Recovery of polyphenols and compounds with antioxidant activity from spirulina (*Arthrospira platensis*) through the use of different organic solvents assisted by pulsed electric fields

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Abstract

Currently, there is a growing nutritional interest in microalgae because they are a good source of nutrients and bioactive compounds. These bioactive compounds include polyphenols, which are known to be beneficial to health due to their antioxidant capacity. However, its extraction by conventional methods requires time and uses organic solvents, which are harmful to the environment. To reduce both time and environmental impact, the use of pulsed electric fields technology as a pre-treatment prior to extraction by stirring has been studied. For this purpose, a treatment of 100 kJ/kg at 3kV/cm was applied to a suspension of 2% spirulina in water. Afterwards, a extraction was carried out using ethanol (EtOH) 50% or dimethyl sulfoxide (DMSO) 50% in water (v/v) for 3h. In order to evaluate both the polyphenol extraction and the antioxidant capacity, a kinetic curve for each one was carried out at different extraction times with the different solvents. It was observed that the pre-treatment with PEF had a significant ($p<0.05$) positive effect on the extraction at all times with respect to the conventional treatment. The greatest differences were observed in the first times of the extraction (5-15) min. The highest antioxidant capacity measured by ORAC and TEAC was obtained using EtOH as solvent. When DMSO was used, PEF pre-treatment allowed higher recovery of polyphenols after 5 min (12.53 ± 0.31 mg gallic acid equivalents (GAE)/g dry weight) than control sample after 180 min (4.84 ± 0.48 mg/g). For both solvents, the highest value of total phenolic compounds (TPC) was obtained after 120 min of extraction. Finally, PEF increased the extraction of polyphenols by 408% using EtOH 50% as solvent. Then, it can be concluded that PEF technology increases the

extraction of polyphenols from microalgae, reducing the process time and the consumption of organic solvents.

Keywords
spirulina (Arthrospira platensis) ; polyphenols; antioxidant activity; pulsed electric fields