV lamp and a solution of potassium peroxodisulfate (2% (w/v) $K_2S_2O_8$ / 2% (w/v) NaOH). The developed method led us to the separation of four arsenosugars, AsB, As(III), DMA, MMA and As(V) in less than 17 minutes, with limits of detection between 35 and 65 pg of As (100 µL sample injection volume). This method allowed us to identify and quantify different arsenic species, depending on the origin and nature of the marine algae samples studied. Thus, As(III) and MMA were not detected in none of the samples analysed, and DMA and As(V) were the only toxic species determined. Regarding non-toxic arsenic species, AsB was not detected, while glycerol and phosphate-ribose was determined in all the samples studied, and sulfonate and sulfate-ribose was only determined in five of the samples analysed.

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