Effects of moderate electric fields on microalgae cell structure novel perspectives towards improved bio accessibility of metabolites

MACHADO L. (1,2), GEADA P. (1,2), TEIXEIRA J. (1,2), PEREIRA R. (1,2)
1 Centre of Biological Engineering - University of Minho, 4710-057, Braga, Portugal
2 LABBELSAssociate Laboratory, Braga, Guimars, Portugal

The use of microalgae in food industry has started to gain some interest due to their unique and promising characteristics. They are well known to present several compounds of interest such as proteins and essential amino acids with high nutritional impact for human and animal health. Usually, microalgae present a complex cellular structure, composes by strong polysaccharides, which affects their digestibility, and consequently the bio accessibility of their metabolites during gastrointestinal digestion. These could significantly decrease microalgae nutritional value. The electric fields processing have become an interesting approach in food industry as a way of inactivate some microorganisms which could be present in foods causing impact in the microorganisms cellular structure. Electro and thermal-permeabilization effects can result in a more fragile cell wall which in turn will increase bioaccessibility or leverage extraction of intracellular compounds of great interest given their nutritional value and functionality such as proteins. This work aims to establish a strong body of knowledge about how moderate electric fields (MEF) technology and its attendant ohmic heating effect can be combined to disrupt microalgae cell wall structure towards improved accessibility of intracellular compounds. Flow cytometry has shown that for example *Chlorella vulgaris* cell morphology - i.e., size and complexity – can change significantly after electroheating treatments, when variables such as electric field intensity (from 2 to 225 V/cm) and thermal load (temperature -treatment time binomial) are properly designed. Pulsed heating treatments, applied at 90 °C in less than 10 s, resulted in an accelerated extraction (within the first hour) of compounds, such as chlorophylls, from treated cells to an aqueous ethanolic solution. Interestingly, these treated cells of *Chlorella vulgaris* also presented a higher ability to naturally flocculate thus confirming cellular structural damage imposed by MEF. Results obtained under this study unveil that MEF pre-treatment in microalgae biomass has potential to bring novel insights towards bioaccessibility of important intracellular bioactive compounds during gastrointestinal digestion, as well as to contribute to a more efficient downstream processing regarding harvesting and extraction operations.