Healthier food products with naturally encapsulated functional ingredients - microalgae

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Abstract

The use of microalgae as a food ingredient has been tested in several food products due to their potential health promoting effects, probably related to a general immune-modulating effect[1]. One of the main attribute of microalgae is their ability to accumulate natural colourings and nutraceuticals. Aside chlorophylls, their primary photosynthetic pigment, microalgae also synthesized various secondary pigments, such as phycobiliproteins and a wide range of carotenoids. Other cumulative substances are proteins and PUFAcids. The beauty of the process is that these nutraceuticals, are protected against oxidation inside the vacuoles of the microalgae cells. This mechanism of natural encapsulation led us to study the addition of the microorganisms to the food products without a priori extraction of the functional ingredients. Instead, the work was focused on tailored the microalgae to accumulate the target substances induced by biostress conditions.

The present work results from a project that aims to use microalgal biomass as a source of pigments, antioxidants and omega3-fatty acids in food products.

Chlorella vulgaris, *Haematococcus pluvialis*, *Spirulina maxima*, *Isochrysis galbana* and *Diacronema vlkianum* were produced and studied as colouring agents. A carotenogenesis process was induced to *Chlorella* and *Haematococcus*, by salt, light and nutritional stress, a massive accumulation of secondary carotenoids resulting, *e.g.* canthaxanthin and astaxanthin. Microalgal biomass nutrient profile was determined in terms of moisture, total ash, crude protein, crude fibre, total fat, fatty acid profile. Total carotenoids were determined by extraction with acetone, spectrophotometric quantification, TLC and HPLC separation. Phycocyanin content of *Spirulina* was also determined by extraction with phosphate buffer and spectrophotometric quantification. Additional toxicological analysis and antioxidant capacity assays of the microalgae were also conducted.

The addition in microalgal biomass has been studied in several food products – oil-in-water emulsions, vegetable puddings, biscuits and pastas. The effect of microalgal concentration on the products colour parameters was investigated, as well as its stability through the processing conditions and along storage time.

In general, the developed products presented appealing and stable colours with added value in terms of health benefits, considering the antioxidant properties and PUFA-ω3 content of the microalgae. The results obtained are promising since it was possible to obtain common food products enriched with microalgae, resulting stable, attractive and healthier foods with enormous potential in the functional food market.

[1]Belay (1993) *Journal of Applied Phycology, 5*, 235-240.

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