IBSC 2026

10th Joint International PSU-UNS Bioscience Conference

28-29 September 2026, Novi Sad, Serbia

Book of Abstracts

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Organised by:
Prince of Songkla University, Thailand
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University of Novi Sad,
Faculty of Sciences, Serbia

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Impact of Cascading Biorefinery Processing on the Nutritional, Mineral and Antioxidant Properties of *Alaria esculenta* Residues

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Brown seaweeds represent promising feedstocks for sustainable biorefinery applications. A cascading biorefinery approach was applied to *Alaria esculenta* for the sequential recovery of mannitol, laminarin, and alginate, while simultaneously evaluating the impact of different extraction intensification technologies on the nutritional, mineral, and antioxidant properties of the resulting residual biomass. Conventional acid and alkaline extraction was combined with ultrasound probe and bath treatment, enzymatic treatment, microwave-assisted extraction, high-pressure processing (HPP), pulsed electric field (PEF), and hydrodynamic cavitation as alternative treatments. The raw biomass exhibited a nutritionally valuable composition characterized by a favorable ω-3-rich fatty acid profile, including high eicosapentaenoic acid (EPA) content (9.26% of total fatty acids), high mineral levels, and a low Na/K ratio (0.36), indicating potential for functional food applications. Sequential extraction promoted substantial removal of carbohydrates, resulting in relative enrichment of proteins (from 5.35% in the starting biomass to 21.7% in the residue after ultrasound probe) and polyphenolic compounds in the residual biomass (from 8.06 mg GAE/g DW in the starting biomass to 11.88 mg GAE/g DW in the residue after ultrasound probe). However, the treatments also induced pronounced mineral redistribution, particularly increased sodium accumulation and unfavorable Na/K ratios, which generally exceeded 4 in intensively treated samples. Distinct differences in heavy metal partitioning were observed among the investigated extraction technologies. Lead remained predominantly associated with the residual biomass, whereas cadmium was partially removed during extraction, suggesting different binding affinities within the seaweed matrix. Hydrodynamic cavitation showed the highest retention of Pb and Cd, their content increased 15.6 and 1.52 times in the residue after hydrodynamic cavitation, respectively. The fucoxanthin content detected in the raw material (1.160 ± 0.272 μg/g DW) was substantially lower than values reported in the literature, likely due to the post-harvest degradation and processing effects. Nevertheless, antioxidant activity remained significant and was positively correlated with total phenolic content ($r = 0.626$, $p < 0.05$).

Keywords: *Alaria esculenta*, Biorefinery, Extraction technology, Mineral composition, antioxidant activity

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