OP1.7 - VALORIZATION OF *GELIDIUM CORNEUM* BY-PRODUCT THROUGH SOLID-STATE FERMENTATION

Marta Ferreira [1(*)], ***José Manuel Salgado*** [2], ***Helena Peres*** [3,4], ***Isabel Belo*** [1,5]

[1] *Centre of Biological Engineering, University of Minho, Campus de Gualtar, Braga, Portugal.*

[2] *Biotecnia Group, Department of Chemical Engineering, Campus Agua, University of Vigo (Campus Ourense), As Lagoas s/n, Ourense, 32004, Spain*

[3] *Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Porto, Portugal*

[4] *CIMAR/CIIMAR – Centro Interdisciplinar de Investigação Marinha e Ambiental, Universidade do Porto, Terminal de Cruzeiros do Porto de Leixões, Matosinhos, Portugal*

[5] *LABBELS –Associate Laboratory, Braga, Guimarães, Portugal*

[(*)] *e-mail:* ***martaf824@gmail.com***

Keywords: red seaweed by-product, chemical composition, solid-state fermentation, enzyme activities analysis, bioreactor, scale-up

ABSTRACT

Industrial agar extraction of red seaweed *Gelidium* produces a significant amount of by- products (red seaweed by-product - RSB), which are often discarded. Nevertheless, their rich composition in carbohydrates and proteins makes them appropriate for value-added compound production through solid-state fermentation (SSF). In this study, RSB was utilized as substrate for SSF with *Aspergillus ibericus* MUM 03.49 and *Aspergillus niger* CECT 2915. RSB was initially characterized, and after was used as substrate for SSF as unsupplemented RSB, RSB supplemented with Mandel salt solution, and in a 50% (w/w) mixture of RSB with agro-industrial by-products (rice bran, sunflower cake, rapeseed cake, and corn gluten feed) and green seaweed *Ulva rigida*. The changes in crude protein content and carbohydrases production in the fermented biomass were assessed. The maximum xylanase activity (498 ± 49 U g^{-1}) was achieved with SSF of RSB mixed with sunflower cake using *A. niger*, while the mixture between RSB and rapeseed cake led to the production of the highest cellulase activity (382 ± 37 U g^{-1}). Additionally, protein content increased after SSF with *A. niger* in RSB mixed with rice bran (30%), rapeseed (18%), an sunflower cakes (15%). As a proof of concept, an SSF scale-up of up to 20-fold of dry substrate was done with *A. niger* using a mixture of RSB and sunflower cake. The effect of aeration and agitation on xylanase and cellulase production was studied using two types of bioreactors. In tray- type bioreactors enzyme activities were similar with values obtained at small scale, while in the stirred-drum bioreactor, forced aeration and low agitation enhanced both enzymes production. SSF-based bioprocessing of RSB mixed with agro-industrial by-products was demonstrated to be a cost-effective and sustainable approach for producing high-value enzymes and valorizing this seaweed by-product.

Acknowledgements:
This study was supported by the Portuguese Foundation for Science and Technology (FCT) under the scope of the strategic funding of UIDB/04469/2020 unit; by the project "Macroalgae biorefinery: a novel approach to produce sustainable feedstuffs and functional additives towards low carbon footprint aquafeeds", reference 2022.06587.PTDC; and by LABBELS Associate Laboratory in Biotechnology, Bioengineering and Microelectromechanical Systems (LA/P/0029/2020). Marta Ferreira was supported with a PhD grant, SFRH/BD/143614/2019, funded by the Portuguese Foundation for Science and Technology (FCT).