An adsorptive approach to enhance the 2-phenylethanol (2-PE) production from L-phenylalanine (L-Phe) biotransformation

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Introduction:
The consumers demand for flavors produced by natural means has led to a decrease of natural resources and, in this scenario the use of microorganisms as biotechnological platforms for its production is becoming a promising alternative. 2-PE is an aromatic alcohol with a delicate fragrance of rose petals. In fact, product inhibition during biotransformation limits the final 2-PE concentrations in conventional biotransformation. In order to improve 2-PE production a strategy applying *in situ* product removal by adsorption was investigated.

Materials and Methods:
This study described the 2-PE production from L-Phe biotransformation (7 g L^{-1}) in a medium containing crude glycerol as carbon source, using two *Y. lipolytica* strains (W29 and CH1/5). The experiments were performed in batch mode at shake flask scale, in two different scenarios: without product removal and with *in situ* product removal by adsorption.

Results and Discussion:
The affinities of three resins (XAD4, XAD7-HP and XAD16) for 2-PE and L-Phe adsorption were first studied, and the resin XAD4 was chosen, since it adsorbed the most 2-PE and the least L-Phe. Biotransformation of L-Phe to 2-PE without addition of the adsorbent resin was carried out and it was observed that both strains were able to produce 2-PE with a maximum concentration of 1.57 and 1.19 g L^{-1}, for the strain W29 and CH1/5, respectively. The addition of 7% (w/v) resin to the biotransformation system allowed a 1.4-fold and 2.1-fold increase in 2-PE production, for the W29 and CH1/5 strain, respectively, compared to the biotransformation without addition of the adsorbent resin.

Conclusion:

Y. lipolytica W29 and CH1/5 show a greater potential for 2-PE production, with a titer of around 1.5 g L^{-1} produced from 7 g L^{-1} of L-Phe, which are competitive with the concentrations obtained by other species. The proposed *in situ* removal strategy demonstrated the potential of increasing the 2-PE production and may not only lead to a simpler downstream process design, but also to the avoidance of potential problems with the toxicity of 2-PE to the cells, especially when larger titers are obtained.

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