Enhancement of Lipid Content in *Chlorella* sp. by Providing Stress Conditions during Cultivation

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Lipids from microalgae are renewable source of biofuels. Large amounts of algal biomass are produced under optimal growth conditions with relatively low lipid content. However, they have potential to accumulate high amount of lipids under stress conditions. This study was aimed to enhance the lipid content of *Chlorella* sp. by providing stresses such as deficiency of nitrogen and zinc and excessive salinity during cultivation. Bold's Basal Media (BBM) was used as the culture media. Two control sets were used; one set cultured by adding appropriate amount of BBM and other set cultured by adding 3 times of BBM. Five sets each of three treatments and two controls were maintained in batch reactors arranged randomly. Light intensity was kept constant. Photo period cycle was followed to optimize microalgae growth. Air spargers were applied for uniform mixing. From the beginning, all samples were grown under the same conditions with adding appropriate amount of BBM except two batches; Zn stressed batch which was maintained without adding Zn from the beginning and the second control which was added with 3 times of BBM. After 7 days, stresses were introduced to the remaining batches except controls and Zn stressed batch. N stressed set was maintained without adding N. Salinity stress set was treated with extra amount of NaCl (2 M). One set from each treatment/ control was harvested on 4th, 8th, 11th, 14th and 17th day of cultivation. Maximum optical density was achieved after 14 days. Harvested biomass was dried and lipids were extracted from dried biomass using chloroform: methanol (1:1) mixture. Lipid content of stressed samples increased, compared to control samples (highest was 16.9%). Zn stressed samples achieved highest lipid percentage (highest was 23.3%). After certain period of time (14th day), lipid content of stressed samples decreased. Gas chromatographic analysis of the lipid identified the major fatty acids such as C11:0 (4.6%), C18:0 (35%), C18:2 (30%) and C21:0 (6%). Therefore, lipid content can be increased significantly by providing stresses during cultivation and zinc deficiency was found to be more effective than other stress conditions studied to enhance the lipid content of *Chlorella* sp.

Keywords: Algal lipids, Biofuel, Microalgae, Stress conditions