Seaweed: A Sustainable Solution for Agriculture and Environmental Cleanup

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Abstract

The underutilized biomass of macroalgae, found in both marine and freshwater environments, is a valuable feedstock for the production of value-added products in many regions around the world. The unique chemical composition of this biomass, characterized by a high content of micro- and macroelements, polysaccharides, vitamins, antioxidants, and amino acids, makes it suitable for use in many branches of the economy (Figure 1). One of the most popular applications of algal biomass is agriculture. Algal extracts obtained using novel extraction techniques, such as supercritical fluid extraction, ultrasound- or enzyme-assisted extraction can be used as plant growth biostimulants. These extracts can also be used for the biosynthesis of metal/metal oxide nanoparticles, which are becoming increasingly popular in various areas of the economy, including agriculture. The process of pyrolysis of algal biomass enables production of biochar, which can be applied as an additive to the soil, improving its physico-chemical properties, as well as plant growth and yield. The unique properties of biochar mean that it can be used in environmental management – for the remediation of contaminated soil (pollution immobilizing agent) and wastewater (biosorbent of pollutants). The very good sorption properties of biochar play a key role in these processes. Biosorption process can also be used to produce algae-based feed or fertilizer additives with microelements. The presented technological processes make it possible to obtain products with added value from waste algae biomass, consistent with the assumptions of a sustainable and circular bio-based economy.

Keywords: seaweed, extraction, seaweed extracts, biostimulant of plant growth, nanoparticles, biochar, biosorption, heavy metal removal

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