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ORIGINAL RESEARCH PAPER

Environmental Science

APPLICATION OF ALGAE AS BIO ADSORBENT FOR TREATMENT OF WASTE WATER

KEY WORDS: Algae, Waste Water treatment, Adsorption, COD, BOD

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ABSTRACT

As many wastewater treatment plants are operational for the treatment of process effluent, a newly developing wastewater treatment by algae is much important, this is an innovative, economic and environmentally safe alternative for treating wastewater. Algae takes up N and P from the wastewater treated with algae. This treatment system is economical, green and environment friendly. In this research paper, process effluent was treated with algae which was collected from Tapi river and was washed with tap water and dried. The dried algae were grinded to form powder. Parameters were analyzed using standard method prior to and after treatment for Dairy, Textile and Sewage wastewater. The percentage reduction rate observed for Textile wastewater was 85.50% (COD), 94.93% (BOD), 87.5% (Ammonia), 53.57% (Phosphorus) while for Sewage wastewater it was 66.66% (COD), 79.79% (BOD), 90.21% (Phosphorus), 76% (Ammonia) and for Dairy wastewater it was 90% (COD), 91% (BOD), 83.12% (Phosphorus), 87.5% (Ammonia). Algae uses the nutrients (Nitrogen and Phosphorus) for their growth and have the capacity to reduce the chemical oxygen demand and biochemical oxygen demand.

INTRODUCTION

The treatments of wastewater require large amount of chemicals. Nutrient rich wastewater instead of discharging into the environment is supplemented for the growth of algae in the wastewater treatment system. Textile industry is one of the largest water consuming industries in the world and its wastewater contain many pollutants such as dyes, degradable organics, detergents, stabilizing agent, inorganic salts, and heavy metal. A large amount of wastewater is being generated by all these processes, which contains many pollutants like reactive dyes, chemicals, high chemical oxygen demand (COD), biological oxygen demand (BOD), organic compounds. While dairy industry is considered to be the largest source of food processing wastewater in many countries, large quantity of wastewater originates due to their different operations and products. The organic substance in the wastes largely comes from their various products, though the dairy wastes are biodegradable but are very strong in nature. Sewage is considered as wastewater consisting largely human excreta and wash water, but at times it may have industrial and agricultural waste (e.g. waste from livestock i.e. chicken, cattle, horse, etc.) that enter the sewage system. In general sewage contains about 95.5% water and 0.1 to 0.5% organic and inorganic material.

MATERIALS AND METHOD

Wastewater samples were collected from industry located in the vicinity of Surat. Samples collected were Textile industry effluent sample, Sewage waste water and Dairy waste water, the samples were collected in carbuoys and stored at 4°C till further use. *Chra globularis* is found both in freshwater and brackish water. Fresh water habitat includes lakes and rivers. Algae was collected from Tapi river located in Surat and washed with tap water, dried naturally by sunlight, then dried and grinded to form powder by domestic blender. This powder was sieved through 6mm sieves and stored in bottle for further treatment use.

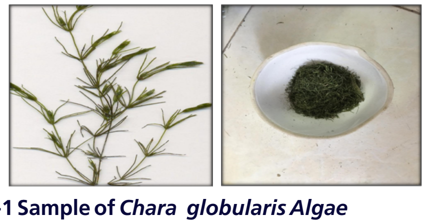

Figure-1 Sample of *Chara globularis* Algae

Figure-2 Powder of Chara algae

Industrial wastewater collected was analysed for various parameters like pH, TS, TDS, TSS, Turbidity, B.O.D, C.O.D, Ammonia and Phosphate.

Optimization of Contact Time, pH, Dosage

1)Optimization of Contact Time:

0.4gm of powdered algae was taken and added to conical flasks containing wastewater of industries. No pH adjustment was done to the industrial samples, then each sample was given various contact time with the algae and then the samples were collected and analyzed for various parameter like TS, TDS, TSS, Turbidity, B.O.D, C.O.D, Ammonia and Phosphate.

2)Optimization of pH:

After optimizing time, the pH of wastewater was varied to get the best pH, the selected pH was 04, 05, 06, 07 and 08. and then the samples were collected and analyzed for various parameter like TS, TDS, TSS, Turbidity, B.O.D, C.O.D, Ammonia and Phosphate.

3)Varying Algae Dosage:

The wastewater was treated with different dosage of algae, after optimizing time and pH, the selected dosage was 0.2, 0.4, 0.6, 0.8 and 01 gm and then the sample was collected after treatment and analyzed for various parameter like TS, TDS, TSS, Turbidity, B.O.D, C.O.D, Ammonia and Phosphate.

RESULTS AND DISCUSSION

Table 3.1 shows the values of the analyzed parameters of the raw wastewater collected from industry. The selected parameters are typical for industry effluents and showed relative high biochemical oxygen demand (B.O.D), TDS and chemical oxygen demand (C.O.D), this indicated that the wastewater had pollution potentials and therefore should be treated before discharging into the environment.

Sr. No.	Parameter	Permissible limit as per (IS mg/L)	Sample 1 (Textile Industry)	Sample 2 (Sewage Sample)	Sample 3 (Dairy Industry)
1	pH	6-9	6.61	7.15	7.5
2	Turbidity NTU	5 NTU	74	66	60
3	COD mg/L	250	1380	900	1200
4	BOD mg/L	50	434	99	110
5	TS mg/L	500	1800	3800	1200
6	TDS mg/L	2100	1000	1400	400
7	TSS mg/L	150	800	2400	800
8	Ammonia mg/L	5	0.8	2.5	0.6

9	Phosphorus mg/L	0	28	115	160

Table 3.1 Initial concentrations of various Parameter in untreated Wastewater Sample

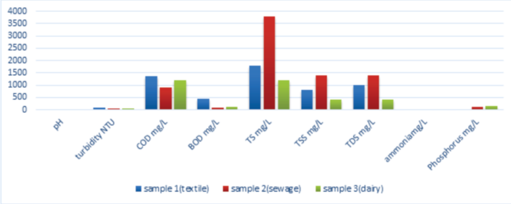

Figure 3: Graphical representation of Initial Concentrations in untreated samples.

Table 3.2 shows the maximum percentage removal by taking 01 gm as optimum dosage, 7.0 as the best pH for treatment and taking 5 hours as the optimum contact time. Here the values are compared with initial concentrations in untreated samples.

Parameter	Sample 1 (Textile Industry)	Sample 2 (Sewage Sample)	Sample 3 (Dairy Industry)
Turbidity NTU	56.75	60.60	51.66
COD mg/L	85.50	66.66	90
BOD mg/L	94.93	79.79	91
TS mg/L	88.88	94.73	66.66
TDS mg/L	50	98.57	50
Ammonia mg/L	87.5	76	87.5
Phosphorus mg/L	53.57	90.21	83.12

Table 3.2 Maximum Percentage removal by optimum dosage 1 gm, pH 7 and contact time 5 hours

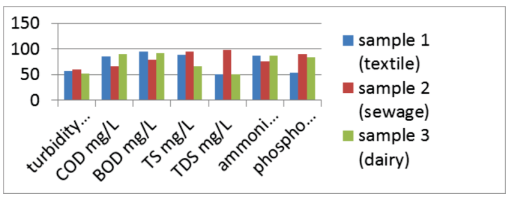

Figure 4: Graphical representation of maximum percentage removal.

CONCLUSION

- The removal of organic and inorganic substance from wastewater was accomplished using algal biomass. As the number of hours got increased the removal efficiency of various parameters also got increased.
- In textile waste water the removal efficiency of C.O.D was about 85.50%, B.O.D was about 94.93%, Phosphorus was about 53.57% and Ammonia was about 87.5%, TDS was about 50%.
- In sewage waste water the maximum removal efficiency of C.O.D was about 66.66%, B.O.D was about 79.79%, Phosphorus was about 90.21%, Ammonia was about 76%, TDS is about 98.57%.
- In dairy waste water the maximum removal efficiency of C.O.D was about 90%, B.O.D was about 91%, Phosphorus was about 83.12%, Ammonia was about 87.5%, TDS was about 75%.
- As pH changed from acidic to alkaline the removal efficiency increased and maximum removal of organic and inorganic substances was obtained at pH 7.
- Treated water can be used for irrigation of sampling, landscape vegetation and certain agricultural crops.
- The bio-adsorbents once used could be re-used as a fertilizer and this could be employed commercially in the future.
- In this study algae were used for removal of organic matters. These algae majorly removes the contamination of organic pollution. For the better future aspect other algae species can also be used for the removal of contaminations.
- Since algae has adaptability to grow in polluted environment. They naturally grow at higher cell densities in nutrient rich waters and therefore can be grown in conditions with minimal freshwater requirement as compared to other aquatic plants. Due to their characteristics they can potentially be utilized for low-cost and environment friendly waste water treatment process.

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