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STUDY AND APPLICATION OF SOIL BIOTECHNOLOGY FOR REMOVAL OF COD FROM FERTILIZER WASTEWATER

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Abstract

In a laboratory study, treatment of fertilizer wastewater having chemical oxygen demand (COD) in the range of 600 to 800 mg/L. by soil biotechnology was examined. Soil biotechnology is a system for water renovation which consists of soil, formulated granular filter media, selected culture of macro organisms such as earthworms. Earthworms body act as a 'biofilter' and they were found to decrease COD-70 to 82 % at different detention time. Earthworms treat the wastewater by the mechanism of 'feeding' and 'biodegradation. Also increase the hydraulic conductivity and natural aeration by grinding the soil particle. In the present study the effluent passed through top layer of the filter and found out the efficiency of removal of COD. There is no sludge formation in this process which requires additional expenditure on landfill and disposal. The process is odor-free, eco-friendly and cost effective.

Key words**:** *SBT (Soil Biotechnology), COD (Chemical Oxygen Demand), Fertilizer wastewater.*

I. INTRODUCTION

Water is one of the most valuable liquid on our planet. History reveals that the life originated in water and is also sustained by water. It is the lifeline of all life form. Human civilization flourished wherever water was available in abundance. We could not last, neither this world, if there is no water.

Water pollution is of widespread national concern. Many industrial and agricultural activities use water in an excessive way. The waste or by-products discharged from industries are severely disastrous to the environment consists various kind of contaminant which contaminate the surface water, ground water and soil.

The discharge from fertilizer industry which has not undergone any treatments is one of the major sources of pollution to water reservoirs such as lakes, ponds, rivers and ocean. The discharge contains certain toxic components which might be responsible for causing metabolic impairment in the aquatic organisms.

Fertilizer residues enter in the water from

1) The effluent treatment plants of manufacturing facilities, 2) Leaching and surface water contamination due to surface runoff of nutrients from agricultural lands.

There are conventional and non-conventional approaches for wastewater treatment. Due to inconvenience in conventional treatment methods, SBT is introduced to achieve green environment, for municipal and industrial wastewater. Treatment of the fertilizer wastewater by soil Biotechnology is cost effective as compared to conventional treatments.

II. SOIL BIOTECHNOLOGY

Soil biotechnology is a system for water renovation which consists of soil, formulated granular filter media, selected culture of macro organisms such as earthworms. Earthworms body act as a 'biofilter'. Earthworms treat the wastewater by the mechanism of 'feeding' and 'biodegradation. Also increase the hydraulic conductivity and natural aeration by grinding the soil particle. There is no sludge formation in this process which requires additional expenditure on landfill and disposal. The process is odor-free, eco-friendly and cost effective. In Soil Biotechnology energy required is less, No skilled man-power required to operate, Very simple to operate & maintain and Cost of operation & maintenance is less.

III. MATERIAL AND METHOD

3.1 Preparation of Reactor bed

Reactor is made in plastic drum of 290mm diameter and 330mm height. Reactor bed is made up of different layers of gravel, sand and garden soil with Cow dung and earthworms. The bottom most layer was made of 50-60mm of aggregate at a depth of 40mm, Above this layer Another three layers of aggregate 40-50mm, 25-40mm and 10-12.5mm are introduced at a depth of 30mm. Above this the layer of sand passing from 2.36mm IS Sieve is introduced at a depth of 30mm.The top most layer consist

of mixture of garden soil and Cow dung in 1:3 proportion (Sahu pali et al.) with 200 Eisenia fetida earthworms (Telang Sarika et al.) at a depth of 120mm. 50mm of free board is kept for distribution of wastewater.

3.2 Experimental Procedure

Fertilizer wastewater was kept in 10lit of plastic drum. The drum was kept near reactor bed at elevated platform. The plastic drum had a tap at the bottom to which an irrigation system is attached. The irrigation system consisted of rubber pipe of 0.5" with holes of 3mm for trickling water that allowed uniform distribution of wastewater on reactor bed. The wastewater flowed through the pipe by gravity. The wastewater percolated down through the different layers of the reactor bed and at the end was collected in a plastic bucket kept at the bottom of the kit. This treated wastewater were collected and analyzed for pH, COD.

Figure 1: 50-60 mm size of gravel

Figure 2: 40-50 mm size of gravel

Figure 3: 25-40 mm size of gravel

Figure 4: 10-12.5 mm size of gravel

Figure 5: Sand passing through 2.36mm I.S. sieve

Figure 6: Soil Bed with Earthworms

Figure 7: Experimental Set Up

IV. RESULT AND DISCUSSION

5.1 SAMPLE ANALYSIS

pH of the sample is adjusted by using NaOH and measured by pH meter from the company EI products, Parwanoo (H.P), India. pH meter is calibrated by using commercially available Thallate buffer. Raw and treated waste water sample is analyzed for COD according to the methods summarized in the standard methods for the analysis of wastewater.

SR. NO.	CHARACTERISTICS	VALUES	UNIT
1	pH	7.0-8.0	-
2	COD	600-800	mg/l
3	TDS	1530	mg/l
4	TSS	1.9	mg/l
5	CHLORIDE	524.8	mg/l
6	SULPHATE	150	mg/l
7	NITRATE	0.05	mg/l
8	NITRITE	0.015	mg/l
9	AMMONICAL	300-400	mg/l

	NITROGEN		
10	UREA	0.31	g/l

TABLE 1: RAW EFFLUENT CHARACTERISTICS

The wastewater characteristics play a significant role on its treatment. Raw wastewater parameters were measured and listed in Table 1. These results indicate that this wastewater contains organic and inorganic matter. Therefore, this wastewater can cause damage to the environment when discharged directly without proper treatment. In this study, the effect of Soil biotechnology was examined for the different detention time of 6, 8 and 10 hours.

In this study, the effect of Soil biotechnology was examined for the different detention time of 6, 8 and 10 hours.

5.2 COD REMOVAL

The chemical decomposition of organic and inorganic contaminants in wastewater which cannot be biologically removed is termed as COD. Results indicate that the overall efficiency of COD of the treated fertilizer wastewater from the soil biotechnology was found upto 81.8%.

TABLE 2: % REMOVAL OF COD

Detention Time (Hours)	% Removal of COD			
	Sample-1	Sample-2	Sample-3	Sample-4
6	69.7	70	62.8	66.61
8	73.3	72.7	65.7	68.85
10	79	81.8	69.64	70

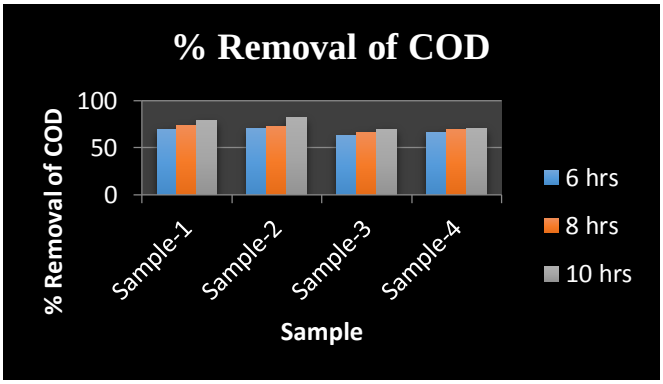

Figure 8: % Removal of COD

V. CONCLUSION

Results showed that soil biotechnology achieves good performance and the results were better than conventional wastewater treatment. The treatment was cost effective, odor free, very simple to operate & maintain, does not require skilled man-power, Low energy requirement, environmentally responsible with the good efficiency of removal of COD up to 81.8% at 10 hours detention time, 73.3% at 8 hours detention time and 70% at 6 hours detention time. There is no sludge formation in this process. It provides primary, secondary and tertiary treatment all in one unit, in a single evergreen facility open to atmosphere. The treated water through soil bio technology can be used for Irrigation, groundwater recharging, Industrial process, gardening, flushing, construction, road/car wash etc.

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