

## Extraction of Nutraceutical Bioactive Compounds from the Native Algae Using Solvents with a Deep Natural Eutectic Point and Ultrasonic-assisted Extraction

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**Abstract :** Food is the source of energy and growth through the breakdown of its vital components and plays a vital role in human health and nutrition. Many natural compounds found in plant and animal materials play a special role in biological systems and the origin of many such compounds directly or indirectly is algae. Algae is an enormous source of polysaccharides and have gained much interest in human flourishing. In this study, algae biomass extraction is conducted using deep eutectic-based solvents (NADES) and Ultrasound-assisted extraction (UAE). The aim of this research is to extract bioactive compounds including total carotenoid, antioxidant activity, and polyphenolic contents. For this purpose, the influence of three important extraction parameters namely, biomass-to-solvent ratio, temperature, and time are studied with respect to their impact on the recovery of carotenoids, and phenolics, and on the extracts' antioxidant activity. Here we employ the Response Surface Methodology for the process optimization. The influence of the independent parameters on each dependent is determined through Analysis of Variance. Our results show that Ultrasound-assisted extraction (UAE) for 50 min is the best extraction condition, and proline:lactic acid (1:1) and choline chloride:urea (1:2) extracts show the highest total phenolic contents ( $50.00 \pm 0.70$  mgGAE/gdw) and antioxidant activity [ $60.00 \pm 1.70$  mgTE/gdw,  $70.00 \pm 0.90$  mgTE/gdw in 2,2-diphenyl-1-picrylhydrazyl (DPPH), and 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS)]. Our results confirm that the combination of UAE and NADES provides an excellent alternative to organic solvents for sustainable and green extraction and has huge potential for use in industrial applications involving the extraction of bioactive compounds from algae. This study is among the first attempts to optimize the effects of ultrasonic-assisted extraction, ultrasonic devices, and deep natural eutectic point and investigate their application in bioactive compounds extraction from algae. We also study the future perspective of ultrasound technology which helps to understand the complex mechanism of ultrasonic-assisted extraction and further guide its application in algae.

**Keywords :** natural deep eutectic solvents, ultrasound-assisted extraction, algae, antioxidant activity, phenolic compounds, carotenoids

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