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Seaweed: A promising natural source of multifunctional molecule for therapeutic applications

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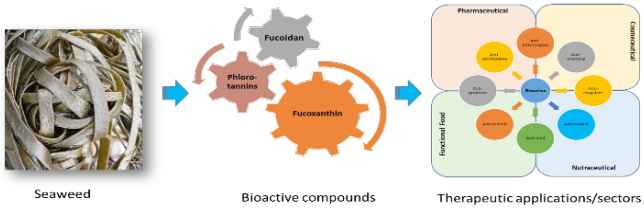

Figure 1: Biological properties and industrial applications of seaweed bioactives

Seaweed or macroalgae are gaining reputation as untapped potential sustainable source of bioactive compounds. They harbor some highly valuable compounds such as phlorotannins, Fucoxanthin, carrageenan, ulvan and fucoidan which are exclusive seaweeds. These bioactive have shown multiple health beneficial properties including anti-inflammatory, anti-microbial, anti-proliferative, anti-tumor, anti-viral and anti-oxidant activities in both *in vitro* and *in vivo* systems. However, for successful analysis of these bioactives an integrated approach for characterization is required. This study explored step-by-step characterization (extraction, screening, purification and structure elucidation) of some exclusive bioactive phlorotannins and fucoxanthin together with their potential antioxidant activity from *Himanthalia elongata* seaweed. Phlorotannins (polyphenol) were extracted with aqueous methanol and the crude extract was purified with liquid-liquid partition followed by column chromatography and solid phase extraction. Fucoxanthin (lipid) was extracted with low polarity solvents (n-hexane, diethyl ether and chloroform) and the crude extract was purified with preparative thin layer chromatography. The quantification of both purified compounds was carried out by Reverse Phase-High Performance Liquid Chromatography (RP-HPLC) coupled to a Diode Array Detector (DAD), while their identification was performed by LCDAD-ESI-MS/MS. Quantitative analysis revealed the recovery of 394.1±4.33 µg/g phloroglucinol and 434.1±2.13 µg/g fucoxanthin. The fragmentation pattern confirmed that the purified fractions contained phlorotannins (m/z 125 $[M-H-CO]^-$) and fucoxanthin (m/z 641 [M+H-H2O]+) as the major compounds respectively. Antioxidant activity results revealed that phlorotannins exhibited significantly ($p<0.05$) higher 2, 2-Diphenyl-1- picrylhydrazyl scavenging capacity (EC50; 14.5±0.57 mg/g) than the ascorbic acid (EC50; 35.8±0.59 mg/g) while fucoxanthin showed statistically similar ($p>0.05$) 2, 2-Diphenyl-1- picrylhydrazyl scavenging capacity (EC50: 12.9±1.04 µg/mL) as the commercial fucoxanthin (EC50:13.4±1.08 µg/mL). The promising results of phlorotannin and fucoxanthin purity, recovery and antioxidant activity can constitute a new move in the understanding of the health benefits of seaweed and can be considered as substantial alternate for functional ingredients in food and medicinal preparations.

Recent Publications

1. Duffy S K, O'Doherty J V, Rajauria G, Clarke L C, Hayes A, O'Grady M N, Kerry J P, Jakobsen J, Cashman K D and Kelly A K (2018) Vitamin D-biofortified beef: A comparison of cholecalciferol with synthetic versus UVB-mushroom derived ergosterol as feed source. *Food Chemistry*; 256: 18-24.

2. Ganesan A R, Shanmugam M, Seedevi P and Rajauria G (2018) Development of edible film from *Acanthophora spicifera:* Structural, rheological and functional properties. *Food Bioscience*; 48; 121-128.

Biography

Gaurav Rajauria is a Natural Product Chemist at University College Dublin (UCD), Ireland. His primary research interest aims at mining and characterizing functional ingredients from underutilized marine resources and food waste-streams. One of his research interests relates to the investigation of greener extraction techniques for bioactives from natural sources. His research also focuses on improving quality of meat, milk, eggs and other farm animal products by formulating animal diets with functional ingredients. He has edited books in food science and his patented technology has garnered attention nationally (Irish Research Council) and internationally (MIT, USA). His research is published in various books and peer-reviewed journals and he has presented at many national and international conferences. He is a Member of Royal Society of Chemistry, UK and Phytochemical Society of Europe.

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