

Bioprocessing of olive mill and winery wastes by solid-state fermentation for simultaneously enzymes production and to increase their nutritional value

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One of fundamental challenges of olive oil and wine industries is to develop the new model of circular economy, that should lead to improve their competitiveness. In Portugal, these sectors generate more than 600,000 t and 300,000 t of wastes each year, respectively. Solid-state fermentation (SSF) is an eco-innovative process that allows to use the agro-industrial wastes as substrate to obtain value-added products as enzymes. In addition, it can increase the protein and lipids content by fungus growth, turning a poor nutritional quality materials into a fortified feed.

In this work, several enzymes have been produced using a filamentous fungus. A novel strain isolated from grapes, *A. ibericus*, was evaluated for the first time on SSF. This strain was able to produce lipases using olive pomace mixed with wheat bran (1:1), which achieved a maximum activity of 223 U/g of dry solid [1]. On the other hand, it has been proved the potential use of *A. ibericus* for lignocellulolytic enzymes as cellulases and xylanases. For that, olive mill wastes as olive pomace and winery wastes as exhausted grape marc and vineshoot trimmings were used as substrate. The mixtures of these wastes appeared to be positive for enzymes production compared to the separate use of wastes. Thus, this work proposes a novel strategy to create synergies between two industries that are often located in the same area. In addition, the SSF of these wastes were scale-up to tray type, packed-bed and pressured bioreactors, achieving similar results to those obtained in flask experiments.

After enzymes extraction, fermented wastes were characterized to evaluate their potential to be used as animal feed. The growth of fungus allowed to increase the protein content from low protein value (8%) to high value (17%) after 6 days of fermentation [2]. Because of this improvement in their nutritional value, the fermented waste was used as ingredient in fish diet. It was observed that fermented waste has potential as a feedstuff for European sea bass. In this way, all agro-industrial wastes were valued following the strategy of zero wastes, emulating sustainable natural cycle.

In line with strategy of simultaneously use of olive mill and winery wastes as low-costs substrates, in future works it will be evaluated the potential to obtain novel products by SSF as polyunsaturated fatty acids and antioxidant compounds. This will allow to develop the model of circular economy in these industries.

References

- [1] Oliveira, F, Salgado, JM, Abrunhosa, L, Pérez-Rodríguez, N, Domínguez, JM, Venâncio, A, Belo, I, Optimization of lipase production by solid-state fermentation of olive pomace: From flask to laboratory-scale packed-bed bioreactor. *Bioprocess and Biosystems Engineering*, in press, 2017.
- [2] Salgado, JM, Abrunhosa, L, Venâncio, A, Domínguez, JM, Belo, I, Enhancing the bioconversion of winery and olive mill wastes mixtures into lignocellulolytic enzymes and animal feed by *Aspergillus uvarum* using a packed-bed bioreactor. *Journal of Agricultural and Food Chemistry* 63(42), 9306-14, 2015.