# Harmonizing Humanity and Nature: Exploring Economical Feedstock for Oleaginous Fungi Aiming Sustainable Biofuel Solutions

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## Abstract

Lipids from oleaginous fungi show great promise for biofuel production as their production neither require agricultural land nor create any unwanted competition between food and fodder, also it doesn't need a particular wavelength of light for growth like alga and hence are favorable feedstock for biofuel production. Oleaginous organisms produce microbial oils, known as single cell oils (SCOs). Although SCO from filamentous fungi shows promise for biodiesel production, the main hurdle is high production cost. It has been reported that up to 75% of the total costs came from the feedstock's or carbon sources required for producing microbial lipids.

In the current work, study was performed simultaneously on optimized synthetic nutrient media and natural media to screen potential economical media for enhance microbial oil production, using two filamentous fungi of Aspergellious sp. (previously screened by our lab & identified).

In the process pulp were strained from rotten fruits and juice was collected after centrifugation. After autoclaving, chloramphenicol was added to fruit juice at room temperature under sterile conditions. The natural media so obtained, was inoculated with fungal culture and placed in incubator shaker (30°C, 180 rpm) for incubation (5 days) to generate inoculum. Further study was performed on lab scale bioreactor (working volume- 3 L), under controlled fermentation conditions. Biomass harvesting, lipid extraction and conversion to FAME was done using amended standard procedures.

Lipid was characterized by FTIR studies which clearly indicated that the extracted lipid was a fatty acid. The IR band (around 722 cm-1) in finger print region also confirms that the fatty acids produced are having 'cis' distributed olefins. GC analysis of FAME confirms that both the isolates are producing similar kind of fatty acid chain, namely, Palmitate (C16:0), Stearate (C18:0), Oleate (C18:1 (c9)), Linoleate (C18:2 (c9, c12)). The study thus shows that the change in media composition (chemical to waste fruit) and mode of fermentation (shake flask to bioreactor) does not affect the lipid composition, though some alteration in concentration was observed. Also, the unsaturation is not very high in the extracted microbial lipid which makes it a suitable precursor for biodiesel. Idea of using juice from rotten fruits as nutrient media was unique in the study. The components used in synthetic media are costly so to reduce the production cost of SCO, & thus biodiesel, fruit juice from rotten fruits is good option as substrate or media for growing oleaginous fungus. It was found that the fungus was capable of growing on fruit juice (natural media) without the need of any external nutrient supplement. On optimized synthetic media, maximum lipid yields obtained were 31.5% for A-6, and 40.9% for A-Soil fungi. When grown on rotten fruit juice (an economical natural media) without any external nutrient supplement, A-6 yielded 37-61% and A-Soil gave 46-61% microbial lipids.