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ENHANCEMENT OF OXYGEN MASS TRANSFER IN PNEUMATICAL BIOREACTORS USING N-DODECANE AS OXYGEN-VECTOR

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Abstract

In biotechnology, oxygen mass transfer is a key parameter involved in the design and operation of bioreactors and it can be analyzed by means of the oxygen mass transfer coefficient (k_La). Due to the fact that oxygen has a very low solubility in an aqueous media (8–10 ppm at 20°C), actively growing cells can consume all the dissolved oxygen very fast, therefore, it has to be supplied continuously into the broths. In conventionally aerated bioreactors, low oxygen solubility combined with slow oxygen transfer rates often results in reduced growth and culture productivity. Due to their higher oxygen solubility, non-toxicity to microbes, antifoaming action, oxygen-vectors addition is one of the most effective methods to improve oxygen mass transfer rate in aerobic fermentations. The aim of this study was to investigate the use of n-dodecane as oxygen-vector in bubble column and air-lift bioreactors, under different working conditions (air superficial velocity, volumetric fraction of the organic phase, medium temperature). The results show that volumetric fraction of oxygen-vector (φ) has a great influence on k_La ; in the presence of low volumetric fraction ($\varphi=0.005$ (v/v)), the oxygen mass transfer coefficient's value in bubble column bioreactor was increased by almost 100% at 35°C and for $\varphi=0.02$ (v/v) by 5% at 25°C, while in air-lift bioreactor, at 25°C and $\varphi=0.005$ (v/v), the k_La value was enhanced by approximately 50%.

Key words: air-lift, bubble column, n-dodecane, oxygen mass transfer, oxygen-vector

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