POPULAR SCIENTIFIC ABSTRACT

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Extraction, Structural Determination and Bioactivity assessment of Fucoidan from Brown Algae

Brown macroalgae, also called brown seaweeds, contain several unique complex carbohydrates which help them survive in the harsh environment at Sea. Some of these carbohydrates, i.e. the alginates, have seen applications mostly related to tissue engineering (as wound dressings) and in the food industry (as thickening agents). While they are less used in commercial applications, the sulfated seaweed carbohydrates from brown algae, fucoidans, have shown several health promoting biological effects in humans. These biological effects show great promise in several applications, such as medicine, food, cosmetics and nutraceuticals. However, their use, especially in modern medicine, is impeded by their heterogeneity. Fucoidans comprise a group of structurally diverse carbohydrates, with varying biological effects. So far, the influence of the carbohydrate structure on the biological effect is not fully understood, which complicates their use as medicine. Furthermore, as fucoidans are extracted from seaweeds, their chemical compositions are affected by natural seasonal fluctuations, which affect the seaweed itself. Due to these fluctuations, production of fucoidans for medical use requires careful optimization and planning of the seaweed raw material, including when and where they should be harvested.

This PhD study focused on several aspects of fucoidan production, namely the extraction of fucoidans, their characterization using rapid and non-destructive analysis tools, and finally, which parameters influence the biological effects of fucoidans to be used in cosmetics and in medicine. While the exact mechanisms for several biological effects are still to be discovered, it is generally understood that the degree of sulfation and the molecular weight of the fucoidan influences the biological effects.

From the results obtained during this work, it was seen that production of fucoidan extracts is very complex, with several parameters affecting the yield and the biological effect. Species and harvest time were found to contribute significantly to the biological properties of fucoidans. Furthermore, it was found that the harvest time for optimal sulfation and fucoidan yield differ among brown algae species. This finding may enable fucoidan producers to alternate between algae species for continuous production of fucoidan. Lastly, the spectroscopic methods, Raman and Fourier Transform Infrared spectroscopy, proved to be efficient in providing a rapid, characterization of the fucoidan structure and the fucoidan purity.