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Food and natural products

Spirulina (*Arthrospira platensis*) protein extract: techno-functional properties and potential application as a natural emulsifier

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Microalgae are valuable sources of proteins (20-70%) and have emerged as great alternatives to animal-based proteins (e.g., whey protein, egg yolk)¹. This work aimed to obtain a microalga protein extract (SpE) from *Arthrospira platensis* (Spirulina) and evaluate its techno-functional properties and emulsion formation capability. The SpE was obtained by ultrasound and conventional mechanical stirring under an alkaline medium (pH 9.0) followed by acid precipitation (pH 3.0)². In addition, the SpE techno-functional (protein solubility; oil and water absorption capacities) and structural properties (FTIR analysis) were investigated. An emulsion (oil/water ratio (30/70); pH 7.0; SpE concentration (3.5%)) was prepared according to two sequential steps: i) high-shear homogenization (UltraTurrax; 11,000 rpm; 3 min) and ii) high-pressure homogenization (100MPa; 6 cycles)³. Then, it was analysed by optical microscopy, zeta potential and particle size. The SpE (66.6%±0.31 protein) presented the lowest solubility at pH 3.0 and the highest at pH 8.0. The protein extract showed higher absorption capacity in oil (21.7±0.10 g oil/ g SPE) than in water (10.3±0.50 g water/ g SPE). From the FTIR analysis (**Figure 1a**), the SpE showed two peaks at 1635 cm⁻¹ and 1535 cm⁻¹ (red circles in **Figure 1a**) attributed to the presence of characteristic protein groups, amide I and amide II, respectively. The oil-in-water emulsion (ESp) presented a light blue-green colour due to the presence of SpE (**Figure 1a**) and remained stable for 30 days (**Figure 1b**). The ESp presented a zeta potential of -47.20 mV and a particle size of 330 nm (D₅₀, volume distribution) on the 30th storage day. Small and spherical droplets were observed, evidencing the particle size and stability over the storage time (**Figure 1c**). Thus, the SpE showed the ability to form emulsions with stability for up to 30 days, being a great alternative to replace animal-based and synthetic emulsifiers.

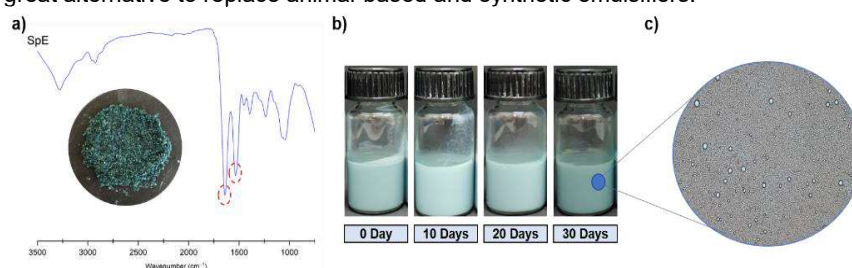


Figure 1: a) FTIR analysis and visual appearance of the SpE; b) Visual inspection of the emulsion over the storage time (30 days); c) optical microscopy (400X) of the emulsion after 30 days of storage.

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