Lard as a suitable and cheap substrate for microbial lipids production by Yarrowia lipolytica

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Current agricultural and industrial practices have led to the generation of large amounts of various low-value or negative cost crude wastes, which are difficult and economically not-attractive to treat and valorize. One important example of waste generation is animal fat, commonly found in tanning process and slaughterhouses. These wastes, in which the lipids are often the main and most problematic components, are not currently used effectively and there are almost no application methods to recover the respective value.

The non-conventional yeast *Y. lipolytica* has the capability to assimilate fatty substances and has been used for lipid production on agro-industrial residues and industrial fats. It has excellent lipid accumulation capacity, commonly accumulating up to 36 % of its dry cell weight in lipids and most of the storage lipids (single cell oil, SCO) produced in *Y. lipolytica* is in the form of triacylglycerols (TAG).

In order to study the effect of several factors (pH, fat concentration, oxygen mass transfer rate and Gum arabic concentration) on microbial lipids production, an experimental design based onTaguchi method was applied in batch cultures of *Y. lipolytica* W29. In this work, a commercial lard was used as a "model" of animal fat.

According to the analysis of variance (ANOVA), OTR was by far the most significant parameter (65 %) for SCO production maximization, followed by Gum arabic concentration (11 %). A 2-fold improvement in maximum lipid accumulation (58 % w/w) was achieved, by increasing OTR from 96 $mg \cdot L^{-1} \cdot h^{-1}$ to 192 $mg \cdot L^{-1} \cdot h^{-1}$. In the optimum conditions for SCO production, the main fatty acids accumulated by *Y. lipolytica* W29 cells were oleic acid, followed by palmitic and linoleic acids. These results prove that Y. lipolytica W29 can be considered an interesting oil-producing yeast with the ability to store large amounts of lipids, which can be used in the production of biodiesel (since their composition is similar to vegetable oils).

Additionally to the SCO production, also citric acid (9 $g \cdot L^{-1}$) and extracellular lipase (2800 $U \cdot L^{-1}$) production was observed. The simultaneous induction of lipase and citric acid synthesis constitutes a side biotechnological application on its own and may reduce the production cost of the microbial lipds, representing an economical advantage.