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Citric acid production by *Yarrowia lipolytica* from crude glycerol: Influence of oxygen mass transfer rate (OTR)



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Glycerol from biodiesel industry, which is available in high amounts nowadays, is a renewable low-cost substrate that can be used for many biotechnological applications. *Yarrowia lipolytica* is a strictly aerobic yeast, known for the ability to use several carbon sources and to produce several high value compounds. Citric acid, an intermediate of tricarboxylic acids cycle, is extensively used in food and pharmaceutical industry. This organic acid can be produced by *Y. lipolytica* from glycerol under specific growth conditions, namely under nitrogen limitation. Oxygen availability in the culture medium is also an important factor that influences these aerobic bioprocesses.

In this work, the influence of Oxygen Transfer Rate (OTR) from air to the culture on citric acid production by *Y. lipolytica* W29 (ATCC 20460:CLIB89) using crude glycerol was evaluated. Batch cultures with 50 g L^{-1} of glycerol were performed at OTR values from $52 \text{ mg L}^{-1} \text{ h}^{-1}$ to $878 \text{ mg L}^{-1} \text{ h}^{-1}$ obtained varying aeration and agitation rates, from 1 vvm to 3 vvm, and from 200 rpm to 600 rpm, respectively.

The increase of OTR up to $408 \text{ mg L}^{-1} \text{ h}^{-1}$ led to a 7.7-fold increase of citric acid production ($10.8 \pm 0.5 \text{ g L}^{-1}$). Further increase of OTR values above $408 \text{ mg L}^{-1} \text{ h}^{-1}$ did not improve citric acid concentration and productivity. In fact, for these OTR values oxygen dissolved concentration in the medium was kept above 50% of the saturation value, during the production of citric acid, meaning that the process control by oxygen limitation was prevented.

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