World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:9, No:10, 2015

Single Cell Oil of Oleaginous Fungi from Lebanese Habitats as a Potential Feed Stock for Biodiesel

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Abstract : Single cell oils (SCOs) accumulated by oleaginous fungi have emerged as a potential alternative feedstock for biodiesel production. Five fungal strains were isolated from the Lebanese environment namely Fusarium oxysporum, Mucor hiemalis, Penicillium citrinum, Aspergillus tamari, and Aspergillus niger that have been selected among 39 oleaginous strains for their potential ability to accumulate lipids (lipid content was more than 40% on dry weight basis). Wide variations were recorded in the environmental factors that lead to maximum lipid production by fungi under test and were cultivated under submerged fermentation on medium containing glucose as a carbon source. The maximum lipid production was attained within 6-8 days, at pH range 6-7, 24 to 48 hours age of seed culture, 4 to 6.107 spores/ml inoculum level and 100 ml culture volume. Eleven culture conditions were examined for their significance on lipid production using Plackett-Burman factorial design. Reducing sugars and nitrogen source were the most significant factors affecting lipid production process. Maximum lipid yield was noticed with 15.62, 14.48, 12.75, 13.68 and 20.41g/l for Fusarium oxysporum, Mucor hiemalis, Penicillium citrinum, Aspergillus tamari, and Aspergillus niger respectively. A verification experiment was carried out to examine model validation and revealed more than 94% validity. The profile of extracted lipids from each fungal isolate was studied using thin layer chromatography (TLC) indicating the presence of monoacylglycerols, diaacylglycerols, free fatty acids, triacylglycerols and sterol esters. The fatty acids profiles were also determined by gas-chromatography coupled with flame ionization detector (GC-FID). Data revealed the presence of significant amount of oleic acid (29-36%), palmitic acid (18-24%), linoleic acid (26.8-35%), and low amount of other fatty acids in the extracted fungal oils which indicate that the fatty acid profiles were quite similar to that of conventional vegetable oil. The cost of lipid production could be further reduced with acid-pretreated lignocellulotic corncob waste, whey and date molasses to be utilized as the raw material for the oleaginous fungi. The results showed that the microbial lipid from the studied fungi was a potential alternative resource for biodiesel production.

Keywords : agro-industrial waste products, biodiesel, fatty acid, single cell oil, Lebanese environment, oleaginous fungi
Conference Title : ICBT 2015 : International Conference on Biotechnology
Conference Location : Chicago, United States
Conference Dates : October 08-09, 2015