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Potential of Treated Dairy Waste Water for the Cultivation of Algae and Waste Water Treatment by Algae

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Abstract:
Algae (singular Algae) is a term that encompasses many different groups of living organism. Algae capture light energy through photosynthesis and convert inorganic substances into simple sugar. Algae made up of eukaryotic cells and range from single cell to multicellular organisms. All algae have plastids, with chlorophyll that carry out photosynthesis, but various lines of algae can have different combinations of chlorophyll molecules; some contained chlorophyll A, some possess Chl. A-B and A-C. These are the most robust organism on earth, able to grow in a wide range of conditions . Algal strains, diatoms, and cyanobacteria have been found to contain proportionally high levels of lipids (over 30%). Ajmer Milk Dairy treated waste water was further treaded by Algae. Treatment level of waste water determined by estimation of ammonia, Nitrate, Phosphorous, DO (Dissolved oxygen) and BOD (Biological Oxygen Demand). The growth pattern of algal samples were observed by chlorophyll estimation ,Biomass Estimation (Dry weight) method. Algae are an important bioremediation agent and are already being used by many wastewater facilities. The treated dairy waste water are used for algal growth and final product of algal growth are used as a biomass for biofuel production and this treated dairy waste also treated by that algae and use in further many work such as in agriculture, other industrial process.

Keyword: Algae Cultivation, Waste Water, Biofuel, Waste Water Treatment.

1.0 Introduction:
Algae (singular Algae) is a term that encompasses many different groups of living organism. Algae capture light energy through photosynthesis and convert inorganic substances into simple sugar using the captured energy. Algae range from single – celled organism to multicellular organisms, Algae are made up of eukaryotic cells. These are cells with nuclei and organelles. All algae have plastids, the bodies with chlorophyll that carry out photosynthesis. But the various strains of algae have different combinations of chlorophyll molecules. Some have only Chlorophyll A, some A and B, while other strains, A and C Algae biomass contains three main components: proteins, carbohydrates, and natural oil. While the percentages vary with the type of algae, there are algae types that are comprised of up to 40% of their overall mass by fatty acids. It is this fatty acid (oil) that can be extracted and converted into biodiesel (Byung-Hwan Uma et al., 2009).

Most of algal species are obligate phototrophs and thus require light for their growth. Several cultivation technologies that are used for production microalgal biomass have been developed by researchers and commercial producers. The phototropic microalgae are most commonly grown in open ponds and photobioreactors . The open pond cultures are economically more favorable, but raise the issues of land use cost, water availability, and appropriate climatic conditions. Further, there is the problem of contamination by fungi, bacteria and protozoa and competition by other microalgae. Photobioreactors offer a closed culture environment, which is protected from direct fallout, relatively safe from invading microorganisms, where temperatures are controlled with an enhanced CO2 fixation that is bubbled through culture medium. This technology is relatively expensive compared to the open ponds because of the infrastructure costs (Patil et. al.,2008).

Algal strains, diatoms, and cyanobacteria have been found to contain proportionally high levels of lipids (over 30%). The following species listed are currently being studied for their suitability as a mass-oil producing crop, across various locations worldwide:(Becker, 1994) *Gracilaria, Chlorella, Sargassum, Neochlories oleoabundans, Pleurochrysis carterae, Prymnesium parvum* (a toxic algae),*Tetraselmis chui* ,*Tetraselmis suecic* . While a number of methods are currently being used for sewage treatment and industrial waste water treatments at sewage treatment plants (STP) effluent treatment plants (ETP), these are very expensive methods that rely on high- cost chemicals and heavy inputs of energy. Waste water treatement by algae has been a more cost effective way to remove biochemical oxygen demand, pathogens, phosphorus and nitrogen and other pollutents (Oilgae, 2010).

Municipalities and industries the world over are exploring bioremediation as an important route by which to treat waste water . Bioremediation uses naturally occurring microorganisms (microalgae) to treat wastewater of its nutrients. This method provides an economical and environmentally sustainable and effective treatment method. Algae are an important bioremediation agent, and are already being used by many wastewater facilities. Algae based wastewater treatment system it is essential to consider both Wastewater treatment as well as algal cultivation. these parameters BOD reduction, TDS reduction, pH, Nitrogen removal rate and Phosphorus removal rate are commonly considered for wastewater treatment (Oilgae, 2010)

For industries and companies both large and small keen on exploring the potential of using algae for bioremediation of waste water and sewage. Good treatment of wastewater by algae requires good growth of algae.While a diverse range of industries will benefit from this report, specific industries that will benefit most from the report are Meat and Poultry, Pulp and Paper, Textiles Dyeing, Metal Finishing, Dyes & Pigments ,Pharmaceutical, Food & Dairy, Biotechnology, Starch & Cellulose, Pesticides & Insecticides, Chemical & Drug Formulation Units, Fertilizers, Photography (Oilgae, 2010).

Using algae has been shown to be a more cost effective way to remove biochemical oxygen demand, pathogens, phosphorus and nitrogen than activated sludge against the traditional waste water treatment processes at ETPs (effluent treatment plants) which involves high energy costs of mechanical aeration to provide oxygen to aerobic bacteria to consume the organic compounds in the waste water. Oil from microalgae can easily be converted to biofuels such as biodiesel through the same technology used with oil from oil seeds which is currently used to convert vegetable oil to biodiesel (transesterification is the main conversion process). In addition, it is possible to hydro- treat the algae oil to produce other fuels such as JP-8 and other jet fuels. The resulting algae biomass is a source of useful products such as biodiesel. Algae can be used to make bioethanol and biobutanol and by some estimates can produce vastly superior amounts of vegetable oil, compared to terrestrial crops grown for the same purpose. Algae can be grown to produce hydrogen. (Oilgae,2010).

2.0 Materials and Methods:

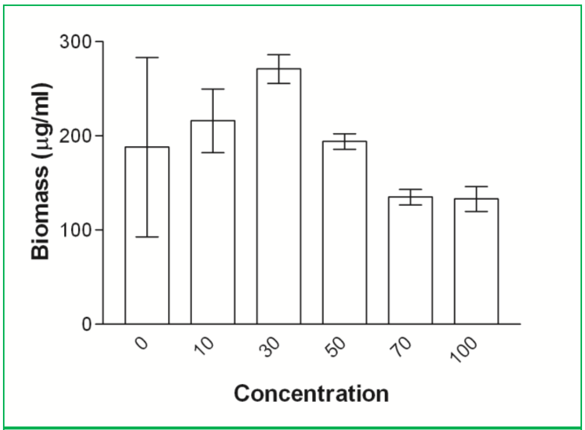
For the determine of the potential of Treated Dairy waste water , first of all make up the different concentration of TDWw .Then 10ml Algal mix Sample was inoculated into different TDWw Conc. After 10 days algal growth, we determined the potential of TDWw for the cultivation of algae by method of Chlorophyll Estimation (Porra et al.,1989) and Dry Weight (Biomass) Estimation Method , after this select the best one conc. Of TDWw according to Dry Weight Estimation and Chlorophyll Estimation Method for further Waste Water Treatment Experiment by Algae and then determined the again treatment level of TDWw by Algae according to result of Ammonia Estimation ,Nitrate Estimation ,Phosphorous Estimation ,DO ,and BOD Estimation method .

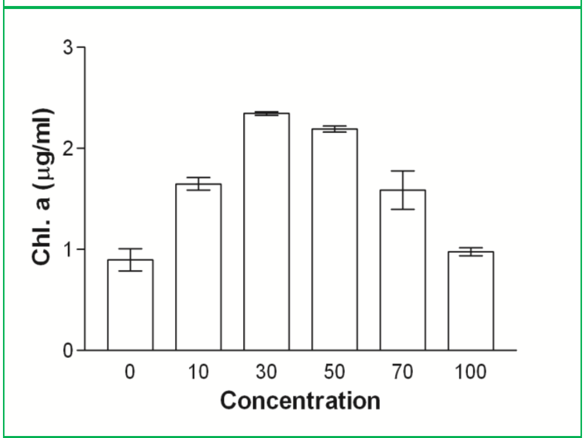
Table 1: Concentrations of Dairy Treated Waste water in BG11 Medium

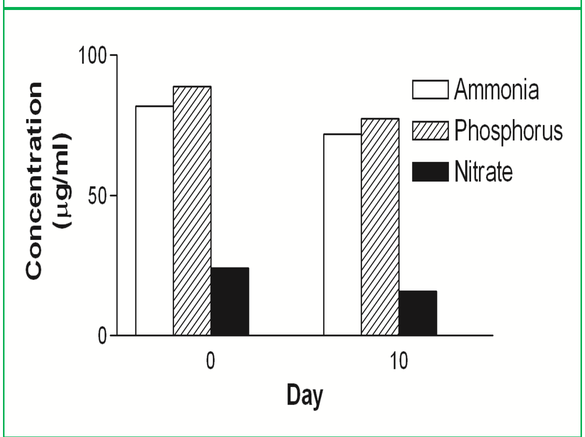
Conc.	BG11 media	Dairy waste water	Inoculums (Algal sample)
0%	90 ml	0 ml	10 ml
10%	80 ml	10 ml	10 ml
30%	60 ml	30 ml	10 ml
50%	40 ml	50 ml	10 ml
70%	20 ml	70 ml	10 ml
100%	0 ml	90 ml	10 ml

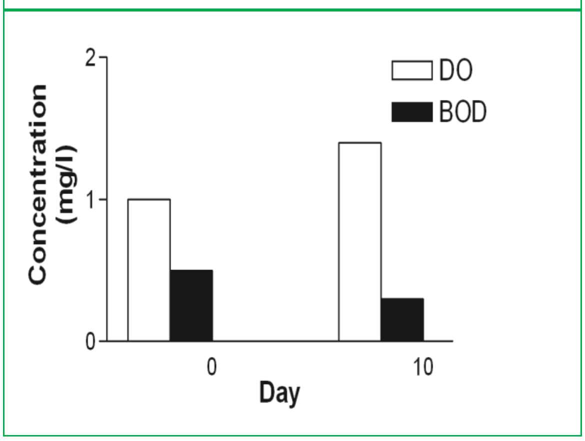
3.0 Results:

According to Chlorophyll Estimation and Dry Weight (Biomass) Estimation results, determined the potential of TDWw for the cultivation of algae and after that according to Ammonia, Phosphorous, Nitrate, DO and BOD estimation, determined the waste water treatment level.









4.0 Conclusion:

From the above results it can be concluded that the optimum growth of dairy algal sample was observed at 30% concentration of dairy waste water.

The various parameters as estimated Ammonia, Nitrate, Phosphorous, BOD seem to be decreasing by significant amounts by the 10^{th} day and DO seem to be increasing by significant amounts by the 10^{th} day .Hence effective in treatment of waste water treatment.

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