MIXED CULTURE OF *KLUYVEROMYCES LACTIS* AND *SACCHAROMYCES CEREVISIAE* FOR ETHANOL PRODUCTION FROM CHEESE WHEY

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Introduction. Cheese whey is a byproduct in the production of cheese; however, it still contains a significant concentration of lactose, protein and minerals, and thus it could be used to obtain new products, such as ethanol, by fermentation. *Saccharomyces cerevisiae* is employed for the alcoholic fermentation; however this species is unable to utilize lactose as a carbon source, and therefore does not produce ethanol from this carbohydrate, but *Kluyveromyces lactis* does produce ethanol (1, 2, 3).

The objective of this study was to determine if it was possible to increase the production of ethanol by mixed cultures of *Kluyveromyces lactis* (KL837) and *Saccharomyces cerevisiae* (SC326, SC718) using the cheese whey as fermentation medium.

Methods. Reducing sugar content in cheese whey was adjusted to 120 (C1) and 160 (C2) g/L by addition of whey powder, pasteurized and stored at 5 °C until use. For the fermentation, 500 ml of this medium were inoculated with 1% of each pure culture or mixed culture (KL837/SC326, KL837/SC718). The fermentation was followed for 96h, and the pH, cell growth, reducing sugar consumption and ethanol production were quantified every 24h.

Results. KL837 was able to grow and produce ethanol in cheese whey at various concentrations of lactose (as fermentable sugar), whereas SC326 and SC718 had a slight growth but did not produce ethanol in this medium. No significant difference was observed in the growth kinetics between pure cultures and mixed cultures too (data not show). Increased reducing sugars consumption was observed in mixed cultures (Fig 1), with a maximum during the first 48h of culture of KL837/SC326 in C2 culture. At this time, reducing sugars concentration was augmented in KL837 pure culture, possibly due to β-galactosidase activity of this type of yeast (4). Finally, a higher rate of ethanol production was show in mixed cultures for both fermentation conditions, with maximum of 0.724 and 0.673 g/L·h for KL837/SC326 and KL837/SC718, respectively (Fig. 2).

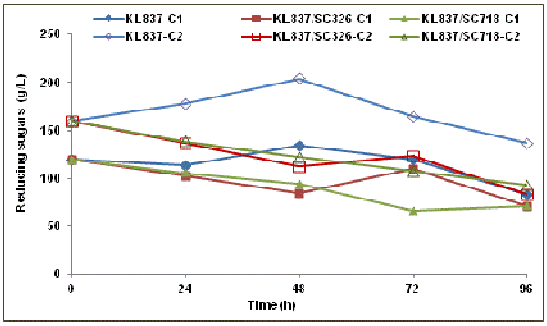

Fig.1. Reducing sugars consumption during fermentation with mixed cultures of yeast.

Thereby, the production of ethanol was increased from 6.29 and 8.8 g/L in the pure culture of KL837, to 57.39 and 51.20 g/L in the mixed cultures at C1 and C2 conditions, respectively.

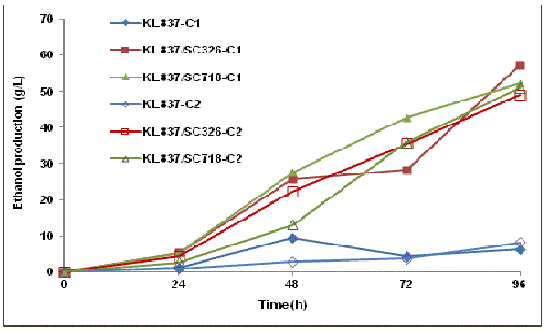

Fig. 2. Ethanol production by *Kluyveromyces lactis* and *Saccharomyces cerevisiae* in mixed cultures.

Conclusions. Our results show that it is possible to increase the production of ethanol from cheese whey by using mixed cultures of *K. lactis* and *S. cerevisiae*, on the recovery of this byproduct both for food and to reduce its environmental impact.

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