HABIB PUBLIC SCHOOL

ALUMNI ASSOCIATION

# UTILIZATION OF MICROALGAE BIOMASS

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Pakistan's current population is 229 million and is expected to double in the next 36 years. Pakistan having less than 1% share in the world energy consumption, meets its energy demands through imported and indigenous resources, with a major portion of using petroleum based derived fuels.

According to Integrated Energy Planning for sustainable Development (IEP) report published by Ministry of Planning, Development & Special Initiatives Government of Pakistan (2021), the statistical data showed that final energy consumption in Pakistan increased from 12 M toe in 1986 to 5217 toe in 2020, with a 4.4% annual compound growth rate.

Therefore, it is important to look for alternative fuel to reduce dependence on imported crude oil with an expenditure of large amount of foreign exchange. As per Pakistan Bureau of Statistics (PBS), petroleum import bill hit a record high of $11.69 billion in the first seven months (July to January) 2021-22 mainly due to a surge in energy prices in the global market and partly due to a pickup in demand in the country.

Therefore, looking at the renewable energy resources to reduce dependence on imported petroleum crude oil and fossil fuels, biomass from plant source is a potential feedstock to produce liquid, gaseous and solid biofuels. Biofuels are biodegradable and environment friendly in nature and help in mitigating climate change and global warming issues with reduced emissions of greenhouse gases (GHGs).

These biofuels are a source of renewable energy and can be used directly in the existing internal combustion engines without any modifications. The major biomass sources include agricultural residues, non-edible vegetable oil seed crops and microalgae. Oil can be extracted from these feedstock to produce biodiesel fuel for diesel engines through transesterification method, while the solid biomass residue can be utilized to produce bio-gas by anaerobic digestion process and bio-ethanol fuel for gasoline engines is made from the microbial fermentation process.

Microalgae is a unicellular marine or aquatic microorganisms (Phytoplankton), which is getting importance in the last few decades as a promising feedstock for biofuels production due to its higher biomass productivity rate than terrestrial crops.

It helps in Carbon dioxide (CO2) sequestration for its growth cycle through photosynthesis process, thus mitigating climate change/global warming issues and gives us oil to produce biodiesel and other valuable products. It can be cultivated in open ponds, raceway ponds and closed photobioreactors depending upon the availability of the area. Microalgae culture needs essential nutrient resources such as carbon dioxide (CO2), Nitrogen (N), Phosphorus (P), Potassium (K), and other nutrients for its growth production.

Therefore, microalgae can be cultivated from domestic wastewater utilizing the nutrients present in it for its growth and simultaneously treats wastewater by removing organic and inorganic pollutants. Microalgae cultivation on marginal land helps in reclamation of uncultivated land, according to Soil Survey of Pakistan 1.78 million hectares are considered as severely saline, that can be used to cultivate marine microalgae species.

Microalgae oil productivity rate is higher 58,700 litres/hectare as compared to non-edible vegetable seed crop (Jatropha) 1892 litres/hectare per year. Moreover, proceeding with ecological sustainable approaches for microalgae cultivation on marginal land and domestic wastewater to obtain biomass as a feedstock for biofuels generation reduces its production cost. Moreover, microalgae cultivation using domestic wastewater instead of fresh water and sustainable approaches to capture CO2 from the atmosphere thus helps in complying with the UN's Sustainable Development Goals.

The microalgae biomass obtained after harvesting from wastewater is used for biofuels production, whereas the treated wastewater becomes safe for irrigation purpose of non-edible crops and tree plantation. Green liquid and gaseous fuels like biodiesel, bioethanol and biogas are produces from microalgae biomass, while the leftover microalgae solid residue after oil extraction and fermentation processes can be utilized as a solid biofuel or can be used as a natural organic fertilizer (Compost) to improve soil quality with better crop yield.