

## Profile of fatty acids from torula yeast (*Candida utilis*) grown on distiller's vinasse. Technical note

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The study was performed to determine the content of fatty acids (FA) from torula yeast, grown on distiller's vinasse. The total content of fatty acids was 23.66 g/kg. Linoleic acid was that of highest concentration (729 mg/100 g). In respect to the FA total, in the saturated FA group, palmitic was the most representative (21 %), and in that of monounsaturated FA (22 %), it was oleic. It was concluded that the fatty acids from torula yeast, grown on vinasse, being predominant in the ether extract (1.20 %) were linoleic, oleic, and palmitic.

Key words: yeasts, fatty acids, vinasse.

Most of the yeast species are capable of spreading in different media. However, *Candida utilis* is particularly fitted to these purposes, due to its capacity of assimilating hexoses and pentoses, besides other organic compounds, such as organic acids, alcohols, and aldehydes (Spencer *et al.* 1997 and Saura *et al.* 2008). Out of these advantages, a torula yeast production technology using distiller's vinasse as basic substrate was developed in Cuba.

It is considered that the substrate and, in particular, the nitrogen from the substrate affect the content of lipids from the yeasts (Bendová *et al.* 1991). If the nitrogen contribution is poor, the synthesis of lipids will be high. It can reach up to 60 % (Hsu 1961). Thus, the object of this study was determining the content of fatty acids (FA) from torula yeast, grown on distiller's vinasse.

Torula yeast (*Candida utilis*) was obtained through an aerobic fermentation process, with distiller's vinasse as substrate, from the industrial complex "Antonio Sánchez" of the Cienfuegos province, in Cuba.

In order to determine the profile of fatty acids, 500 g of torula yeast were collected and obtained from vinasse with 30 d of elaboration. The analysis was performed in the Department of Public Veterinary Health of the Institute of Nutrition, at the University of Veterinary Medicine of Vienna, Austria.

The sample was treated with toluene and chloroform (1:1 in volume). The extraction of lipids was performed by the original method of extraction by solvents of Bligh and Dyer (OBD), according to the adaptations of Schreiner *et al.* (2005). The methyl esters of the fatty acids were obtained from the total lipids by catalyzed acid transmethylation, according to the method of Christie (2003). The analysis was made by gas chromatography.

A capillary column RTX (25 m of length, 0.25 mm of internal diameter) was used. Hydrogen was used, with flow rate of 3 mL/min (heat pressure of 90 kPa). The temperature was of 170 °C for two minutes, followed by 5 °C/min and period of 220 °C. The final sustained

time was of 10 min. A flow injector of internal diameter was used at temperature of 250 °C.

The injection was performed through the use of a hot needle, according to the technique of thermo-spray temperature (Grob and Biedermann 2000). Solvent of additional flow was used by injection of 1 µL of the sample, before adding 0.8 µL of the solvent (toluene). The methyl esters of fatty acids were identified tentatively by comparison with the authentic standards (methyl heptadecanoate).

The ether extract (1.20 %) of the torula yeast grown on distiller's vinasse is low, according to Rodríguez *et al.* (2011). This figure shows the low contribution of the lipids from this protein source to its energy concentration. Figure 1 shows that the saturated fatty acids represented 35.24 %; the monounsaturated, 29.68 %, and the polyunsaturated, 35.08 % of the total of the fatty acids under study.

The profile of fatty acids is presented table 1. Among the saturated FA, palmitic acid (C16:0) was predominant, and represented 58 % within this group, and 21 % compared with the total FA. Oleic acid (C18:1n9) was the most representative (73 %) in the group of the monounsaturated FA. In respect to the total FA, it represented 22 %.

Linoleic acid (C18:2n6) was the most abundant (88 %) in the group of the polyunsaturated FA, and in the total of the FA (31 %). Also, linolenic acid (C18:3n3) was present. These acids are essential for birds, thus, they should be added to the diet, but with the inclusion of yeasts in the rates traditionally used, the requirements of these fatty acids (1%) are not fulfilled in the feeding of birds.

The amount of lipids in the different yeasts varied from 2 to 6 %, according to the strain (Carrillo 1971). Several works proved that the yeast (*Saccharomyces ssp.*) has a relatively low content, from 0.20 to 1.60 % (Fialho *et al.* 1985 and Lima *et al.* 1987). Other types (*Candida utilis* and *Rhodotorula gracilis*) also have

Fatty acids, %

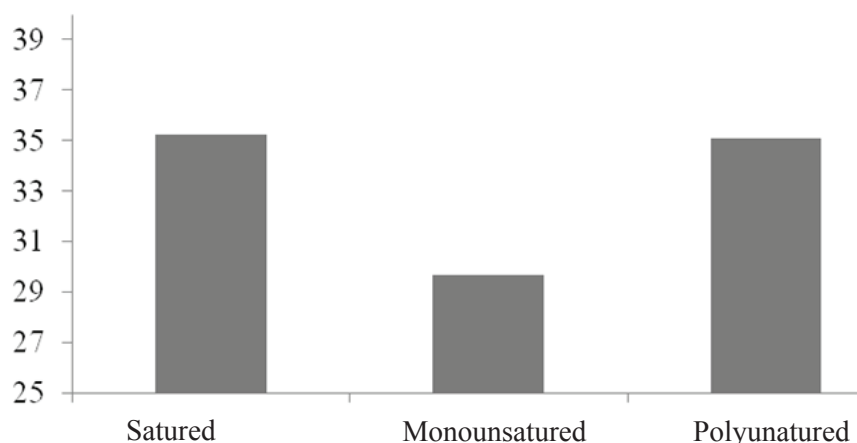


Figure 1. Percentage of fatty acids of torula yeast, grown on distiller's vinasse, depending on the degree of saturation (total, 2366 mg/100g)

Table 1. Profile of fatty acids of a sample of torula yeast grown on distiller's vinasse

Fatty acid	mg/100g	Fatty acid	mg/100g
C12:0	4.63	C16:1n9	0.62
C13:0	39.44	C17:1	45.42
C14:0	15.53	C18:1n9	512.70
C15:0	19.47	C18:1n7	26.55
C16:0	485.04	C20:1	2.89
C17:0	94.11	C22:1n9	1.76
C18:0	151.40	C18:2n6	729.41
C20:0	5.72	C18:3n3	90.74
C21:0	0.93	C18:3n6	2.23
C22:0	4.80	C18:4n3	0.30
C23:0	2.05	C20:3n6	3.99
C24:0	10.82	C20:4n6	0.60
C14:1	8.98	C20:5n3	2.17
C15:1	28.96	C22:6n3	0.84
C16:1n7	74.37		
Total fatty acids (mg/100g)		2366.47	

relatively low levels, from 0.70 to 0.75 % (Sales *et al.* 1977).

According to Nagar-Legmann and Margalith (1987) and Bendová *et al.* (1991), the yeasts used in ethanol production are not able of producing polyunsaturated fatty acids, such as linoleic and linolenic. However, they indeed produce palmitic and oleic. In this yeast, linoleic acid was the one with the highest concentration, which could be determined by the substrate, when considering they are able of acquiring fatty acids from the medium

(Resende and Alterthum 1986).

The results of this study agreed with those of Gutiérrez and da Silva (1993), who studied the composition of fatty acids from two yeasts grown on sugarcane molasses and found that linoleic and palmitic acids were those of highest concentration (837 and 801 mg/100 kg, respectively). These authors concluded that the content of fatty acids was affected by the type of molasses and the yeast species.

It was concluded that the fatty acids of the torula

yeast, grown on distiller's vinasse, predominating in the ether extract (1.20 %) were linoleic, oleic and palmitic.

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