Quantification and characterisation of nitrogenous components of three native Irish seaweeds

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Keywords: Biology & Life Sciences

Abstract

Quantification of total nitrogen, protein nitrogen and non-protein nitrogen as a function of season and geographical location is currently underway for the native Irish macroalgal species, Palmaria palmata, Chondrus crispus *and* Porphyra dioica. *Samples are gathered bimestrially from sites in Spiddal, Carraroe and Finvarra. Variation in the nitrogenous components was observed, for example,* P. dioica *harvested in Spiddal in July and November had a protein nitrogen content of 19.03±0.5 mg/g and 40.00±0.1 mg/g dry weight (dw) respectively. Spatial variation was observed with the same species harvested in the same period from sites in Spiddal and Finvarra with values of 19.03±0.5 and 15.57±0.3 mg/g dw respectively. Characterisation of the protein profile is currently underway using sodium dodecyl sulphate polyacrylimide gel electrophoresis (SDS-PAGE).*

1. Introduction

Macroalgae (seaweeds) have been exploited by humans for millennia both as a fertiliser and a food source. With over 500 species native to the Irish coast, seaweeds are classified into three distinct groups, Rhodophyceae (red seaweed), Phaeophyceae (brown seaweed) and Chlorophyceae (green seaweed). While many of these have been exploited for a variety of compounds including agars, carageenans and other hydrocolloids, the specific utilisation of the nitrogenous components is a relatively recent development.

The red seaweeds, in particular, have been shown to have a high protein content, up to 47% dw [1], and for this reason are under investigation herein. While the protein content has been traditionally estimated with a Kjeldahl conversion factor of 6.25, this has been shown in many cases to overestimate the actual protein content. It is evident that few studies have been undertaken to date to characterise the proteins and to identify a more accurate approach for protein quantification. Furthermore, due to the complexity of the carbohydrate structures from one species to another and their interactions with the nitrogenous components, a limited number of species specific protocols for protein extraction have been developed to date.

2. Materials & Methods

Macroalgal samples were supplied by Dr. Dagmar Stengel's laboratory, National University of Ireland, Galway. Total nitrogen (TN) and protein nitrogen (PN) were determined in freeze-dried and milled (0.4 mm mesh) samples using the Kjeldahl method [2].

Total protein was extracted using a modification of the method of Wang *et al* [3] and then analysed by SDS-PAGE.

All experiments were carried out in triplicate (n=3).

3. Results & Discussion

P. dioica TN values ranged from 24.83±0.5 mg/g dw in July to 48.80±0.1 mg/g dw in December, with PN levels of 19.03±0.5 and 40.00±0.1 mg/g dw, respectively. *C. crispus* displayed similar variation, e.g., the July and December samples had TN values of 19.47±0.1 and 31.38±0.2 mg/g dw, respectively. Furthermore, November samples from Finvarra and Carraroe had TN values of 38.41±0.2 and 24.21±0.1 mg/g dw, respectively. These seasonal and spatial variations have been linked to diversity in conditions such as salinity, shore position, wavelength of light absorbed, desiccation and nutrient availability.

Preliminary SDS-PAGE analyses of the total macroalgal protein show distinct protein bands, the intensity of which vary with season and location.

4. Conclusion

Variation in the nitrogenous content and protein profile as a function of season and spatial location of the three macroalgae studied has been observed.

5. Future studies

These studies will involve continued assessment of TN and PN variation as a function of season and location. Furthermore, highly variable protein components will be identified using mass spectrometry following excision from PAGE gels.

6. References

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