Bioactive profile, bioaccessibility and antioxidant activity of Diatoms: a comparative study

Helena R. Rocha,[1] Marta Coelho,[1] Natacha Coelho,[2,3], Rui M.S.C. Morais,[1] Manuela E. Pintado,[1] Ana M. Gomes,[1]

[1] CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

[2] Necton Companhia Portuguesa de Culturas Marinhas SA., Belamandil s/n, 8700-152 Olhão, Portugal

[3] MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências e Tecnologia, Campus de Gambelas, Universidade do Algarve, Ed. 8, 8005-139 Faro, Portugal

Diatoms are microalgae with significant biotechnological potential due to their richness in bioactive compounds, including carotenoids and phenolics, contributing to their antioxidant properties. This study aims to compare the bioactive profile and antioxidant activity of three diatom species: *Chaetoceros calcitrans*, *Nannofrustulum shiloi*, and *Cylindrotheca fusiformis* cultivated in closed Flat Panel photobioreactors by Necton S.A. The biomass was harvested via centrifugation, freeze-dried, milled, and vacuum-packed for subsequent analysis.

Carotenoids were extracted using ethanolic extraction assisted by ultrasound and analyzed through HPLC-DAD. The Total phenolic content (TPC) was determined using the Folin-Ciocalteu method, considering both free and bound phenolics to provide a comprehensive understanding of their distribution. Antioxidant activity was evaluated using ABTS, ORAC, and DPPH assays, offering complementary insights into the radical-scavenging potential of the diatom species. Additionally, a bioaccessibility assessment was performed using the standardized INFOGEST *in vitro* model to evaluate the stability of these bioactive compounds.

Carotenoid analysis revealed distinct profiles among the species. *N. shiloi* exhibited the highest levels of β-carotene and zeaxanthin, highlighting its strong potential as a source of antioxidant pigments, whereas *C. fusiformis* showed a balanced composition of β-carotene, zeaxanthin, and other carotenoids, suggesting a varied antioxidant capacity. In contrast, *C. calcitrans* contained comparatively lower levels of these carotenoids. In addition to carotenoids, phenolic compounds play a significant role in the antioxidant potential of these diatoms. The TPC varied significantly, with *C. fusiformis* presenting the highest levels, followed by *N. shiloi* and *C. calcitrans*. Besides the differences in the results of the antioxidant activity among species, all exhibited considerable antioxidant capacity, suggesting the presence of multiple bioactive compounds contributing to distinct yet effective mechanisms of action.

These findings highlight the potential of diatoms as sources of natural bioactives, particularly for nutraceutical and pharmaceutical applications. The study underscores the importance of species selection in maximizing bioactive compound yield and antioxidant properties, paving the way for further exploration in functional food and cosmetic industries.

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