

***Yarrowia lipolytica* as a cell factory to produce valuable compounds**

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Yarrowia lipolytica, a strictly aerobic yeast, with GRAS status, has an intense secretory activity and can metabolize a wide range of substrates that guaranteed a spot as an interesting industrial organism. Recently, food supplements derived from this yeast were approved for commercialization, which is particularly important for broadening the range of possible applications of the compounds produced by *Y. lipolytica* [1]. Within "Bioprocess Development and Optimization" research team, *Y. lipolytica* has been used as a cell model and exploited applying the biorefinery concept for the production of enzymes, microbial lipids, aroma and organic acids, using low-cost renewable substrates.

A yeast-based integrated system was developed to valorize agro-industrial wastes, namely waste cooking oils and lard (used as a model of animal fat), by producing microbial lipids and lipase. The yeast oil content accumulated by *Y. lipolytica* from these inexpensive wastes was one of the higher ever reported for a non-genetically modified *Yarrowia* strain. Moreover, the simultaneous production of lipase may reduce the production cost of the microbial lipids and demonstrates that a biorefinery approach may be designed based on fat raw materials, allowing at the same time the reduction of fatty wastes surplus.

Lipids accumulation on *Y. lipolytica* may also occur from non-oily substrates such as glucose or glycerol that can also lead to citric acid (CA) production under nitrogen-limitation conditions. Crude glycerol, by-product from Biodiesel industry, has been used for CA production. Optimization of CA has been carried out by enhancing oxygen transfer rate at different types of bioreactors, such as STR, pressurized and airlift, as well as by mutagenesis strategies for strains improvement.

Yarrowia lipolytica is a model microorganism for lipids metabolism. It can produce several compounds from fatty acids catabolism, mainly aromatic compounds, such as lactones. This species is able to transform ricinoleic acid into γ -decalactone, a peach-like aroma compound of great importance for flavoring industry. The production of γ -decalactone has been intensively studied in order to better understand all process and optimize it. The role of lipases in substrate hydrolysis, the effect of substrate concentration, dissolved oxygen concentration and different fermentation strategies - batch and step-wise fed-batch - and bioreactor designs (STR and airlift) in the γ -decalactone production was investigated [2]. The characterization of γ -decalactone production by genetic modified strains at lab-scale bioreactor was also performed. *Yarrowia lipolytica* potential to produce other aromatic compounds, such as 2-phenylethanol, is been now explored.

References

- [1] Ledesma-Amaro, R, Nicaud, J-M, *Yarrowia lipolytica* as a biotechnological chassis to produce usual and unusual fatty acids, *Progress in Lipid Research* 61, 40-50, 2016.
- [2] Braga, A, Mesquita, DP, Amaral, AL, Ferreira, EC, Belo, I, Aroma production by *Yarrowia lipolytica* in airlift and STR bioreactors: differences in yeast metabolism and morphology. *Biochemical Engineering Journal*, 93, 55-62, 2015.