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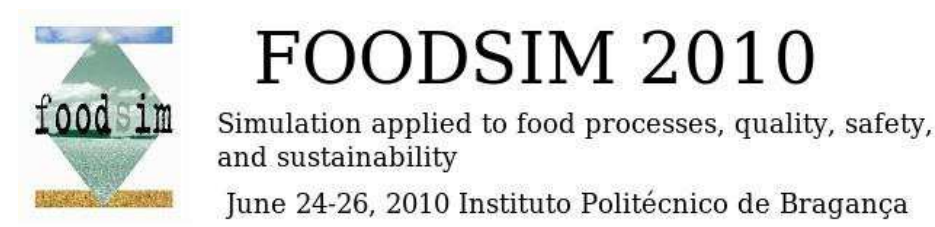
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MEAD PRODUCTION: COMPARISON OF DIFFERENT PRODUCTION SCALES (PRELIMINARY RESULTS)

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Aims

The aim of this work was to compare different production scales of mead in relation to the characteristics of the final product and to the fermentations development.

Introduction

In the northeast of Portugal, the production of honey is an activity with significant economic importance [1].

Honey is a natural complex product composed of carbohydrates and other minor substances, such as organic acids, amino acids, proteins, minerals, vitamins and lipids. Fructose and glucose are the predominate carbohydrates [2].

Mead production may be an activity with economical potential, adding surplus value to honey. Mead fermentation is a time-consuming process, often taking several months. The fermentation rate depends on several factors, such as, honey variety, yeast strain, yeast nutrition and pH, among other factors [3].

Associated with its production several limitations have been documented that decrease the organoleptic quality of the final product. Other problems are encountered in the clarification and filtration stages. Although desirable, these steps may increase production costs. For these reasons, research work is needed in order to optimize the production process of this beverage [3].

Results and Discussion

Fermentation performances in mead production at lab- and pilot-scales are represented in Figures 1 and 2, respectively. In general terms, some differences were detected when comparing both scale productions.

In relation to the biomass, in pilot scale, cells reached the stationary phase at OD lower than lab-scale and was observed a decrease in OD in next hours. This might be due to two phenomena: i) Difficulties in promoting the desirable agitation of the medium when sample collection was being performed; ii) Cell sedimentation. The maximum growth specific rate obtained for the inox cube was also lower than the obtained in 1.5L bioreactor (Table 1).

In terms of sugars, glucose and fructose were metabolized by the yeasts during the exponential and stationary phases in both assays; however, it was verified a

preferential consumption of glucose over fructose.

In relation to ethanol, a higher final concentration was observed in the pilot-scale, resulting in a higher ethanol yield (Table 1). Another important aspect that must be referred is the uncommon behavior of ethanol production, as this is a primary metabolite that is expected to be produced along the exponential phase; however, during mead production, ethanol was also obtained along the stationary phase. Glycerol and acetic acid were always produced along fermentations. Glycerol concentrations obtained in both assays were in agreement with values published in the literature for wines (1.4 and 9.9 g/l). In relation to acetic acid, higher concentrations were obtained at the pilot-scale production; however, in the two cases the values still remain lower than the legal limit (1.1 g/L) [4].

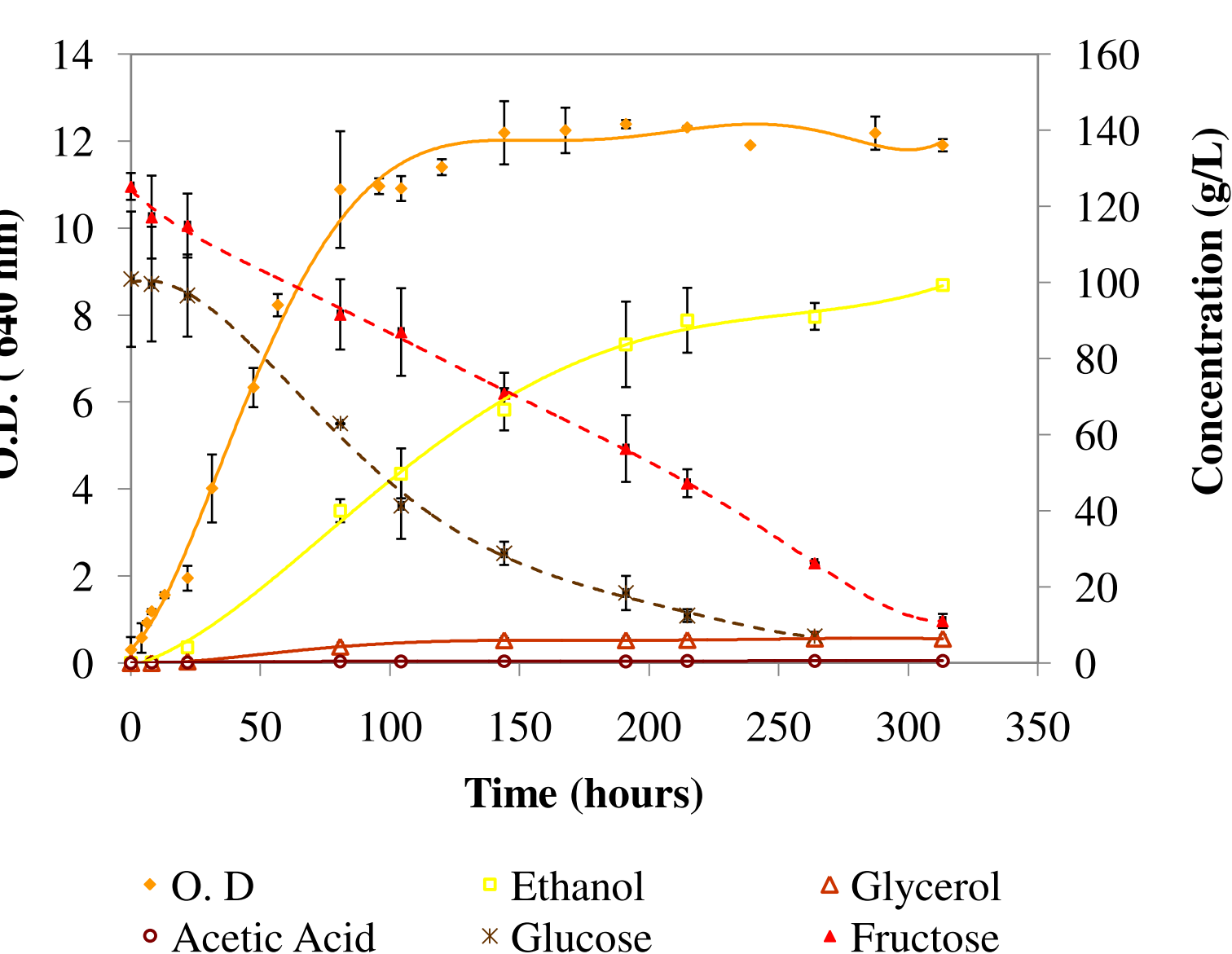


Figure 1 – Fermentation performance in mead production at lab-scale.

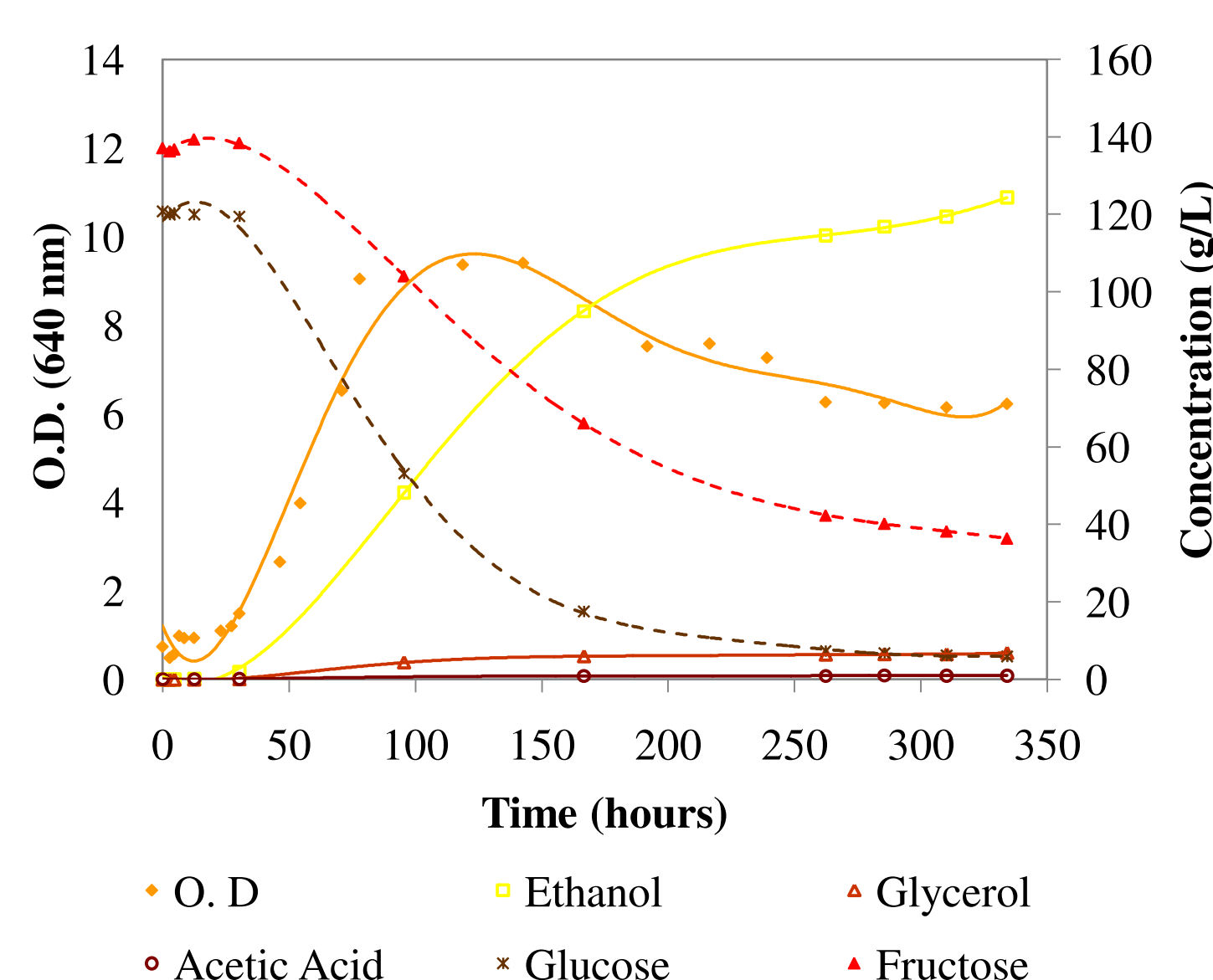


Figure 2 – Fermentation performance in mead production at pilot-scale.

Table 1 - Mead production - Parameters determined for the alcoholic fermentations carried out in bioreactors of 1.5L (lab-scale production) and inox cube of 20L (pilot-scale production).

Parameter	Bioreactor (1.5L)	Inox cube (20L)
Total time of fermentation (h)	315±22	334
μ_{max} (h ⁻¹)	0.045±0.000	0.038
Sugars consumed (g/L)*	218±16	216
Ethanol (%)	9.69±0.02	12.4
$Y_{Ethanol/Sugars}$ (%)	35.3±2.2	45.5
Glycerol (g/L)	6.36±0.09	6.84
Acetic acid (g/L)	0.56±0.02	0.94

*Evaluated as $\Sigma(\text{Glucose} + \text{Fructose})$.
Values presented correspond to median±amplitude/2

Conclusions

With this work it was verified that changing from lab-scale to pilot-scale production (an increase of more than ten times fold), differences among the fermentations were observed. A higher lag-phase and a lower maximum specific growth rate were determined for the pilot-scale production; however, higher final ethanol concentrations were obtained in this assay.

References

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Acknowledgements



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