PRODUCTION AND EVALUATION OF OILS FROM OLEAGINOUS YEASTS USING GLYCEROL AS SUBSTRATE

Xochitl Niehus, Georgina Sandoval;
Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco (CIATEJ),
Unidad de Biotecnología Industrial, Guadalajara, Jalisco, México.
xniehus@gmail.com, georgina@confluencia.net

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Introduction. Oleaginous microorganisms are considered those to be able to accumulate more than 20% of their dry cell weight as oils [1]. This accumulation is mainly due to an excess of carbon source (C) and limitation of another nutrient, such as Nitrogen (N) [2]. Oils from yeasts are mainly triacylglycerols which can be compared, in terms of their chemical composition, to the oils and fats obtained from plant oilseeds (common biodiesel raw material). In the biodiesel production process raw material accounts 70-90% of the total cost and glycerol is a byproduct (10% of the amount produced) [3]. In this way, glycerol is an interesting C source for oleaginous yeasts and later biodiesel production.
The aim of this work was to produce suitable lipids for biodiesel production from two previously selected oleaginous yeasts using glycerol as C source.

Methods. From a previous screening [4], the yeasts Y1 and C3 from CIATEJ's microbial collection, were selected as the best ones for lipid production on a medium with glycerol as C source under N limitation.
Biomass (dry cell weight, DCW), lipid production, pH, glycerol and N consumption were evaluated during batch fermentations in 2L bioreactors by duplicate. The fatty acid composition of the extracted oils was determined. Finally biodiesel was produced by a model enzymatic reaction [5].

Results. In both yeasts lipid accumulation began at the end of the exponential growth phase, when N was completely consumed and pH decreased to a final value of 3.1. Glycerol was completely consumed after 60 hours.
The maximum production obtained, in the 2L bioreactors with the two yeasts, in terms of biomass, lipid concentration and lipid percentage are shown in table 1.

Table 1. Maximum production obtained.

PRODUCTION	Yeast	
	Y1	C3
Biomass (g/L)	9.9	12.3
Lipid concentration (g/L)	5.35	7
Lipid percentage	55	58

The lipids from Y1 and C3, were mainly composed by oleic (C18:1), linoleic (C18:2) and palmitic (C16:0) acid.
In the enzymatic reaction for biodiesel production with the extracted oils from Y1 and C3, as mentioned in methods, the conversion percentage was higher than 92%.

Conclusions. The yeasts Y1 and C3 accumulate more than 50% of their DCW as lipids in the tested conditions, the yeast C3 was better. The obtained lipids have similar composition as the common vegetable oils used for biodiesel production. It was also proven by an enzymatic reaction that the oils produced by both yeasts are suitable for biodiesel production.

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References.

1. Ratledge C. (1991). *Acta Biotechnologica.,* vol. 11: 429-438.
2. Granger L., Perlot P., Goma G., Pareilleux A. (1993). *Biotech. and Bioengin.* 42(10): 1151-1156.
3. Fan X., Niehus X. and Sandoval G. (2012). Lipases as Biocatalyst for Biodiesel Production. Lipases and Phospholipases: Methods and Applications. G. Sandoval, Springer-Humana Press: 471-483.
4. Niehus X., Sandoval G., Gshaedler A., Pelayo C. (2011). Screening of oleaginous yeasts and obtaining of their oils to produce biodiesel, using residual glycerol from the process as carbon source.*10th International Symposium on Biocatalysis Abstract book*. Biotrans 2011. Giardini Naxos (ME), Sicily, Italy. 160.
5. Rivera I. Villanueva, G. and Sandoval G. (2009). *Grasas y Aceites.* 60(5): 468-474.