Bioactive Polysaccharides from Brown Algae of Djibouti: Structural Characterization and Evaluation of Antioxidant and Cosmetic Potentials

Moustapha Nour*[1,2], Sylvain Petek[1], Abdourahman Daher[2], Stephane Cerantola[3], Nathalie Cosquer[4], Eric Deslandes[1], and Valérie Stiger-Pouvreau[1]

[1]Univ Brest, IRD, CNRS, Ifremer, LEMAR, IUEM, F-29280 Plouzane, France – Université de Bretagne Occidentale [UBO] – France

[2]Centre d'Etudes et des Recherches de Djibouti (CERD) – Djibouti

[3]Univ Brest, Plateforme Résonance Magnétique Nucléaire-Résonance Paramagnétique Electronique (RMN-RPE), F-29238 Brest, France – Université de Bretagne Occidentale [UBO] – France

[4]Univ Brest, CNRS, CEMCA, 6 Avenue Le Gorgeu, CS 93837–29238 Brest CEDEX 3, France – Université de Bretagne Occidentale [UBO] – France

Résumé

Brown algae are a valuable source of bioactive polysaccharides, particularly alginates and fucoidans, with promising applications in cosmetics and pharmaceuticals. In this study, polysaccharides were extracted from four brown macroalgae, *Padina pavonica*, *Sargassum ilicifolium*, *S. latifolium*, and *Turbinaria decurrens*, collected along the coast of Djibouti. The properties characterization of the extracts was performed using FT-IR and ^{1}H-NMR spectroscopy. The M/G ratio of alginates revealed species-specific variability, with the highest ratio recorded for *P. pavonica* and the lowest for *T. decurrens*. FT-IR spectra showed a slightly higher intensity of the band around 1025 cm^1 (M blocks) compared to 1082 cm^1 (G blocks), indicating a mannuronic acid-rich composition. A strong band around 1600 cm^1 was also observed, and *T. decurrens* showed the highest degree of sulfation (83.34% transmittance). The biological activities of the fucoidan-rich extracts were evaluated through DPPH radical scavenging and FRAP antioxidant assays, as well as tyrosinase and elastase inhibition tests. Significant antioxidant activities were observed across all species. *P. pavonica* showed the highest elastase inhibition (63.19%), followed by *S. ilicifolium* and *T. decurrens* (60%), and *S. latifolium* (52%). In the tyrosinase assay, *S. ilicifolium* (62%) and *P. pavonica* (57%) demonstrated notable inhibition at 0.5 mg/mL. These results highlight the multifunctional potential of brown algal polysaccharides and their relevance for marine-based cosmetic applications. The observed structure–activity relationships emphasize the impact of subtle structural differences on biological efficacy, supporting further exploration of marine algae in sustainable biotechnology.

Mots-Clés: Brown algae, Polysaccharides, Antioxidant activity, Cosmetic applications, Structural characterization

*Intervenant