

Does the edible seaweed Hijiki deal with its arsenic burden via complexation with phytochelatins?

B. Alan Wood¹, Toshikazu Kaise², Shinichi Miyashita², Andrea Raab¹, Jörg Feldmann¹

¹ Department of Chemistry, University of Aberdeen, Meston Walk, Aberdeen, AB24 3UE, United Kingdom, b.a.wood@abdn.ac.uk

² School of Life Sciences, Tokyo University of Pharmacy and Life Sciences, Horinouchi 1432-1, Hachioji, Tokyo 192-0392, Japan

Edible species of seaweed, such as *Arame*, *Kombu* and *Hijiki*, are considered delicacies in Japan and Asia, and are gaining in popularity within the western world. Seaweeds have long been established as aquatic hyperaccumulators of the highly toxic metalloid arsenic. To deal with this burden, biotransformation of arsenic to organic species such as arsenosugars occurs, resulting in a drastically lower toxicity. However, one major exception to this is *Hijiki*, which stores arsenic mainly as the highly toxic inorganic species arsenate (As(V), [AsO₄]³⁻) and arsenite (As(III), [As(OH)₃]). Consequently, Food Standards Agencies in countries including Canada and the United Kingdom have advised against the consumption of *Hijiki*.

Phytochelatins (PCs), peptides of generic structure [γ-Glu-Cys]₂₋₄-Gly, are synthesised by higher plants to bind toxic metal(loid)s such as cadmium, mercury and arsenic during cellular influx. This results in the formation of complexes such as Cd-PC, Hg-PC and As-PC, which reduces the toxicity relative to the free metal(loid). Recently, we have observed that species of brown and red algae are able to synthesise PCs. Interestingly, only one particular peptide, [γ-Glu-Cys]₂-Gly, (PC₂) has so far been found during our investigations.

Here, for the first time, we perform a dual chromatographic approach to determine whether As-PC complexes form *in vivo*. 1 % formic acid extraction of seaweed samples, a technique used for the analysis of As-PC complexes in terrestrial plants, was performed on fresh and As-exposed samples of *Hijiki* and *Fucus spiralis*. Speciation analysis via C₁₈ RP-HPLC-ICP-MS/ESI-MS, shows that As-PC complexes do not form *in vivo* for seaweeds. This data is combined with the more traditional arsenosugar analysis, via AEC-HPLC-ICP-MS/ESI-MS which looks at the fate of arsenic during short-term high-concentration As-exposure.