Overflowing processes for the production of surfactant in bioreactors

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RÉSUMÉ. La taille de ce résumé ne doit pas dépasser une dizaine de lignes. Il est à composer en Times New Roman corps 9 italique, interligné 11 points.

MOTS-CLÉS : Biological process ; Bacillus subtilis ; Lipopeptide ; Antibiotic :; Biosurfactant

1. Résumé

Mycosubtilin, a lipopeptide antibiotic belonging to the iturin family, can be overproduced by *Bacillus subtilis* BBG100, a derivative of ATCC 6633. Its hydrophilic and hydrophobic moieties confer to mycosubtilin strong surface-active properties.

The synthesis of such a biosurfactant in aerated and stirred tank bioreactors entails a serious foam overflow risk leading to an unknown loss of biomass. Indeed, the increasing foaming capacity of the culture broth due to the synthesis of biosurfactant causes an overflow, out of the bioreactor, of the culture medium and of the cells. This loss prevents the specific growth rate (μ) calculation which is a fundamental physiological variable, particularly for what concerns the study of the specific productivity (q_P).

Up-scaling the production process of biosurfactant from flasks to aerated and stirred bioreactor is challenging. The design of a new process named O-EFBC, which is relied to a continuous partial recycling process, recently helped to overcome these difficulties (Guez et al., 2007). In this process, a feeding strategy was applied in reference to a carbon-limited EFBC protocol. A dynamical Monod-based growth model showed enough accuracy to simulate the evolution of the specific growth rate that was shown to be inconstant.

The present work deals with the design of an original feeding strategy applied within the frame of the recently described O-EFBC. This control law aims at maintaining the specific growth rate as a constant with taking into account the recycled biomass. It can be regarded as the generalisation of a conventional exponential feeding strategy and is generic enough to cover the case of continuous processes with partial recycling. Indeed, conventional exponential feeding strategy fails in taking into account the loss of biomass induced by the foaming. From the values of the model parameters provided by previous O-EFBC experiments, μmax, KS, mS and YX/S, a new feeding law was computed. Experimental results highlighted the complete agreement between the expected and practical features. Further productivity optimisation studies could now be performed on the basis of this new feeding strategy.

Reference : Guez J.S., Chenikher S., Cassar J.Ph. et Jacques P. 2007. Setting up and modelling of overflowing fed-batch cultures of Bacillus subtilis for the production and continuous removal of lipopeptides. J Biotechnol. 131, pp. 67-75.