Preparation of Effective Microbial Technology For Industrial waste water Treatment

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Abstract:

Industrial waste water is a significant source of water pollution. The present investigation was carried out for biodegradation of industrial effluent by using selected aerobic microbial isolates and preparation of their effective microbial consortium. The research was initiated with the isolation of microbes from industrial waste water and by testing of individual isolates efficiency in terms of reduction in Biochemical oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and Oil and Grease estimation. After gram staining, microbial isolates were identified as Lactobacillus casei, Rhodopseudomonaspalustris, Bacilluspumilis, Clostridium spsand Bacillus subtilis. On the basis of degradation capacity of individual bacterium, the culture was selected for preparation of consortium. The bacterial consortia ofL.casei, R.palustris&B.subtiliswere prepared and mixed with effluent (1:9), after incubation of 3 days there was a significant reduction in BOD, COD, TSS, TDS and Oil and Grease as 98.4, 31, 98.5,96, 91.6% respectively. The use of such specific consortium would be helpful in overcoming the problems for treating sewage as well as industrial waste water.

Keywords: Industrial waste water, BOD, TSS, TDS and Oil & Grease.

1. Introduction

The rapid rise of industries have a profound effect on increasing economic growth and productivity, besides, these are causing health hazards by releasing toxic substances into the environment. It has seriously affected normal operations of ecosystems, flora and fauna. In recent years, considerable attention has been paid to the industrial wastes, which are usually discharged on land or into different water bodies. This is likely to result in the degradation of environment [2].

Water is the basic need for all living beings. Now-a-days, its supply has been constant due to overgrowth of world's population and industries [9].Thus, it is one of the challenging issues to prevent pollution of fresh water by various anthropogenic activities [14]. Presence of high concentration of contaminants even in human and industrial treated effluents reach surface and ground water affecting the growth of vegetation, human and animal life [3].

Especially chemical industries produce both organic as well as inorganic wastes that vary in their concentration. These types of wastes are basically toxic, carcinogenicand mutagenicand might be biodegradable [4]. Therefore, on the basis of biodegradability, the industrial pollutants have been classified as low, moderate and highly biodegradable. Activated sludge for sewage treatment involves the use of aerobic microbes for biodegradation of waste [13]. It may be difficult for a single microorganism to degrade complex industrial waste water. Hence, a combination of various microorganisms is being used for degrading complex industrial waste water [12].

The consortia of naturally occurring microorganisms that have not undergone any

modification such as genetic engineering, chemical preparation are formulated as Effective Microorganism (EM). This technology of blending effective microorganismsin molasses at low pH was initially developed by Dr. TeruoHiga at Okinawa, Japan [1].

Firstly, it was used to enhance soil activity for tremendous increasing the soil activity. Later, it has found applications in waste water treatment and also in various areas of agriculture such as natural farming, livestock, gardening, composting, bioremediation, algal control and prawn culture. It is also effective in suppressing growth of soil pathogen, pest and promote plant growth and used as a feed additive for livestock [6].

MATERIALS&METHODS

Sample Collection: Industrial waste water has been collected from sector – 63, Noida.

Isolation of Microorganisms: The bacteria were isolated from the industrial waste water for degradation and identified using Gram's staining..

Treatment of effluent by using single isolate: Five sets of individual bacteria with effluent (1:9) has been prepared for testing their degradation potential in terms of reduction in BOD, COD, TSS, TDS and Oil & Grease after incubation of 3 days.

Degradation activity of consortium: The three selected bacterial cultures were mixed in the ratio of 1:1:1 to prepare the effective consortium in presence of 6% dextrose as a supplement nutrient for consortium preparation.Then, the consortium was mixed with effluent in the ratio of 1:9 and incubated for 3 days. The BOD, COD, TDS, TSS and Oil & Grease were estimated according to standard procedures.

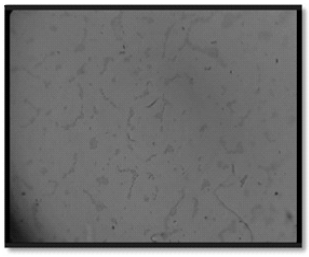
RESULTS & DISCUSSIONS

Isolation of microorganisms: Five bacteria were isolated from industrial waste water. Their morphological identification was carried out by Gram's Staining.

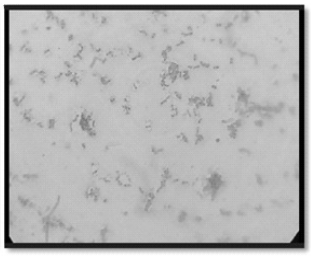
Table No. 1:Morphological characteristics of isolated bacteria

S. No.	Laboratory Name of Bacteria	Morphology
1.	Isolate 1	Positive Long Rods
2.	Isolate 2	Negative Long Rods
3.	Isolate 3	Positive Long Rods
4.	Isolate 4	Positive Short Rods in Chain
5.	Isolate 5	Negative Short Rods with Endospores

Among the isolated bacteria, these could be classified as Lactobacillus casei, Rhodopseudomonaspalustris, Bacillus pumilus, Clostridium sps&Bacillus subtilis respectively. The isolated bacteria came under the category of aerobic bacteria.The bacteria have the capacity to utilize the nutrients present in waste water. 11 species of bacteria isolated from were used for treating beer waste water. Those species possess cocci and filamentous morphology [10].



1-Po sitive long rods



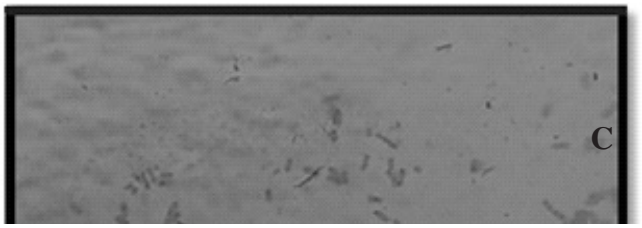
2- Negative long rods



3- Positive long rods



4- Positive short rods in chain



5-Negative short rods with endospores

Fig.1 Morphology of Isolated bacteria

Treatment of effluent with microbial consortium: Five sets of individual bacterium were prepared to test the reduction in different parameters viz. BOD, COD, TSS, TDS and Oil & Grease. The bacterium with effluent was kept for 3 days incubation. The BOD, COD, TSS, TDS and Oil & grease of effluent without treating with isolated bacteria are 6.4, 0.0128, 1, 6.2 and 0.84mg/L respectively. On treating effluent with isolated there is a significantdecrease in the water parameters.

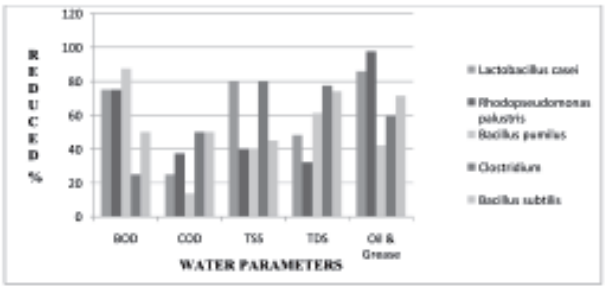


Fig.2 Degradation activity of water parameters by single isolate

From the fig.2, it is clearly observed that L.casei, R.palustris&B.subtilisshowed sharp decrease in the percentage of water parameters. Therefore, these 3 bacteria were selected to prepare consortium and treated effluent following the same procedure as of effluent with single isolate. Since microorganisms adapt themselves faster if nutrients and environment are provided to the environment in accordance with them. The microbes, then, quickly utilize the nutrients present in waste water and degrade them into simpler organic nutrients [5].

The degradation activity of consortium has reduced the different parameters of water viz.BOD, COD, TSS, TDS and Oil & Grease to a significant extent as 98.4, 31, 98.5,96, 91.6% respectively.The oxidation of organic matter present in waste water that provides energy for microbial metabolism could affect the decrease in BOD & COD [7]. The value of TSS decreased because the suspended particles that were deposited earlier become dissolved by microbial activity.

The rate of degradation of waste water by microbes is also affected by pH and temperature of waste water. The pH of treated waste water shifted from acidic to alkaline due to degradation of proteins & nitrogen into NH_4^+that were further catalyzed the hydrolysis of polysaccharides, lipids present in waste water [8].

Besides pH, temperature is one of the important factors affecting the microbial degradation activity. It affects solubility of oxygen in water. During degradation of waste water, the temperature rises to accelerate the rate growth of microbial population [11].

CONCLUSION

The selected formulated consortium consisting of the isolated aerobic bacterial strains capable of degrading organic waste in water in a synergistic way. This consortium reduced the pollution in terms of BOD, COD, TSS, TDS and Oil & Grease up to the desired limit. This consortium is very useful from economic perspective since it can be proved helpful in overcoming the limitations of conventional biological treatment of industrial waste water.

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