A Study of Grape Skins as Support Material for Whole-Cell Immobilization during Malolactic Fermentation in Model Wine

Introduction

Malolactic fermentation (MLF): desirable for most red wine and certain types of white wine. However, MLF process is usually done by batch process in wine industry, which is not very efficient.

Oenococcus oeni: a type of MLF bacteria that converts malic acid to lactic acid to reduce the tartness and acidity in wine.

Grape skins: the outer layer of grapes. In this study, the grape skins were obtained after the crush process in winemaking.

Whole-cell immobilization: an alternative to enzyme immobilization. It is defined as “the physical confinement or localization of intact cells to a certain region of space with preservation of some desired catalytic activity”.

Objectives

• Determine a good concentration of grape skins for efficient whole-cell immobilization with Oenococcus oeni
• Study malolactic fermentation using immobilized cells in model wine

Methods and Materials

• HPLC analysis was done after 8 and 17 days MLF
• The amount of immobilized cell on grape skin was determined by weight
• Microorganism Preparation
  - Incubate for 48 hours @ 28 °C under static condition
  - Centrifuge at speed of 5000 RPM for 15 min at 4 °C
  - Collect O. oeni cells

Results

• The results for 10g/l grape skins were not determined.
• As the concentration of grape skin increased from 20 g/l to 30 g/l, the quantity of immobilized cells (per gram of grape skins) at least doubled

Conclusions and Future Work

• Grape skins, at the concentration of 30 g/l was the optimized concentration for O. oeni immobilization.
• The maximum malic acid conversion was 30.8% ± 5.1 % for O. oeni immobilization during MLF in model wine.
• Grape skins are natural products and they are often taken out after grape juice extraction in winemaking process, therefore, it is a very environmental friendly approach and it can also improve economic efficiency.
• Further study on higher concentration of grape skins can be performed to test the maximum limit of affinity.
• More detailed investigation on HPLC analysis of residual sugar, lactic and malic acids are needed for sound winemaking practices.

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References


Figure 1: Comparisons of O. oeni Cell Immobilization Efficiency on Different Concentrations of Grape Skins

Figure 2: Malic Acid Conversion after 8 and 17 days of MLF with 10g/l Grape Skins Compared to Controls

Figure 3: Malic Acid Conversion in Malolactic Fermentation after 17 Days in Model Wine