
A new protein source on the rise: Effect of pulsed electric fields and ultrasound on efficient and sustainable protein extraction, yield and techno-functionality from duckweed cultivated under optimized conditions

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In the context of obtaining high-quality protein alternatives, upstream processes are becoming increasingly important with regard to the initial state of raw materials. The focus in this research is on duckweed as a new rich protein source with a complete amino acid profile.

Taking into account the food value chain, optimized cultivation conditions for an optimal protein yield, in greenhouse and indoor vertical farming systems are explored and adapted to the duckweed production process. Moreover, gentle extraction methods are established, for optimal protein extraction assisted by physical processes like pulsed electric fields (PEF) and ultrasonication (US) to observe their implications on cell disruption and protein release from duckweed (*L. minor*, *L. gibba*).

For the “green leave protein” RuBisCo, the enzyme that plays an important role in carbon fixation in all green plants, a sustainable extraction process to be designed by three processing steps: pre-extraction, separation of pigments/secondary metabolites and protein isolation.

Pre-extraction of freshly harvested material as well as freeze-dried and subsequently ground duckweed flour is carried out and compared to PEF or US processed samples, which are applied directly on the raw material to break down cell membrane by cell disintegration.

Utilization of these rising technologies PEF and US in our study, has shown a clear improvement for protein release reaching up to 30% by using freshly harvested duckweed. Furthermore, a protein hydrolysis of 95% is achieved by US treatment of a suspension of duckweed flour at an optimized pH of 11, which is ~30% higher than the non-treated duckweed flour. Additionally, US treatment expectedly resulted in smaller particles than 100 µm for 97% of the particles size distribution, which indicates a good degree of cell disruption of plant cells (100-300 µm).

Duckweed protein isolates presented so far a protein yield of 65% and will be adapted based on the predefined optimal pre-extraction procedure assisted by mild heat and ultrafiltration/microfiltration. The isolates will then be analyzed for their techno-functional properties.