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Study of Secondary Metabolites of Sargassum Algae: Anticorrosive and Antibacterial Activities

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Abstract : For several years, the Caribbean islands and West Africa have had to deal with the massive arrival of the brown seaweed Sargassum. Overall, this macroalgae, which constitutes a habitat for a great diversity of marine organisms, is also an additional stress factor for the marine environment (e.g., coral reefs). In addition, the accumulation followed by the significant decomposition of the Sargassum spp. biomass on the coast leads to the release of toxic gases (H_2S and NH_3), which calls into question the functioning of the economic, health and tourist life of the island and the other interested territories. Originally, these algae are formed by the eutrophication of the oceans accentuated by global warming. Unfortunately, scientists predict a significant recurrence of these Sargassum strandings for years to come. It is therefore more than necessary to find solutions by putting in place a sustainable management plan for this phenomenon. Martinique, a small island in the Caribbean arc, is one of the many areas impacted by Sargassum seaweed strandings. Since 2011, there has been a constant increase in the degradation of the materials present in this region, largely due to toxic/corrosive gases released by the algae decomposition. In order to protect the structures and the vulnerable building materials while limiting the use of synthetic/petroleum based molecules as much as possible, research is being conducted on molecules of natural origin. Thus, thanks to the chemical composition, which comprise molecules with interesting properties, algae such as Sargassum could potentially help to solve many issues. Therefore, this study focuses on the green extraction and characterization of molecules from the species Sargassum fluitans and Sargassum natans present in Martinique. The secondary metabolites found in these extracts showed variability in yield rates due to local climatic conditions. The tests carried out shed light on the anticorrosive and antibacterial potential of the algae. These extracts can thus be described as natural inhibitors. The effect of variation in inhibitor concentrations was tested in electrochemistry using electrochemical impedance spectroscopy and polarization curves. The analysis of electrochemical results obtained by direct immersion in the extracts and self-assembled molecular layers (SAMs) for Sargassum fluitans III, Sargassum natans I and VIII species was conclusive in acid and alkaline environments. The excellent results obtained reveal an inhibitory efficacy of 88% at 50mg/L for the crude extract of Sargassum fluitans III and efficacies greater than 97% for the chemical families of Sargassum fluitans III. Similarly, microbiological tests also suggest a bactericidal character. Results for Sargassum fluitans III crude extract show a minimum inhibitory concentration (MIC) of 0.005 mg/mL on Gram-negative bacteria and a MIC greater than 0.6 mg/mL on Gram-positive bacteria. These results make it possible to consider the management of local and international issues while valuing a biomass rich in biodegradable molecules. The next step in this study will therefore be the evaluation of the toxicity of Sargassum spp..

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