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Cyanobacteria and Red Macroalgae as Potential Sources of Antioxidants and UV Radiation-Absorbing Compounds for Cosmeceutical Applications

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Abstract: In recent years, research on natural products has gained considerable attention, particularly in the cosmetic industry, which is looking for new bio-active and biodegradable molecules. In this study, cosmetic properties of cyanobacteria and red macroalgae were analyzed. The extractions were conducted in different solvents (water, ethanol and two combinations of water:ethanol). The main molecules with antioxidant and photoprotective capacity were mycosporine-like amino acids (MAAs), scytonemin and phenolic compounds. The highest contents of scytonemin (only present in cyanobacteria) were observed in *Scytonema* sp. (BEA 1603B) and *Lyngbya* sp. (BEA 1328B). The highest concentrations of MAAs were found in the red macroalgae *Porphyra umbilicalis*, *Gelidium corneum* and *Osmundea pinnatifida* and in the cyanobacterium *Lyngbya* sp. *Scytonema* sp. was the unique species that presented an MAA with maximum absorption in the UV-B band, being identified as mycosporine-glutaminol for the first time in this species. The highest content of polyphenols was observed in *Scytonema* sp. and *P. umbilicalis*. Water was the best extraction solvent for MAAs and phenols, whereas scytonemin was better extracted in a less polar solvent such as ethanol:$_{d}H_2O$ (4:1). Cyanobacterium extracts presented higher antioxidant activity than those of red macroalgae. Positive correlations of antioxidant activity with different molecules, especially polyphenols, biliproteins and MAAs, were observed. Hydroethanolic extracts of some species incorporated in creams showed an increase in the photoprotection capacity in comparison with the base cream. Extracts of these organisms could be used as natural photoprotectors improving the diversity of sunscreens. The combination of different extracts enriched in scytonemin and MAAs could be useful to design broad-band natural UV-screen cosmeceutical products.

Keywords: antioxidant activity; cyanobacteria; mycosporine-like amino acids; scytonemin; photoprotection; red macroalgae; UV-screen

1. Introduction

Solar UV radiation (UVR) comprises UV-C (200–280 nm), UV-B (280–315 nm) and UV-A (315–400 nm), although only UV-A and a small part of UV-B reach the Earth's surface. UV-B radiation is the most harmful, inducing mutations in the DNA of skin cells, whereas UV-A radiation is indirectly mutagenic by generating reactive oxygen species (ROS) [1,2]. UVR can provoke some clinical effects in humans, such as erythema, pigmentation, immunosuppression, photoaging or carcinogenesis [3–6]. Recently,