Component Fatty Acids of *Aspergillus terreus* Fat

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ABSTRACT

The component fatty acids of the fat elaborated by *Aspergillus terreus* Thom, which was found to be a promising mold for the production of fat, have been studied. The fat has, based on gas liquid chromatographic evidence, 0.1% lauric, 1.9% myristic, 23.4% palmitic, 0.1% palmitoleic, 0.3% stearic, 14.1% oleic, 39.4% linoleic and 20.7% linolenic acids. The presence of large proportions of linoleic and linolenic acids suggests technological interest for the fat.

Though the production of fat through the agency of microorganisms has attracted attention, detailed analysis of the component fatty acids of only a very few microbial fats has been reported. During study of the fat-forming capacities of a selection of fungi, Singh and Sood (1) observed that *Aspergillus terreus* Thom gave a very high yield of fat (51.0%) when grown on an inorganic medium containing sucrose as the carbon source. It was considered of interest to determine the fatty acid composition of the fat produced by *Aspergillus terreus*.

MATERIAL AND METHODS

Cultivation of the Mold

Aspergillus terreus Thom 309 was the subculture of the mold obtained from Indian Agriculture Research Institute, New Delhi. It was maintained and cultivated according to the method reported by Singh and Sood (1). The synthetic medium used for cultivation contained (in grams per liter): sucrose, 150; $NaNO_3$, 4.780; $ZnSO_4 \cdot 7H_2O$., 0.050; $FeCl_3 \cdot 6H_2O$, 0.160; K_2SO_4, 0.440; $MgSO_4 \cdot 7H_2O$, 5.000; $NaH_2PO_4 \cdot 2H_2O$, 7.300. The mold was harvested at the end of 10 days, which was found earlier (2) to be the optimum period for maximum fat formation. The mycelium obtained was given a number of washings with distilled water to remove adhering sucrose and was then dried.

Extraction of Total Lipids

The dry mycelium of the mold was ground with mortar and pestle to a very fine powder and the total lipids were extracted, purified and dried according to the method reported by Folch et al. (3). Chloroform-methanol 2:1 v/v was used for extraction of lipids and 0.58% sodium chloride solution was used for removing the water soluble impurities.

Preparation of Methyl Esters

Methyl esters were prepared from 60 mg of the dry lipid, and isolated by the method of Luddy et al. (4), utilizing .4N sodium methylate for methyl ester formation.

Gas Liquid Chromatography of Methyl Esters

The AIMIL Model II gas chromatograph with flame ionization detector (2 m column, 6 mm ID, packed with 15% [w/w] diethylene glycol succinate [DEGS] on celite) was used for the separation of methyl esters of fatty acids. The instrument was operated at 180 ± 1 C with a gas flow rate of 35 ml/min. The fatty acids were identified from their retention times and their respective peak areas were directly converted to relative percentages.

RESULTS AND DISCUSSION

The component fatty acids of the fat elaborated by *A. terreus* Thom have been shown and correlated with the component fatty acids of the fats produced by *P. javanicum*, *T. utilis* and *P. flavo-cinereum* in Table I. Data obtained from the analysis of rubber seed oil is also shown for comparison with the figures relating to microbial fats, rich in linoleic acid.

The content of hexadecenoic acid in *A. terreus* fat is very low (0.1%). This is in harmony with the concept that an increase in the reserve fat content of a microorganism is accompanied by a decrease in the hexadecenoic acid content of the fat.

The proportion of linolenic acid in microbial fats is usually very low. Singh et al. (5) reported the linolenic acid content of *P. flavo-cinereum* fat to be 0.8%. The corresponding value for *T. utilis* fat was found by Reichert (6) to be 4.4%. In *A. terreus* fat the proportion of linolenic acid is very high (20.7%), and in this respect it resembles rubber seed oil (7).

The combined proportion of linoleic and linolenic acids

TABLE I

Component Fatty Acids of *Aspergillus terreus* Fat Compared to Those of Fats from Other Microorganisms and Rubber Seed Oil

	Per cent				
Microorganism investigator	*A. terreus* (present investigation)	*P. javanicum* (Ward and Jamieson [8])	*T. utilis* (Reichert [6])	*P. flavo-cinereum* (Singh et al. [5])	Rubber Seed Oil (Gunstone and Hilditch [7])
Total lipids in product	51.0	11.0	6.4	31.3	40.0
Component acids in fat					
Lauric	0.1	---	---	---	---
Myristic	1.9	---	0.3	0.3	---
Palmitic	23.4	23.4	7.9	19.4	10.6
Stearic	0.3	9.4	3.8	9.9	11.5
Arachidic, Behenic, Lignoceric	---	0.8	0.2	0.7	1.0
Palmitoleic	0.1	---	7.6	1.5	---
Oleic	14.1	34.6	21.5	39.4	17.2
Linoleic	39.4	31.8	49.7	27.1	35.8
Linolenic	20.7	---	4.4	0.8	23.9
Unsaturated C_{20-22}	---	---	---	0.9	---

in *A. terreus* fat is 60.1%, which apparently exceeds the requisite proportion of 55% of mixed linoleic and linolenic acids for a good drying oil. The presence of large proportions of linoleic and linolenic acids in *A. terreus* fat is of great technological interest since it induces rapid drying and produces film of considerable toughness, which is of great advantage to the paint industry.

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