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Coastal Circular Bioeconomy Models: Valorization of Algal Biomass for Democratic and Responsible Bio-innovation

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Ecological transition requires innovation models that integrate environmental sustainability, social ethics, and economic feasibility. This study proposes a circular economy model based on the valorization of algal biomass, including invasive species, transforming organic waste into high-value resources through biorefinery processes. Aqueous and alcoholic extracts from *Ulva ohnoi* and *Asparagopsis taxiformis* were analyzed for the development of agricultural biostimulants and eco-compatible antifouling coatings. Experimental results indicate that priming *Lactuca sativa* and *Spinacia oleracea* seeds with Liquid Seaweed Fertilizers (LSF) at the optimal concentration of 2 mL L^{-1} increases the germination rate by 20% and seedling dry biomass by up to 35% compared to the control. Simultaneously, the application of extracts on marine substrates demonstrated a substantial reduction in biofouling colonization, offering viable alternatives to toxic synthetic biocides. The adopted transdisciplinary approach goes beyond technical assessment, highlighting how the local management of algal resources can support "democratic bio-innovation". This model promotes the technological sovereignty of coastal communities, reduces the carbon footprint, and fosters inclusive governance in line with the European sustainability goals promoted by the FORTHEM Alliance.

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