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Extraction of Nutrients from Industrial Waste Water

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ABSTRACT

The high potential for algal proteins and other nutritional benefits in addition to their high values for proteins, carbs, and lipids is characteristic of the interest in the production of microalgae in industrial effluent for nutrient extraction and their use. For use in food, spirogyra sp. has a high protein content. Because industrial effluent provides a specific quantity of proteins and nutrients necessary for microalgae growth, studies have been done to see if microalgae may be grown there. River microalgae samples were chosen, and under controlled laboratory settings, they were cultivated in commercial effluent. Microscopical analysis was used to determine the species and features of the farmed microalgae. The resulting microalgae biomass is then utilised to compute different nutritional values. They consist of lipids, protein, and carbs. The results show how nutritious microalgae cultivated in industrial effluent are when compared to naturally occurring river water algae.

Key Words : Microalgae, Spirogyra, Protein

INTRODUCTION

By 2030 near about 40 % water unavailability will affecting the overall growth and development of the world in all the aspects (https://www.seametrics.com/blog/future-water/). Globally, a number of sectors, including distilleries, pulp and paper mills, tanneries, textile, chemical, sugar, and food and beverage production, are to blame for the scarcity of clean water and the release of several hazardous pollutants. http://link.springer.com/chapter/10.1007/978-981-13-5889-0 12, Ministry of Water Resources, River Development, and Ganga Rejuvenation, Government of India. Urban, agricultural, and industrial activities produce large amounts of waste water that are very nutrient-rich, which results in eutrophication in aquatic environments that cannot be ignored (Cai *et al.,* 2013b; Conley *et al.*, 2009; Kumar and Pal, 2015; Le *et al*., 2010; Ruiz-Martinez *et al.*, 2015;Sukacova and colleagues, 2015). The number of organics, NH_4-N, and TP recovered from municipal wastewater in China is 35.8%, 35.8%, and 35.7% (2.12 106, 2.05 105, and 2.92 104 tons/year), respectively, based on the prediction of 70% treatment rate and 70% hidden utilisation potential (Sun *et al.*, 2016), indicating a significant area for improvement in terms of water recycling and utilisation as well as nutrient recovery in wastewater. Both the local and national governments have implemented stringent rules and regulations to limit the amounts of pollutants discharged and improve resource reclamation and recycling in order to ameliorate the dire situation and advance the circular economy idea. As algae may be used to produce biodiesel, biohydrogen, bioethanol, and biogas as well as organic fertiliser in the agrochemical business, it not only has potential in the field of recovering micronutrients but also offers numerous chances in the energy sector. Additionally, it plays a significant role in the production of animal feed, poultry feed, aquaculture feed, cosmetics, and feed for animals. Selective algae species can even be used to make footwear by drying algae and giving it a shape in a mould. It can also be used as a replacement for plastic because it can withstand greater weight and longer shelf life.

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METHODOLOGY

Table 1 : Kjeldahl Method for protein estimation

Instrument	Glassware	Other requirements
pH meter	Plastic bottle	Diary ETP water
Weighing balance	Plastic bottles	Food industry waste water
Distillation unit	Conical flask	Tissue paper
Titration unit	Test tubes	
Chemicals and reagents		
Sulphuric acid (H_2SO_4)		Kjeldahl catalyst
Copper sulphate		Potassium sulphate
NaoH		Sodium hydroxide
Mercuric oxide		Methyl red

Sample collection:

Two samples were taken from each of the two locations. the first sample was taken from a pond near a food company, where as the second set of samples was taken at an ETP plant for the dairy industry.

Growing and propagation of samples:

In particular waters, selected samples were allowed to grow. Chosen samples were mixed with chosen water in plastic bottles. 8 hours were spent exposing sample bottles to the sun. Daily with monitoring water temperature 60-80° F for three to four weeks till growth of bio mass.

Microscopic examination:

Microscopic inspection of both sample was done with compound microscope with slide preparation. Sample was placed on glass slide with drop of water and cover slip was placed on top of sample and observations recorded under 40x to 100x power of microscope

Methods of nitrogen determination by Kjeldahl method:

Determine protein as below given steps:

1. Weight 0.5 g of sample and transfer into the 800 ml of kjeldahl flask and taking care to see no portion of sample grip of the neck of the flask.

2. Add 0.7 gm of mercuric oxide, 15gm of potassium sulphate and 40ml of concentrated sulphuric acid (mercuric oxide) is added to increase the rate of organic breakdown during acid digestion because of environmental concern over handling and disposal of mercury, copper sulphate can be used.

3. Then added kjeldahl catalyst it is made up of 48.8% sodium sulphate and 48.9% potassium sulphate and 0.3% copper sulphate, add 2-3 glass beads.

4. Place the flask into the stand in digestion chamber and digest, heat the flask gently at low flame until the initial foaming and these mixture boil regularly at a moderate rate.

5. During heating rotate the flask in several times. Heat the digest for another hour or more until it turns a light blue colour.

Distillation:

6. And allow to cool for 10 min and alternatively added a few drops of water across side of the flask.

7. Cool the digest and slowly add 200 ml of water.

8. Cool and added a piece of granulated zinc and these contents are strongly alkaline before mixing the acid and alkaline layer.

9. Then we are connected these flasks to distillation apparatus.

10. The condenser is fit a delivery tube which dips just below the surface of the pipette volume of standard acid contained in a conical flask receiver.

Titration:

11. Properly mix this content of digestion flask and boil until 100 ml have distilled into the receiver. then slowly added 2-3 drops of methyl red indicator and titrate with standardized 0.1 N sodium hydroxide solution.

12. As will as we are simultaneously carried out by blank titration also.

13. Until the colour changes to faint pink.

Preparation of sample:

Utilizing a dry sample and the air-dry method. then use a grinder or grinding mill to swiftly grind a laboratory sample so that it can pass a sieve with a 1 mm slit. Avoid overheating the equipment when grinding, gently mix to prevent layering, and then store in a dry, airtight container.

Other important nutrient include carbohydrates and lipid content of both samples was analyze by external laboratory.

RESULTS AND DISCUSSION

The edible macroalgae, S.variants, greenalgae commonly available in northern Thailand, was analysed for its biochemical and mineral composition. According to S. various's biochemical and nutritional makeup, it contains a sizable number of pigments, dietary protein,

Table 2: Result of Protein Estimation by Kjeldahl method

Sr. No	Sample	Protein Test	
		T_1	T_2
1.	Spirogyra sp. (River water)	27%	31.5%
2.	Spirogyra sp. (Industrial waste water)	29%	32.7%

carbohydrates, and minerals. The nutritional value of S. various was substantially higher. In light of these findings, it can be said that S. variety is a potential healthy food for human diets and that it may be useful to the food industry as a source of nutrients with high nutritional value. Because to its nutritional content, S. variety can serve as an alternative diet, and by raising the standard and widening the selection of products made from freshwater macroalgae, its commercial value can be increased. *Spirogyra* sp. The river water algae used in this experiment were found to be filamentous green algae. In 0.5 gm of sample testing, protein concentrations of 27 per cent and 29 per cent were noted. In addition, a 0.5 g sample of industrial waste water contained 31.5 per cent and 32.7 per cent of protein.

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