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Oily Domestic Wastewater Treatment by Using Effective Microorganism Technology

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Abstract: *The management of domestic waste water, particularly the oil containments generated during daily domestic water uses processing, it poses significant environmental challenges. The presence of high oil content in wastewater breaks water quality, damaging aquatic ecosystems and complicating waste treatment processes. This study investigates the effectiveness of an Effective Microorganism (EM) solution in enhancing the degradation of oil content in domestic waste. EM, a integrated mixture of beneficial microbes such as lactic acid bacteria, yeasts, and photosynthetic bacteria, was applied to domestic wastewater under controlled conditions. It is observed that from result that the EM solution significantly reduced the oil contamination in the effluent, with a degradation efficiency of over 65 -70% within a four week period. The microbial containments contributed to the breakdown of oil into simpler, non-toxic compounds, while also improving overall wastewater quality by reducing the presence of other organic pollutants. The findings indicate that EM treatment offers a sustainable and eco-friendly alternative for the remediation of oil-polluted domestic waste water , providing an effective solution for improving water quality in domestic waste water processing environments. Further research is recommended to optimize the application parameters and assess the long-term effects of EM use on domestic waste water management.*

Keywords: Effective Microorganism (EM) solution, oil contamination, domestic waste water management

I. INTRODUCTION

Domestic wastewater, especially from kitchens, contains oil, fats, and grease, which are challenging to treat and degrade using conventional methods. Oil contamination in domestic wastewater is a significant environmental concern as it leads to the deterioration of water quality, clogging of sewage systems, and harm to aquatic life. This project explores the potential of using Effective Microorganism (EM) technology to degrade oil present in domestic wastewater.

Effective Microorganisms (EM) technology is a microbial solution that uses a mixture of beneficial microorganisms to break down organic materials, including oils, in wastewater. The approach is sustainable, eco-friendly, and has shown promise in treating various types of organic waste. The kitchen waste is one of the typical household's waste shows a major impact on municipalities for the treatment of the same, but most of them are not possible to use at local level.

In the context of this project, EM technology is being used to degrade oil present in domestic wastewater, providing a sustainable method to treat and purify water.

II. METHODOLOGY

A flowchart showing the methodology for Treatment of oily waste water by using EM Technology.

2.1 Selection Of Study Area for Oily Waste Water Treatment

Study area is first important parameter in my project. First I select the study area for treating domestic waste water containing oil. So I select the domestic waste water collection study area from house hold daily kitchen waste water containing oil.

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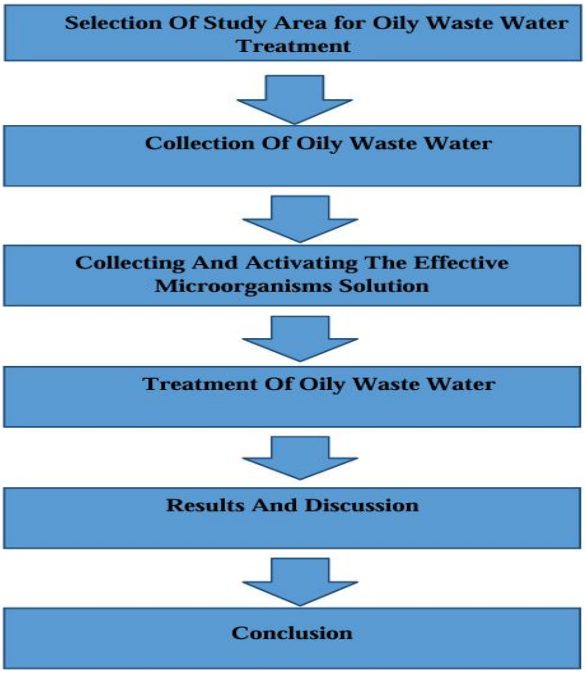

Fig. 2.1. Flow Chart Of Methodology

2.2 Collection Of Oily Waste Water

The waste water containing oil were collected in a sterilized plastic container from household kitchen. After collection, the waste water was brought to the laboratory for further analysis. The collected waste water sample was subjected to physicochemical and microbiological analysis.

Fig. 2.2. Sample of oily domestic waste water

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2.3 Collecting And Activating The Effective Microorganisms Solution

EM is available in a dormant state and requires activation before application. Activation involves the addition of 6000 ml of chlorine free water and 300ml of jaggery water to 300ml of dormant EM one week prior to application. These ingredients were mixed together in either a 7 L or 10 L container and stored in area with minimal temperature fluctuations.

Treatment Of Oily Waste Water

The samples were kept in a closed container at a minimum room temperature for a period of 5 to 7 days with periodic mixing to ensure uniform treatment. After that, the treatment of oily wastewater was done after activating the EM solution, and various tests were conducted to perform the various physical properties and chemical properties are studying. The set up consists of three 1liter Erlenmeyer flasks with 1 litre of waste water each. 100 ml of activated EM culture was added into the waste water sample. The setup was operated continuously for 21 days. The effect of EM was assessed by changes in the oil and grease content , pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), after the incubation period.

III. TREATMENT OF OILY WASTE WATER BY USING EM TECHNOLOGY

Various test to be carried out by studying various parameters in Oily waste water.

3.1 Measurement Of Parameter On Waste Water

The characteristics of oily waste water can be classified under following three heads:

- Physical Characteristics
- Chemical Characteristics
- Biological Characteristics

3.2 Test To Be Performed

Various test to be carried out to doing domestic oily waste water treatment.

3.2.1 Oil And Grease Content Determination Test:-

Determining the oil and grease content in wastewater is important for evaluating water quality, especially in household kitchen waste water where oils are used.

$$\text{Oil And Greese Content} = \frac{(W2-W1)}{V} \text{ X } 1000$$

3.2.2 pH Test:-

pH is a measure of hydrogen ion concentration to determine the alkalinity or acidity of a solution.

3.2.3. Dissolved Oxygen (mg/l) Test

Dissolved Oxygen (D.O.) levels in natural and wastewaters are dependent on the physical, chemical and biochemical activities prevailing in the water body. The analysis of D.O. is a key test in water pollution control activities and waste treatment process control.

$$\text{Dissolved Oxygen in mg/l} = \frac{\text{ml of titrant X normality Of Sodium Thiosulphate X 8 X1000}}{V2(V1-V)/V1}$$

3.2.4 BOD (Biochemical Oxygen Demand) test (mg/l)

The Biochemical Oxygen Demand (B.O.D.) of sewage or of polluted water is the amount of oxygen required for the biological decomposition of dissolved organic matter to occur under aerobic condition and at the standardized time and temperature. Usually, the time is taken as 5 days and the temperature 20°C as per the global standard. The B.O.D. test is among the most important method in sanitary analysis to determine the polluting power, or strength of sewage, industrial wastes or polluted water.

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$$\text{Dissolved Oxygen in mg/l} = \frac{\text{ml of titrant X normality Of Sodium Thiosulphate X 8 X1000}}{\text{V2(V1−V)/V1}}$$

3.2.5 Total Dissolved Solids (mg/l)

The measurement of solids is by means of the gravimetric procedure. The various forms of solids are determined by weighing after the appropriate handling procedures. The total solids concentration of a sample can be found directly by weighing the sample before and after drying at 103°C. However, the remaining forms, TDS and TSS require filtration of the sample. For liquid samples, all these solids levels are reported in mg/L.

IV. RESULTS AND DISCUSSION

The results were found and according to contaminants present in the waste water the various techniques to be used for the treatment is to be known. Studies have suggested that EM treated oily domestic waste water showed distinct reduction in all the tested parameters under all the tested incubation period. Oil and grease content was reduced to 784,784,500,178 and 56.pH was also reduced from 8.56 to 8.01,7.76,7.42 and 6.85. No reduction was observed in DO content. The BOD was reduced from 5.6 to 5.5, 4.7,3.9 and 3.5. The COD was decreased from 203 to 199, 175,146 and 129 mg/litre. Total dissolve solid was found to be reduced from 1400 mg/lit to 1200, 900,800 and 750 mg/litre at the respective incubation time. The analyses were carried out according to recommended ISO methods.

Table 4.1 Changes In Parameters Of Oily Domestic Waste Water Treated With EM

Sr. No.	Parameters	Incubation Time In Days				
		Before Treatment	0	7	14	21
1	Oil And Grease Content (mg/l)	784	784	500	178	56
2	pH	8.56	8.01	7.76	7.42	6.85
3	Dissolved Oxygen (mg/l)	7.9	8.4	9.0	9.4	9.6
4	BOD (mg/l)	5.6	5.5	4.7	3.9	3.5
5	COD (mg/l)	203	199	175	146	129
6	Total Dissolved Solid (mg/l)	1400	1200	900	800	750

V. CONCLUSION

The study demonstrates that Effective Microorganisms (EM) technology is a promising, sustainable, and eco-friendly solution for degrading oil in domestic wastewater. The results suggest that EM technology can effectively reduce oil contamination, providing a viable alternative to traditional wastewater treatment methods. Moreover, the use of EM technology aligns with global trends in seeking sustainable and green solutions to environmental problems.

The study reveals that EM technology in wastewater treatment significantly reduces environmental impact by decreasing oil and grease concentrations. It also effectively controls pH, TDS, and BOD, improving water quality. EM technology significantly reduces the content of contaminants in water, including phosphorus compounds, E. coli, coliform bacteria, and the total plate count of bacteria, up to 21 days after application.

Economic development through industrialization, agriculture for the better future of our society results in environmental deterioration. The present study was undertaken to determine the use of one of such new technique i.e., Effective Microorganisms for the treatment of wastewater. The indicator like oil and grease content, pH, DO, BOD, COD, TDS, were estimated before and after the treatment of wastewater, to observe the efficiency of selected process. There was appreciable reduction in the above mentioning values which has been observed by other liquid waste management.

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