

P - 224

Air pressure: An Important Parameter to Fed-batch Operation with High-density Cultures of *Candida utilis*

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The yeast *Candida utilis* (fodder yeast) is a popular microorganism for physiological studies and is also particularly useful yeast because of its high respiratory activity, protein content, good amino acid profile and ability to utilize a range of substrates. In typical industrial with high cell densities cultures, oxygen is usually the major growth limiting factor. The use of pressure to improve oxygen transfer rate into bioreactors is an alternative way of preventing oxygen limitation.

Candida utilis CBS 621 was grown in a high cell density fed-batch culture with increased air pressure. The culture medium with sucrose as carbon source at 100 g·L⁻¹ was feed into the hyperbaric biorreactor with a constant dilution rate of 0.025 h⁻¹.

The results showed important differences between the three values of the air pressure studied, 1 bar, 6 bars and 12 bars. The air pressure increased the final cell concentration and decreased the ethanol production. No significant differences were found of cell growth during the first 24 h of fed-batch operation at 6 bar and 12 bar air pressures. However, after this period of time, under an environment of 6 bar of air pressure, the yeast cells showed an oxidoreductive metabolism leading to a decrease in cell concentration. On the contrary, at 12 bar air pressure, ethanol was never produced, meaning that the metabolism was mainly oxidative. This has a potential interest in the production of single-cell-protein (SCP) and other bioproducts where ethanol production is an undesirably factor.

Besides metabolic behavior of the cells, other parameters were analysed to assess the overall effects of pressure on *Candida utilis* cells.

Morphological parameters, such as single and budding cells, size and elongation, were estimated by procedures of automatic image analysis which were developed for this particular case.

The results indicated that the morphology of this yeast strain was not significantly affected by the air pressure increase till 12 bars.

Thus, in what biological aspects are concerned, it is possible to state that the strain of *Candida utilis* used in this work is resistant to hyperbaric and oxidative stresses, which makes the use of increased air pressure a suitable method of oxygenation enhancement of high-density cultures of this yeast.