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Effects of Hyperbaric Air on the *Saccharomyces cerevisiae* Morphology and Viability

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Fed-batch cultivation of *Saccharomyces cerevisae* is the dominating technique in high cell density cultures of processes such as the production of Baker's yeast [1] and recombinant proteins [2]. Due to the high oxygen demand of these cultures, the oxygen supply to the culture is an important and difficult task. The use of hyperbaric air, e.g., air at increased pressure, for oxygen mass transfer improvement has been proved to be applicable to several microbial strains [3,4].

In this study, the effects of hyperbaric air up to 1.5 MPa on the viability and morphology of *S. cerevisiae* cells grown in fed-batch cultures were investigated. Fed-batch experiments were performed in a stainless steel stirred tank reactor. Exponential feeding at dilution rates up to 0.1 h^{-1} was used, in order to ensure full respiratory metabolism. The ethanol production due to oxygen limitation at atmospheric pressure was reduced by the bioreactor pressurization up to 1.0 MPa. No differences on the fraction of viable cells, size of the cells and genealogical age were observed in this range of total pressure. Moreover, best results were obtained for experiments where pressure was increased gradually throughout time. This observation indicates the existence of an adaptation period of the cells to hyperbaric conditions.

However, a strong inhibition of cell activity was observed for the operation at 1.5 MPa total air pressure. This effect was due to the increase on the oxygen partial pressure because similar cell behaviour was found using pure oxygen at the same partial pressure (0.32 MPa). Oxygen toxicity resulted in a drastic decrease of cell viability, inhibition of ATP synthesis and morphologic changes, mainly, cell size decrease.

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