BIODIESEL AND BIOETHANOL PRODUCTION FROM THE TERRESTRIAL ALGAE AND THEIR BYPRODUCTS

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Algae are single to multicellular photosynthetic organisms generally found in soggy or wet places of all types of water bodies (Wagner, 2007). Algae-based biofuels are technically and economically viable, cost competitive and mitigate atmospheric CO₂ (Medipally et al., 2015). Extracted oil after transesterification and few alkaline wash, gives biodiesel which can be used by blending with petro diesel (Abishek et al., 2014). Microalgae biodiesel solves the major drawbacks associated with oil crops and lignocellulotic-based biofuels. Biodiesel has many advantages like biodegradable, nontoxic, doesn’t compete with food and it has lower emissions of greenhouse gases (Demirbas, 2008). Hence the study was conducted with following objectives

- Isolation and biochemical characterization of the high oil and biomass yielding algae.
- Study of the effects of waste water on algal growth.
- Standardization of ethanol production by algal biomass.
- Study of biodiesel production from algal lipid extracts.

In this study around 62 terrestrial algae were collected from the fresh water bodies of in and around of the Western Ghats regions. These collected algae were identified based on microscopic and biochemical characteristics (Sushanto et al., 2015). Out of these only 7 samples of high oil content and biomass yielding samples were identified and used for multiplication and fermentation study. Maximum oil content found in the sample collected from the Dandiganahalli was 43±0.75 % and minimum fond in the Kerveshe was 2.15±0.5 %. Multiplication of algae was done by open ponds production system and closed photobioreactor system (Brennan and Owende, 2010; Surendhiran and Vijay, 2012; Vasudevan et al., 2012 and Zhu et al., 2013). In closed photobioreactor system with sparger developed for continuous agitation in a BB media. Bioremediation of waste water using high biomass yielding terrestrial algae was performed in open pond production system. In open ponds production system four types of treatments viz, normal tap water, water with nutrient supplements, R.O residual dispensed water with pH 8.5 to 9.0 and urban waste water was used. All collected and characterized seven algae samples have showed good response to various water treatments. Algae were harvested by filtration and centrifugation methods (Surendhiran and Vijay, 2012 and Udhaya et al., 2014). The left water may be used for multiple purposes like culturing same algae, irrigation, dust control, construction purpose etc. In addition, the higher oil containing collected terrestrial algal biochemical composition was documented. The study shows algal oil can be easily converted into biodiesel by transesterification process (Chisti, 2007; Stergiou et al., 2013 and Saber et al., 2016). Bioethanol production study was attempted by anaerobic fermentation using defatted algal residues. The defatted algal residue was acid hydrolyzed with 2.5N HCl and was neutralized with Na₂CO₃. This hydrolyzed residue was used as substrate for fermentation using 5% of Saccharomyces cerevisiae inoculum. In fermentation setup every three days interval biochemical components viz, percent alcohol (Williams et al., 1950), total soluble sugars, total reducing sugars, proteins (Lowry et al., 1951), pH, organic acids, microbial load and brix were estimated and used for standardization of fermentation time. The final anaerobic fermentation biochemical estimate for percent alcohol maximum was 61.76±1.12% and minimum was 57.51±0.99, total soluble sugars initially was 35.54% during fermentation finally reached to 13.53%, total reducing sugars initially was 25.27 ± 0.12% during fermentation finally reached to 16.60 ± 0.36 , proteins was high in the sample collected from Ikola 2.83mg/g , pH was initially 7.5 and finally 6.23, organic acids of oxalic acid as maximum 7.93 and minimum 1.9 acidity, microbial load initially low and it very high on 12th day of fermentation and minimum and brix was maximum 8.26 and minimum was 6.53.

The maximum alcohol was observed at 21st days after fermentation in sample collected from Kaggodu. During the process of fermentation, sugars from defatted algal residue are broken down and converted into ethanol by Saccharomyces cerevisiae.
Where a = Normal tap water, b = water with nutrient supplements (BB medium), c = R.O residual dispense water, d = urban waste water and 1,2,3,4,5,6,7 were algae samples from Ikola, Gadanahalli, Happanadka, Hoovnalli, Kaggodu, Dandiganahalli and ACH campus respectively.