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COMMENTARY ARTICLE

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The Role and Analysis Antioxidant Activity and Phenolic Compounds in Brown Seaweed

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Description

Brown seaweed, also known as *Phaeophyceae*, is a type of seaweed characterized by its brownish color, which comes from the pigment fucoxanthin. Among these sources, brown seaweed stands out for its remarkable antioxidant properties, owing to its abundance of phenolic compounds. Phenolic compounds are renowned for their potent antioxidant activity, which plays a pivotal role in combating oxidative stress and its associated health implications. In recent years, researchers have delved into the antioxidant potential of brown seaweed, comparing it with conventional antioxidant assessment techniques to unravel its true potential. Phlorotannins, a unique class of phenolic compounds found exclusively in brown seaweed, are particularly noteworthy for their potent antioxidant activity

Antioxidant activity of brown seaweed

Brown seaweeds, such as species from the genera *Fucus*, *Laminaria*, and *Ascophyllum*, are recognized for their diverse bioactive compounds, including phenolic compounds. These compounds possess antioxidant properties due to their ability to scavenge free radicals and mitigate oxidative damage within the body. Studies have demonstrated that brown seaweed extracts exhibit significant antioxidant activity, attributed primarily to the presence of phenolic compounds such as phlorotannins, flavonoids, and phenolic acids.

Comparison with conventional techniques: Traditionally, the assessment of antioxidant activity has relied on conventional techniques such as the 2, 2-Diphenyl-1-Picrylhydrazyl (DPPH) radical scavenging assay, Ferric Reducing Antioxidant Power (FRAP) assay, and Oxygen Radical Absorbance Capacity (ORAC) Assay. However, these methods may not accurately reflect the complex antioxidant profile of brown seaweed extracts. As such, researchers have explored alternative approaches, including advanced spectroscopic and chromatographic techniques, to comprehensively evaluate the antioxidant potential of brown seaweed.

One such technique is High-Performance Liquid Chromatography (HPLC), coupled with various detectors such as Ultraviolet (UV), Diode Array (DAD), and Mass Spectrometry (MS). HPLC analysis allows for the identification and quantification of individual phenolic compounds present in brown seaweed extracts, providing valuable insights into their antioxidant capacity. Additionally, techniques such as Nuclear Magnetic Resonance (NMR) spectroscopy enable the structural elucidation of phenolic compounds, elucidating their mechanisms of action in scavenging free radicals.

Moreover, advanced assays like the Cellular Antioxidant Activity (CAA) assay offer a more physiologically relevant approach by evaluating antioxidant activity within cellular systems. This approach considers the bioavailability and bioactivity of phenolic compounds, providing a more comprehensive assessment of their efficacy in combating oxidative stress-related pathologies.

Implications and future directions: The comparison of brown seaweed extracts with conventional antioxidant techniques underscores the importance of employing comprehensive methodologies to evaluate their antioxidant activity accurately. By leveraging advanced spectroscopic, chromatographic, and cellular assays, researchers can elucidate the intricate antioxidant profile of brown seaweed and unlock its therapeutic potential in preventing oxidative stress-related diseases. Use spectrophotometric methods such as the Folin-Ciocalteu assay to determine the total phenolic content in the seaweed extract. This assay

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measures the reducing capacity of phenolic compounds by reacting them with the Folin-Ciocalteu reagent, producing a blue-colored complex that can be quantified spectrophotometrically.

Furthermore, the identification of specific phenolic compounds responsible for the antioxidant activity of brown seaweed paves the way for targeted extraction and formulation strategies to enhance their bioavailability and efficacy. Incorporating brown seaweed-derived phenolic compounds into functional foods, dietary supplements, and pharmaceutical formulations holds promise for mitigating oxidative stress and improving overall health outcomes.

Brown seaweed emerges as a promising natural source of antioxidants, enriched with phenolic compounds that exhibit potent free radical scavenging activity. Comparative analysis with conventional antioxidant techniques highlights the need for advanced methodologies to comprehensively evaluate the antioxidant potential of brown seaweed extracts. Moving forward, further research into the identification, characterization, and utilization of phenolic compounds from brown seaweed holds immense potential for the development of novel antioxidant interventions to combat oxidative stress-related ailments.