Malolactic fermentation with *Oenococcus oeni* immobilized on natural materials

Z. Genisheva, S. I. Mussatto, J. M. Oliveira, J. A. Teixeira*

IBB – Institute for Biotechnology an Bioengineering, Centre of Biological Engineering, Universidade do Minho, 4710-057 Braga PORTUGAL

* *zlatina@deb.uminho.pt*

Bioprocesses with immobilized cells is a fast expanding field of investigation due to the various advantages of this system when compared to conventional free cells fermentations. One of the advantages of this system is the easier control of the fermentation process, which is of great importance especially for processes that are complex and difficult to control, like the malolactic fermentation (MLF) in winemaking. The implementation of MLF is very important for wines produced in cold regions as it reduces the acidity, brings biological stability and may improve the organoleptic characteristics of the product. MLF normally occurs spontaneously during storage of a new wine and is usually a very slow process that can undergo for weeks and even months, and not always give a satisfactory result. The use of immobilized lactic acid bacteria during MLF helps to accelerate the process and also simplifies the control of its extension. However, the material to be used as immobilization support must be carefully chosen in order to not negatively affect the final product, and should also be cheap, abundant in nature, and of food grade purity.

The aim of the present work was to find low cost natural materials of food grade purity, suitable for immobilization of *Oenococcus oeni* for use on MLF. Four natural materials, including corn cobs, grape stems, grape seeds and grape skins were evaluated. Immobilization and fermentation occurred simultaneously in 500 mL Erlenmeyer flasks containing 2 g of support material and 200 mL of synthetic medium inoculated with 1 g/L cells of *O. oeni*. Fermentations were carried out in duplicate, and samples were taken every 2 h for estimation of free biomass, glucose, fructose and malic acid consumption, and lactic acid production. For comparison, free cells assays under the same conditions described above were also performed.

Fermentations with immobilized cells gave better results than the assays containing only free cells in suspension. Among the support materials, corn cobs, grape skins and grape stems proportioned the best results. Grape skins immobilized the highest amount of cells (40.3 mg/g) followed by corn cobs (31.9 mg/g) and grape stems (30.9 mg/g). Fermentations with cells immobilized in corn cobs and grape stems achieved the highest lactic acid productivities [4.06 g/(L h) and 4.03 g/(L h), respectively]. It was concluded that such materials are suitable for use as support for immobilization of *Oenococcus oeni* during malolactic fermentation.

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