Production and properties of protein extracts from red, green and brown seaweeds (P. umbilicalis, U. lactuca and S. latissima)

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There is an increased demand for vegetable proteins and some seaweed species constitute interesting protein raw materials. However, the though polysaccharide-rich cell walls and abundance of polyphenols reduce the digestibility of the seaweed proteins. Therefore, food grade, scalable and environmentally friendly techniques for extracting the proteins from the seaweed matrix are desirable.

The main aim of this study, which is part of the Swedish Seafarm and Sweaweed projects, was to evaluate the efficiency of three different protein extraction methods; (i) solubilization in water and subsequent precipitation with ammonium sulfate, (ii) alkaline protein solubilization followed by isoelectric precipitation (pH-shift method) and (iii) a bio-refinery approach, were the proteins are extracted with methanol after pre-removal of lipids and phlorotannins, when applied on Porphyra umbilicalis, Ulva lactuca and Saccharina latissima. Highest protein yield was achieved by the pH-shift method for Porphyra (23%) and Saccharina (25%) and for the traditional method for Ulva (20%). However, the pH-shift method gave highest protein concentrations for all three species (71%, 51% and 41% for Porphyra, Ulva and Saccharina, respectively).

It was also investigated how the season of harvest and different pretreatments of the Saccharina biomass (drying, ensilaging and freezing) affected the yield in the pH-shift process. Early harvest (March) resulted in higher yield compared to later harvest (April and May) and freeze dried biomass showed to give the highest yield; sun drying and ensilaging affected yields most negatively.

Altogether, the pH-shift process was proven to be a powerful fractionation process that results in highly concentrated protein extracts, in which also valuable LC n-3 PUFA were enriched giving an added value.