

Enhancing Extraction of Food-Grade Pigments From the Microalgae *Chlorella Vulgaris* Through Application of Ohmic Heating

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Introduction:

The use of ohmic heating (OH) with the associated non-thermal effects due to the presence of an electrical field and frequency, has been suggested for extraction of compounds from biological matrices. Microalgae are considered as a very valuable source of compounds of interest for food sector (i.e. pigments, lipids, carbohydrates, and proteins) and the selection of extraction technique to recover these compounds is very challenging due to the intrinsic nature of the microalgae cell walls, which limits the mass transfer through it. The main objective of this study is to investigate the effects of OH on the extraction of pigmented solutes from *Chlorella vulgaris*.

Method:

OH treatments of *C. vulgaris* cultures with a concentration of 0.33 g/L and electrical conductivity of 1 mS/cm were carried out by applying alternating sinusoidal waves of 25 kHz and electric fields up to 50 V/cm. The operating temperatures range was from 22°C up to a maximum of 45°C. The extracted pigments were characterized by spectrophotometric and spectrofluorometric methods.

Significance:

In conclusion, OH has the potential to improve extraction of solutes from a non-concentrated culture of *C. vulgaris* at mild temperatures and low alternating electric fields. Further studies are necessary for a better understanding of the mechanisms involved in the OH assisted extraction process (e.g. effects of using different electrical frequencies and types of electrical wave). However, the demonstration of the positive effects of OH on the extraction of food-grade nutrients is particularly significant due to its potential use in the market of healthy foods, under the operational parameters tested – i.e. low electric fields, high frequency and low cell concentration – which favor energy efficiency and process reliability.

Results:

Results showed that extraction yield of total pigments in the OH assisted process was 15 times higher with respect to that of a conventional extraction process, being the concentration of chlorophyll a, b and carotenoids in the aqueous medium of 0.64 ± 0.04 µg/mL, 0.49 ± 0.01 µg/mL and 0.48 ± 0.05 µg/mL, respectively. Indeed, the concentration of chlorophyll a, b and carotenoids in the extracts obtained with the conventional process was 0.13 ± 0.02 µg/mL, 0.3 ± 0.04 µg/mL and 0.14 ± 0.01 µg/mL, respectively.

Category:

Biotechnology