



Research Article

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Composition and application of fungal oil

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ABSTRACT

Single cell oil have been researched many years, the paper introduced the advantage of microorganism which can produce the lipid, analysis the Comparison of fatty acids from the fungal oil, summarizing the use of fungal oil in the food industry ,the bio-energy etc. in the future.

Keywords: fungal oil, polyunsaturated fatty acid, Comparison of fatty acids

INTRODUCTION

Single cell oils might be defined as the edible oils obtainable from microorganisms being similar in type and composition to those oils and fats from plants or animals. in a world it is extracted from microorganisms, such as ARA, DHA. both fatty acids are mainly produced by US Martek corrently. They are usually used to be added in infant food for required nutritions. At the same time, it has been demonstrated that single cell oils can be transformed to FAME (fatty acid methyl esters) by means of both enzymatic and inorganic catalysis and used in bio-energy[1] [2], [3].

1 The advantage of microorganism which can produce the lipid

1.1 The use of microbes as feedstock for biodiesel has advantages such as their short life cycle, requires less labor and lower land resources, are easier to scale up, and are less affected by venue, season or climate [4].

1.2 Microbial growth is rapid reproduction, strong adaptability, short growth cycle, easy to culture and variety improvement .Source of microbial growth required raw materials are very abundant and cheap, microbe can make use of agricultural and sideline products, food processing, paper industry waste (such as whey, molasses, saccharification) as medium material, the process is very conducive to waste recycling and environmental protection [5].

1.3 Microbe have the ability of oxidation, desaturation hydrogenation and can improve the structure of PUFAs, and the formation of oil and other products such as protein, vitamins, antioxidants, etc.

1.4 The medium product composition varies greatly with the characteristics of different strains, microbe is suitable for the development of some functional oil. Compared with soybean oil, palm oil, sunflower oil, oil products, microbial oil higher nutritional value; it contains fatty acids which cannot be synthesized by plants and animals, such as gamma γ -Linolenic acid (GLA), linoleic acid, arachidonic acid (ARA), Eicosapentaenoic acid (EPA) and Docosahexaenoic Acid (DHA) etc.. Oleaginous microbial grease composition is characteristics [6],[7].

1.5 Microbial oils of PUFA can be used as functional food, and other large amounts of fatty acids can be developed as a new microbial biodiesel, biomass energy.

2 Comparison of fatty acids

At present already it is reported that a lot of microorganisms can produce oil, summarizing fatty acid composition in the table.

Table1. Comparison of fatty acids in different microbial cells

strain	Oil content (%)	palmitic acid (16:0)	palmitoleic acid (16:1)	Stearic acid (18:0)	oleic acid (18:1)	linol(e)ic acid (18:2)	Linolenic acid (18:3)
yeast							
<i>Cryptococcus albidus</i>	65	16	1	3	56	—	3
<i>Yarrowialipolytica</i>	32-36	11	6	1	28	51	1
<i>Rhodospidiumtoruloides</i>	72	24.3	1.1	7.7	54.6	2.1	—
<i>Cryptococcus albidun</i>	58	25	—	10	57	7	—
<i>Lipomyceslipofera</i>	64	37	4	7	48	3	—
<i>Lipomyces</i>	63	34	6	5	51	3	—
<i>Rhodotorula mucilaginoso</i>	72	37	1	3	47	8	—
<i>Rhodospidium toruloides</i>	66	18	3	3	66	—	—
<i>Rhodotorula glutinis</i>	56	34.31	3.8			2.00	10.20
<i>Trichosporon pullulans</i>	65	15	—	2	57	24	1
mold							
<i>Tolyposporium</i>	41	7	1	5	81	2	—
<i>Clavicepspurpurea</i>	31~60	23	6	2	19	8	42
<i>Asoergullus terreus</i>	57	23	—	—	14	40	21
<i>Rhizopus arrizus</i>	26	18	—	6.6	31.6	32.8	4.6
<i>Tolyposporium</i>	41	7	1	5	81	2	—

In fungal, the high content of oil is in yeast cells, add to some characteristics of yeast, the yeast is more suitable for oil production. The fatty acid composition of yeasts and moulds are similar, the content of palmitic acid and oleic acid is higher than other fatty acid content [8].

3 The use of Fungal oil

Fungal oil with polyunsaturated fatty acid (PUFAs) on the development of the most attention, PUFAs has many physiological function [9], so they are widely used in the food (food nutrition fortifier, functional factor), medicine, chemical (cosmetics) feed industry etc [10].

3.1 Application of fungal oil in food field

Fungal oil contain a lot of fatty acid, including ARA and DHA, which are important in period of human brain growth occurs during the last trimester in utero and during the first 12 months of postnatal life. So many kind of milk are added to ARA and DHA, because It was also found that the single cell oil production by oleaginous Fungal has many advantages due to their fast growth rate, high oil content and the resemblance of their triacylglycerol fraction to plant oil [11].

3.2 Application of fungal oil in the petrochemical field

In the past years, biodiesel, which is biodegradable, can be used without modifying existing engines, and produces less harmful gas emissions such as sulfur oxide has received increasing attention because of the environmental pollution and energy crisis worldwide. It has been reported that bio- diesel reduces net carbon dioxide emissions by 78% on a life-cycle basis when compared to conventional diesel fuel. Biodiesel can be produced by transesterification of triacylglycerols from renewable biomass (single cell oils), yielding monoalkyl esters of long-chain fatty acids with short-chainalcohols. Biodiesel come from various animal, vegetable oil by esterification or transesterification process, while the majority of microbial oil composition is similar to vegetable oils in general, including C16 and C18 fatty acids, such as oleic acid, palmitic acid, linoleic acid and stearic acid, therefore the microbial oil can substitute vegetable oil to produce biodiesel, due to technical and economic reasons, in the past single cell oil few large-scale production was reported, but with the development of fermentation microbial oil industrial, more and more new progress was made in single cell oil which will be used to produce biodiesel[12].

3.3 Application of fungal oil in cosmetics area

PUFAs play a important role in caring the skin, promoting hair growth, can add to the beauty in washing cosmetics of some natural oils and fats, there is nutritional protective effect of ARA and GLA to the skin. Such as Nioxin bionutrient cleanser which contain some of ARA and GLA.

3.4 Application of fungal oil in health care

Functional oils consist of triglyceride, including oil other nutritional elements such asVE, phospholipids, sterols and other lipids, which have certain function it is beneficial to human health. Fatty acids are defined as compounds that are composed of long chains of carbon and hydrogen atoms (referred to as hydrocarbon molecules) containing a

carboxylic acid moiety at one end (a carboxylic acid is written –COOH). See the structure of the 16 carbon fatty acid, palmitic acid, in the Figure below. When fatty acids donate their hydrogen ion, which occurs readily at physiological pH, the hydroxyl group (–OH) is negatively charged. The numbering of carbons in fatty acids begins with the carbon of the carboxylic acid group [13].

The clinical significance of omega fatty acids lies primarily in the role they play in inflammatory events in the body. Indeed, the interplay between pro-inflammatory molecules derived from omega-6 PUFAs and the anti-inflammatory actions of molecules derived from omega-3 PUFAs underlies the significant cardiovascular benefits attributable to increasing ones consumption of omega-3 PUFAs while at the same time decreasing consumption of omega-6 PUFAs. The typical Western diet rich in animal fats and partially hydrogenated vegetable oils contributes to the high ratio of omega-6 PUFAs relative to omega-3 PUFAs found in cellular lipids.

While it is not the intention of this discussion to cover the science of omega PUFAs in detail, it is important to have a basic understanding in order to fully appreciate the significant clinical benefits that can be gained from simple changes in ones dietary habits or supplement intake.

4. Method of fungal oil extraction

4.1 Soxhlet extraction

The cells in the cultures were collected and washed three times by entrifugation at 5000×g and 4°C with sterile saline water. The washed cells were dried at 80°C until their weight was constant. The total lipids in the cells were extracted according to Folch et al. [14]. The method is simple, which need not the expensive equipments.

4.2 Supercritical-CO₂fluid extraction

The cells in the cultures were collected and washed three times by centrifugation at 5000×g and 4°C with sterile saline water. The washed cells were dried at 80°C until their weight was constant. The cells were grinded, in the suitable temperature and pressure the equipment of Supercritical-CO₂fluid.

The purity of fungal oil by supercritical-CO₂fluid extraction was high [15].

4.3 Organic solvent extraction

The cells in the cultures were collected and washed three times by centrifugation at 5000×g and 4°C with sterile saline water. The cell precipitation was added chloroform, the ratio was per gram cell to 3mL chloroform and methanol, Oscillating and mixing with 2 minute, adding to 1mL chloroform after Oscillating and mixing with 2 minute, adding 4mL Sodium chloride, centrifugation at 5000×g for 5 minute, extraction the chloroform layer, removing chloroform to obtain oil[16].

4.4Acid-heating extraction

The cells in the cultures were collected and washed three times by centrifugation at 5000×g and 4°C with sterile saline water. precipitation is added 6mL 4mol/L hydrochloric acid per gram, mixing and placing at room temperature for 30min, and boiling water bath for 3min, fast cooling at -20°C, adding to 1mL chloroform after Oscillating and mixing with 2 minute, adding 4mL Sodium chloride, centrifugation at 5000×g for 5 minute, extraction the chloroform layer, removing chloroform to obtain oil [17].

CONCLUSION

Fungal oil contain a lot of PUFAs which is important material in food and other area, with research on fungal oil, it will have more function and uses.

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