Comparative Studies of Alcoholic Fermentations using Flocculent and Non-Flocculent Strains of *Saccharomyces cerevisiae*

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Alcoholic fermentation is one of the oldest applications of biotechnology. However, inhibition problems, by substrate and/or product, arise when the purpose is to carry out fermentations of high glucose concentration. The use of yeasts with high ethanol tolerance and/or the integration of fermentation with the *in situ* recovery of product can be an approach to overcome some of those problems [1].

In this work, the performance of alcoholic fermentations with 200, 300 and 400 g/l of glucose using a flocculent *Saccharomyces cerevisiae saké* strain and a non-flocculent *Saccharomyces cerevisiae* DER24 strain were compared. The fermentation processes were carried out at controlled pH, an agitation rate of 150 rpm and a temperature of 30ºC. In the extractive fermentation systems oleic acid was used as organic solvent (extractant).

The obtained results for batch fermentations (without extraction) showed that: i) the ethanol yield for the flocculent strain was higher than the one observed for the non-flocculent strain; ii) the specific uptake rate of glucose was lower for the *S. cerevisiae saké* yeast.

When oleic acid was introduced in the fermentation systems, in a 5:1 organic phase / fermentation medium ratio, an improvement on fermentation performances was observed, corresponding to a fermentation time reduction and to a glucose consumption increase. In those systems, higher values of both ethanol yield and specific uptake rate of glucose were obtained with *S. cerevisiae* DER24 strain.

For both *S. cerevisiae* yeast strains, extractive fermentations of 300 g/l of glucose (fermentation medium / organic solvent ratio of 1) coupled with enzymatic esterification of ethanol by a free lipase from *Rhizomucor miehei* (10.2 mg/ml) led a high glucose consumption (residual glucose ≈ 4 g/l). In this case, an increase of organic extractant / fermentation medium ratio was not necessary, as in the physical extractive fermentations [2].

References:

[1] Oliveira, A.C., Rosa, M.F., Cabral, J.M.S. and Aires-Barros, M.R., *Bioprocess Engineering*, 16 (6), 349-353, 1997
[2] Aires-Barros, M.R., Cabral, J.M.S. and Novais, J.M., *Biotechnology and Bioengineering*, 29, 1097-1104, 1987