BIOPROSPECTION AND USE OF ALGAL BIOMASS AS A SOURCE OF METABOLITES OF ECONOMICAL IMPACT

Pio Colepicolo Neto

Chemistry Institute / University of São Paulo (USP)

Main researchers: Eliane Marinho Soriano, Mutue Toyota Fujji, Paulo Horta, Norberto P. Lopes, Marcia Mesko, Nair Yokaya, Ernani Pinto

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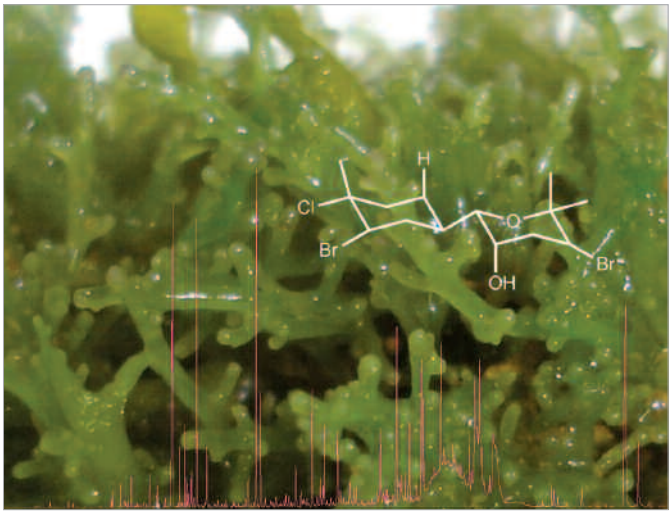


Picture of Laurencia catarinensis *and a CG/MS chromatogram of volatile compounds (photo by Erika Stein)*

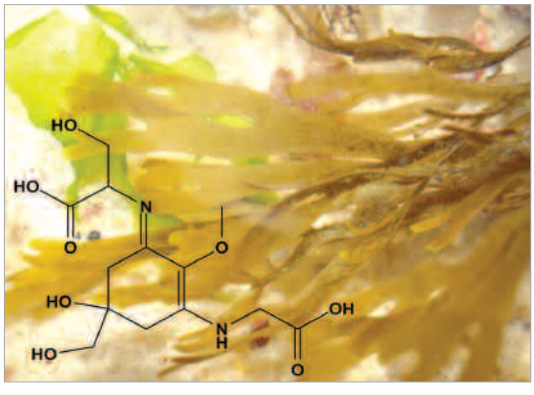
In the marine environment, algae are one of the largest groups in terms of diversity. In order to survive in the highly competitive aquatic environment, marine algae have developed defense strategies that rely on a tremendous diversity of compounds produced by several different metabolic pathways, which makes algae particularly promising as the source of novel biochemically-active compounds, in addition to essential compounds for human nutrition. Macro algae play a vital role in the maintenance of the marine equilibrium, in the preservation of the biodiversity and in the mitigation of the global warming. Due to growing of its economical importance there is an increasing need for improved techniques of the isolation of algae extracts, fractions or pure compounds, novel strategies for bioprospection and for rapid screening of extracts and bioactive fractions. In addition, the microalgae have enormous potential for the development of biotechnology and, as such, constitute an important strategic natural resource for the country. Since the expanding market for algal-based products brings enclosed the risk of natural populations over-harvesting, further improvements in the controlled cultivation, harvesting and conservation of algae will be necessary to allow the sustainable large-scale production of algae and algal-derived products avoiding further damages to marine environments. The long term goal of this project is to isolate biological active substances from macro algae of the São Paulo seacoast. Algae and algal products also have an economic impact in several other sectors, such as in the aquaculture, in the pharmaceutical, nutraceutical, biomedicine, veterinary medicine, cosmetic industries and in the public health. The biological activity includes antioxidant, antibiotic, anticancer, antifungal, anti-inflammatory and UV blocking compounds. In addition, the macro algae biodiversity will be described and its sustainable cultivation, for bioremediation use, will be tested.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

The development of new algal anti-cancer drugs represents one of the least explored frontiers in medicinal chemistry. In this regard, the diversity of macro algae can be viewed as a largely untapped natural resource. As preliminary reported, we have described a comparative study on the cytotoxic properties of extracts obtained from macro algae. Four samples initially investigated have shown significant levels of toxicity towards a model tumor cell line (human uterine sarcoma, MES-SA). The highest levels of cytotoxicity were typically associated with non-polar (hexane) algal extracts, while the lowest levels of cytotoxicity were found with the corresponding polar (methanol) extracts.

Qualitative and quantitative studies of mycosporine-like amino acids (MAAs) in three species *Gracilaria birdiae*, *G. domingensis* and *G. tenuistipitata* were performed. A simple and efficient extraction procedure based on ethanol was used. HPLC, UV and mass spectrometry experiments revealed different profiles between extracts obtained from one species cultivated in the laboratory (*G. tenuistipitata*) and two species collected in their natural environment (*G. birdiae* and *G. domingensis*). The levels detected in the latter two species were approximately 150 times higher than in the species cultivated in vitro. This study revealed that *G. birdiae* and *G. domingensis* present potential sources for economical exploration of MAAs.

The absorption efficiency and kinetic parameters (V_{max}, K_s and V_{max}:K_s) of the seaweed *Gracilaria cervicornis* for NH_4^+, NO_3- and PO_4^{3-} nutrients were evaluated. Absorption efficiency was measured by monitoring nutrient concentrations in culture media. Absorption efficiencies for this alga were greater in treatments with lower concentrations, as evidenced by a reduction of NH_4^+, NO_3- and PO_4^{3-}. Kinetic parameters has shown that *G. cervicornis* exhibits greater ability to take up high concentrations of NH_4^+ and low concentrations of PO_4^{3-}. These results suggest that *G. cervicornis* has good absorption capacity for the nutrients tested and may be a promising candidate as a bioremediation of eutrophized environments.



Picture of genus Dictyota (Dictyotaceae-Phaoephyta) and the strucuture of MAA isolated from marine macroalgae (photo by Jean-Paul Soriano)

MAIN PUBLICATIONS

Stein EM, Colepicolo P, Afonso FAK, Fujii, MT. 2011. Screening for antifungal activities of extracts of the Brazilian seaweed genus Laurencia (Ceramiales, Rhodophyta). *Rev Bras Farmacogn*, in press.

Gressler V, Yokoya NS, Fujii MT, Colepicolo P, Filho JM, Torres RP, Pinto E. 2010. Lipid, fatty acid, protein, amino acids and ash contents in four Brazilian red algae species. *Food Chemistry.* **120**: 585-590.

Pio Colepicolo Neto

Instituto de Química
Universidade de São Paulo (USP)

Departamento de Bioquímica
Avenida Prof. Lineu Prestes, 748 – Caixa Postal 26077
CEP 05508-900 – São Paulo, SP – Brasil

+55-11-3091-2170
piocolep@iq.usp.br