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Abstract

Cyanobacteria as a Source of Eco-Friendly Bioactive Ingredients for Antifouling Marine Coatings †

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Abstract: Marine biofouling is defined as the undesirable colonization of submerged man-made surfaces by fouling organisms (microfoulers and macrofoulers) and represents a major economic nuisance for maritime industries worldwide on account of the drag friction increase on ships' hulls resulting in the over-consumption of fuel and high maintenance costs. The most commonly used strategy to prevent marine biofouling is based on antifouling (AF) paints containing bioactive compounds. However, some of the AF compounds used have been found to be toxic towards target and non-target organisms, which raises many environmental issues. Thus, the development of new eco-friendly AF agents has been a priority. Portoamides (PAs), natural cyclic dodecapeptides isolated in our group from the cyanobacterium *Phormidium* sp. LEGE 05292 from the Blue Biotechnology and Ecotoxicology Culture Collection (LEGE-CC), have shown strong potential as a more sustainable active ingredient in AF compositions. These PAs showed high effectiveness in the prevention of mussel larvae settlement (EC50 = 3.16 µM), and also bioactivity towards growth and biofilm disruption of marine biofouling bacterial strains, while not showing toxicity towards both target and non-target species. Considering the great potential of these natural products in the field of antifouling solutions, in this work, the incorporation of the PAs in commercial polyurethane and silicone (PDMS)-based marine coatings, followed by a proof-of-concept test in real sea conditions (Leixões Port), was carried out to demonstrate their industrial applicability. The in situ test showed effectiveness in the ability to prevent the colonization of fouling organisms on substrates coated with PAs-based marine coating when compared with control, and even compared with the commercial biocide Econea. These results highlight the potential of natural products as active ingredients in new more environmentally friendly marine coatings to prevent biofouling.

Keywords: antifouling; cyanobacteria; portoamides; marine coatings; eco-friendly

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