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Biodegradation of Toxic Substances from Sewage Waste Water by Using Algae

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Abstract

Wastewater the water supply of a community after it has been spoiled by use. Wastewater refers to all effluent from household, commercial establishments and institutions, hospitals, industries and so on. It is also includes storm water and urban runoff agricultural, horticultural and aquaculture effluent. Effluent refers to the sewage or liquid waste that is discharged into water bodies. It is wastewater originating from toilets and bathroom fixtures, bathing, laundry, kitchen sinks, clearness, and similar dirty water that is produced in households and public places. Water used to irrigate turf and gardens, swimming pools, roof drainage, surface runoff and storm water are all wastewater. Thanjavur District is the Rice Bowl of Tamil Nadu. The district stands unique from time immemorial for its agricultural activities and is rightly acclaimed as the Granary of the South India. Algal degradation of organic pollutants is a natural process which ensures a lower environmental impact compared with mechanical, physical, and chemical removal approaches of organic pollutants. The advantages of algae-based bioremediation are greater production biomass and high ability to accumulate, detoxify, or degrade xenobiotics and pollutants.

Keywords: Bioremediation, wastewater, algae, environment

Introduction

Wastewater the water supply of a community after it has been spoiled by use. Wastewater refers to all effluent from household, commercial establishments and institutions, hospitals, industries and so on. It is also includes storm water and urban runoff agricultural, horticultural and aquaculture effluent. Effluent refers to the sewage or liquid waste that is discharged into water bodies either from direct sources or from treatment plants. We consider wastewater treatment as a water use because it is so interconnected with the other uses of water. Much of the water used by homes, industries, and businesses must be treated before it is released back to the environment. Wastewater is not properly treated, then the environment and human health can be negatively impacted. These impacts can include harm to fish and wildlife populations, oxygen depletion, beach closures and other restrictions on recreational water use, restrictions on fish and shellfish harvesting and contamination of drinking water. The major aim of wastewater treatment is to remove as much of the suspended solids as possible before the remaining water, called effluent, is discharged back to the environment. As solid material decays, it uses up oxygen, which is needed by the plants and animals living in the water. Water courses receive pollution from many different sources, which vary both in strength and volume. The composition of wastewater is a reflection of the life styles and technologies practiced in the producing society (Gray, 1989) [5]. It is a complex mixture of natural organic and inorganic materials as well as man-made compounds. Three quarters of organic carbon in sewage are present as carbohydrates, fats, proteins, amino acids, and volatile acids. The inorganic constituents include large concentrations of sodium, calcium, potassium, magnesium, chlorine, sulphur, phosphate, bicarbonate, ammonium salts and heavy metals (Lima *et al*., 2004) [8]. Micro-organisms involved in bioremediation act as a bioremediators. Algae, bacteria and fungi are prime bioremediators used to remediate the environmental pollutants as these bioremediators secrete some enzymes to degrade toxic pollutants (Karigar and Rao, 2011) [7]. These enzymes get easily interact with environmental pollutants to remediate it.

Materials and Methods

Water samples will be collected from different sites, the sample was collected in a brown bottle. Prior to the collection the sample bottle was rinsed thoroughly with the sample water. Then the sample was brought to the laboratory as early as possible and was subjected for various physico-chemical and microbiological studies. The physico-chemical parameters of collected waste water samples will be determined before and after treatment by following the Standard Method Examination of Water and Waste Water given in "Environment and Pollution" of APHA (1990) [3] and APHA (1995) [4]. The colour intensity of water will be observed from naked eyes. pH-the pH will be measured by

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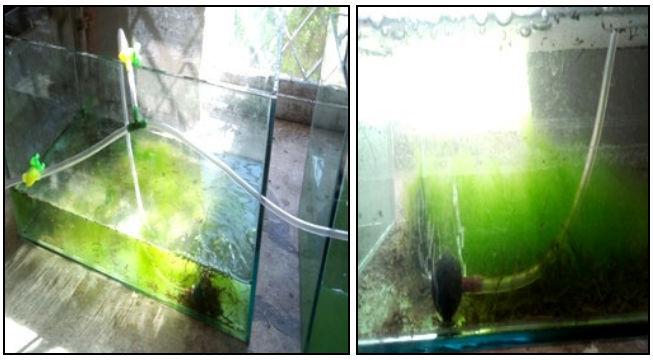
the digital pH meter and other physic-chemical parameters are measured by the Standard Methods. Different types of algae will be subjected for the bioremediation of water. Out of these, few are collected locally (Hydrodictyon sps.) from this water samples and identifies on the basis of their morphological characteristics. Some algae will be cultured in prescribed nutrient medium.

Culture of Algae in Laboratory



(a) (b)

Fig 1(a, b): Culture of Algae in Laboratory

Results

Wastewater samples from identified different areas were collected as per the guidelines of random sample method. The sample bottles were used for water lifting were allowed to run the sewage water for 15 min in order to flush out stationary water. Further, the sample bottles were also flushed with several volumes of water before the samples were collected. During sampling, it enters the new environment from its natural environment, its chemical composition may not remain same but may tend to adjust itself according to its new environment and its content alters at very different rates particularly with organic materials. The water temperature controls the solvent action and there by the chemical quality of water and its general usefulness for drinking and industrial purposes. According to Zajic (1971) [14] water with temperature above 27°C is unsuitable for any purposes and above 32°C is unfit for public use. Whereas low water temperature may impart deleterious effect on water (Ruttner, 1953) [12]. The pH of natural water is controlled to a greater extent by the interaction of hydrogen ions arising from the hydrolysis of bicarbonates. In the present study, much variation is not seen for the pH values in three seasons for all the five sites. They range from (7.8-6.9) Mittal and Varma, (1997) [9]. Hardness shows raised values due to accumulation of Ca and Mg salts. The raised values (190mg/lit) of hardness may be due to the dumping of domestic sewage which contains detergents. Hardness of water is caused by polyvalent metallic ions in freshwater (Angino, 1983) [2]. According to Saxena (1994) the alkalinity (range between 122-58) is imparted more by the presence of CO2 content in natural waters. Total solids are all kinds of solid concentrates (suspended, dissolved, volatile, etc.) in water. These solids mainly enter into the water body from surface soil runoff industrial effluent, agriculture runoff, etc. (Trivedi and Goel, 1984) [13]. It is one of the most important physico-chemical factors of fresh water ecosystem which directly or indirectly affect the ecology of biota living there in (Abhay Kumar *et al*., 1996) [1]. The BOD ranges between 26mg/l, but after treatment with algae it decreases upto 10mg/l sample. Dissolved Oxygen study measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. DO is an indicator measurement of water which can be degraded biologically. A rise has been recorded in DO (Table 1). Initial DO range was between 3.3mg/l, but after treatment with algae it increased upto 7.4 mg/l in the treated sample. (Rao and Rao, 1991) [11], Nasar (1978) and Jameel (1998) [6].

Table 1: Physico-chemical parameters in sewage water and treated water

S. No.	Parameters	Sewage Water	Algal Treated Water
	Colour	**Black**	**Light Green**
1.	Temperature (°C)	28	30
2.	pH	7.8	6.9
3.	Hardness (mg/l)	190	133
4.	Alkalinity (mg/l)	120	58
5.	Total dissolved solids (mg/l)	386	96
6.	Dissolved Oxygen (mg/l)	3.3	7.4
7.	Biological Oxygen Demand(BOD)	26	10
8.	Chemical Oxygen Demand(COD)	89	43
9.	chemical oxygen demand (COD) (mg/l)	40	15

Conclusion

Today, water pollution is one of the serious issues for both developed as well as developing countries. As the nation's growing urban major problem is industrial and sewage discharge of wastes. As huge load of wastes find their way into rivers, ponds and other ground water sources which ultimately deteriorate the water quality leading to inapproachability of potable water. Wastes of river water directly or indirectly effects human health in form of Cholera, Typhoid etc. as these are common disease caused by consuming polluted water. Any pollution in water could cause health hazards to different consumers also like animals and other aquatic life. Wastewater can contain significant levels of pollutants, which can be dangerous to animals, humans, and the environment. As industrial activities expand to fulfill the needs of our growing population, more and more wastewater is being produced as a "by-product." Solutions to effectively treat the large quantities of produced wastewater have to be found rapidly. The relation between physico-chemical parameters and Algae population are significantly associated with most of physico-chemical parameters. Algae is used in bioremediation because it is possible for algae to clean pollutant sources in wastewater since they are food sources for algae. Chemicals that are toxic to the environment or to humans must be removed. Removing chemicals from the environment (remediation) can be achieved by biological, physical, chemical and thermal methods. Biological treatments, which use microbes and plants to degrade chemical materials can both decontaminate polluted sites (bioremediation) and purify hazardous wastes in water. The algal growth in the active phase of growth bind 40-90% pollutants from the solution including heavy metals and chemical. Thus it can be used for the removal of heavy metals from wastewater.

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