Summary of

MINOR RESEARCH PROJECT

Entitled

TO EVALUATE THE BIOFUEL POTENTIAL OF LOCAL ALGAL ISOLATES

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The Western Ghats are one of the major biodiversity hotspots of the world, spread across the southern states of India. It is believed to comprise 23% of the Indian biodiversity, however, algal biodiversity being unaccounted for (Mohammed et al., 2013). Mohammed et al., (2013) reported that the growth of microalgae is best seen immediately post monsoon, followed by the pre-monsoon period, with least growth seen during monsoons.

The coastal region of Karnataka, India, at the foothills of Western Ghats with abundance of sunshine and heavy monsoon, is a rich source of algal diversity many of which could be utilized for their high value bio-products. The coastal town of Mangalore provides adequate environmental conditions necessary to facilitate good growth of freshwater as well as marine phytoplankton. Its close proximity to various freshwater and saltwater bodies, along with ideal temperature conditions allow it to be an ideal geographical location to facilitate the study and culture of algae. Mangalore is also home to many small scale industries. Algal culture and production might be a potential future industry for this region.

Our Institute is situated along the coast and has easy access to local water bodies for easy collection of such algae. The work is focused on assessing isolates of micro algae for their biofuel potential and high value bio-products.

The Laboratory of Applied Biology began its interest in algal biomass production in the year 2011. We have been involved in collection of algae from various sources, both terrestrial and aquatic. The microalgae were collected from the local water bodies and temporary ponds during the post monsoon months.

The isolated monocultures have been upscaled upto 5L in aquariums and an attempt is made to grow the cultures under natural illumination. The potential of microalgae to efficiently use inorganic Carbon source, CO_2 to generate biomass that could be exploited for biofuel production caught our interest.

The objective of this study is to evaluate the biofuel potential of local algae.

Methodology:

- Collection
- Isolation and Identification (pure cultures from mixed cultures)
- Harvesting and collection.
- Extraction and analysis of lipids & high value products
- Laboratory condition scale up of biomass of algae of interest
- Large scale cultivation.

Local sampling sites was chosen where microalgae frequently undergo adverse conditions.
Dilution series in growth medium provide the simplest, most cost-effective and fastest method;
Nile red staining of near stationary cultures followed by visual inspection provides a simple and rapid screening for algae with high lipid accumulation ability; Identification
A standardized growth assay in the laboratory can provide comparative data on lipid and value products productivity; Algal cells are separated from culture media by filtration, flocculation or centrifugation, followed by drying to improve extraction.
Parameters can be directly optimized under outdoor conditions using mid-scale cultures as these are often very different to small-scale laboratory conditions.
Cultivation and Biomass production.
The best candidate strains with potential for lipid production was then used to optimize parameters for rapid growth, lipid induction, harvesting/dewatering and extraction.
Selection of fast-growing, productive strains, optimized for the local climatic conditions particularly for value products such as lipids, pigments, proteins etc. The isolated microalgae were subjected to growth analysis to order to determine the onset and lengths of their exponential and stationary phases. Post this, they were subjected to alteration of various parameters of their growth medium so as to observe the effect of the variations on their growth. The effects of differing compositions of urea on growth was determined. The effect of Vitamin B12 on growth was determined. Further work to be investigated includes the effect of different wavelength of light on growth, protein and lipid production as well as the effects of different salts on the protein and lipid profiles.
Molecular identification
The species thus isolated were further subjected to DNA extraction in order to facilitate confirmation of identity using molecular techniques. Various DNA isolation protocols were performed with and without the utilization of kits.
Simultaneously, upscaling of the microalgal species are being conducted in order to address the feasibility concerns of microalgal mass production.

Challenges

Cost - Capital and operations
Low-cost operational design for scaling up the mass is in progress.
Productivity
Efficiency
Photosynthesis limitations.