

## Optimized twin-screw enzymatic extrusion process to extract protein from micro and macroalgae

**ARHALIASS A. (1)**

1 GEPEA UMR CNRS 6144, Saint-Nazaire, France

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Anthony MASSE [2], Rafik BALTI (5), Nourhène ZAYOUD [2] [5], Hengsim PHUONG\* [1], [2], Justine DUMAY [3], Laurent VANDANJON [4], Hasika MITH [1], Jack LEGRAND [2], Abdellah ARHALIASS\* [2]

[1]: Food Technology and Nutrition research unit, Institute of Technology of Cambodia, Phnom Penh, Cambodia

[2]: Nantes Université, CNRS, GEPEA, ONIRIS, UMR 6144, 37 Bd Université, BP 406, 44602 Saint-Nazaire Cédex, France

[3]: FR CNRS 3473 IUML, Mer Molécule Santé (MMS), EA 2160, Nantes Université, 2 rue de la Houssinière, BP 92208, 44322 Nantes Cedex 3, France

[4]: LBCM EA 3884, Université Bretagne Sud (UBS), IUEM, Campus de Tohannic, 56017 Vannes cedex, France

[5]: CentraleSupélec, Laboratoire de Génie des Procédés et Matériaux, Centre Européen de Biotechnologie et de Bioéconomie (CEBB), 3 rue des Rouges Terres, 51110 Pomacle, France

The objectives of this work are to highlight the potential of extrusion, coupled or not with enzymatic hydrolysis, applied to the valorization of macroalgae and microalgae. Twin-screw extrusion is a thermomechanical process consisting of two inter-meshing and co-rotating screws. One aspect of this work is to understand the mechanisms that lead to the physico-chemical changes of the bio-resources, in relation to the kinetic characteristics. This study will take into account the product-process coupling, in particular the relationship between the nature and composition of the substrates, the processing conditions and the final quality of the product, by integrating the rheological properties and the physicochemical factors involved in the processing.

The optimization of the process was done by means of a design of experiments (DoE). In this study, three variables were investigated including biomass flow rate, enzyme concentration, and screw speed. Results revealed that biomass flow rate and enzyme concentration presented significant effect on the release of protein and sugar respectively. Meanwhile, both biomass flow rate and enzyme concentration were shown to have the significant effect on the release of pigments. The results showed that the extraction rates of extrusion in the presence of enzyme are increased compared to extrusion without enzyme and enzymatic hydrolysis in biomass batch reactor.