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# REUSE & RECYCLE OF DAIRY WASTE WATER BY USING NATURAL BIO-REACTOR

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**ABSTRACT: -** *Increase in demand of milk and their product many dairies of different sizes have come up in different places. The dairy industry involve processing raw milk into product such as consumer milk , butter , cheese, yogurt, condensed milk dries milk (milk powder),and ice cream, using processes such as chilling , pasteurization ,and homogenization. The typical by product of milk are buttermilk, whey, and their derivatives. The effluent are generated from milk processing through milk spillage, dripping, washing of cans, tankers bottles, utensil, and equipment's and floors. The dairy industry generates on an average 2.5-3.0 liters of waste per liter of waste water per liter of milk processes. Generally this wastewater contains large quantities of fat, casein, lactose, and inorganic salt, beside detergent, sanitizer, etc. Used for washing. These all contribute largely toward their biological oxygen demand (BOD), chemical oxygen demand (COD) and oil and grease much higher than the permissible limits. For reuse this waste water for irrigation and much other purpose we have to clean this wastewater up to Permissible limit by using natural bioreactor (earthworm) by passing it through a filter media.From our experiment data it was found that there is percentage reduction in effluent in a BOD, COD, TSS , Alkalinity, TDS, Turbidity, MPN like upto 50%,60%,20%,40%,55%,15% .*

***Keywords:*** *COD, BOD, TSS, pH, Alkalinity, Temperature, TDS, Turbidity, DO, MPN, Earthworm (Eudrilus Eugenie).Phytoremediation.*

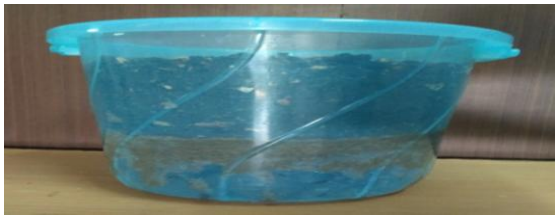
## 1. INTRODUCTION

Dairy waste is commonly define as waste from the dairy industry generated by milk industry while making milk product such as yogurt, pannier, cheese etc. Dou to rapid growth of dairy industry .the reuse of waste water for no potable water application is a notational for waste water reuse in developing countries such as India. Reuse of dairy waste serves two propose, reduces fresh water requirement and sewage generation. In water scarce environment, waste reuse and reclamation are often considered as a viable option for increase water recourses availability. In water scares developing countries dairy wastewater reuse in gardening and irrigation other many purpose. It is an aerobic treatment for dairy wastewater reuse. In this we use filtration techniques called vermifiltration. Vermifiltration is emerging out low cost sustainable technology for liquid waste treatment. Vermifilter means filter with earth warm involving the use of earthworm as a versatile natural bioreactor fir effective recyclable of nontoxic organic solid and liquid waste earthworm can effectively employed to maximize the growth of aerobic bacteria for waste processing this can be achieve by providing proper living condition and feeding them organic waste . This technique does not required expensive laboratories of sophisticated equipment. Nonvermifilter means filter without earthworm use for compression of quality of dairy wastewater effluent.In our present study dairy watste water is collected for recycyling from Thakur dairy located at area Ramnagar,wardha

**1.**1 phytoremediation:-in our experimental study we have used the phytoremediation method techanic we are used wheat seed for purification of effluent of dairy waste and also observed % increment in oxygen level from observation we see below

## 2. EXPERIMENTAL SETUP

The study was carried out in vermifilter kit containing gravel with the layer of black cotton soil on top. This form the vermicomposting bed as shown in fig.1 & 2



It has provision to collect filtered water at the bottom in the collection chamber which open out through a pipe fitted with tap. The bottom most layer is made up of gravel of size 40mm and it fill up to the depth of 40mm. above this line the gravel of 20mm size fill up to depth of 20mm. on the top of this 50mm sand is laid, and sand passed through 1mm I.S sieve were filled up to depth of another 50mm. the topmost layer of soil mixed with cow dung in 3:1 proportion were placed at the top of sand up to depth of 110mm in which the earthworm are released. Over which free board of 50mm is left.

## 3. DESIGN OF FILTRATION UNIT

**Collection of equipment**

1. Buckets of different size (18 /13/10 lit.).
2. Taps to pass water to one stage to another. (1/3").
3. Pipe of size (1/3").

**Collection of material**

1. Sand 1mm.
2. Pebbles of 2mm to 4mm, 20mm and 40mm size.
3. Black cotton soil.
4. Cow dung
5. Wheat seeds.
6. Earthworm

**Role of Earthworm in Filter: -**

**Introduction**

Earthworms are terrestrial invertebrates belonging to the Order Oligochaeta, Class Chaetopoda, Phylum Annelida, which have originated about 600 million years ago, during the pre-Cambrian era (Pierce et al., 1990). Earthworms occur in diverse habitat, exhibiting effective activity, by bringing about physical and chemical changes in the soil leading to improvement in soil fertility. An approach towards good soil management, with an emphasis on the role of soil dwellers like earthworms, in soil fertility, is very important in maintaining balance in an ecosystem (Shuster et al., 2000).The main activity of earthworms involves the ingestion of soil, mixing of different soil components and production of surface and sub-surface castings thereby converting organic matter into soil humus (Jairajpuri, 1993). Earthworms play an important role in the decomposition of Organic matter and soil metabolism through feeding, fragmentation, aeration, turnover and Dispersion. The role of earthworms in the recycling of nutrients, soil structure, soil productivity and agriculture, and their application in environment and organic waste management is well understood.

In vermifilter process earthworm removed BOD, COD, and suspended solid from dairy wastewater obtain from different collection point. Earthworm removes BOD,COD and suspended solid by general mechanism of 'feeding' and 'biodegradable' organic matter into vermicast which is rich in nutrient. We use **Eudrilus Eugenie**as an earthworm species. Shown in fig.3

Fig.3

**Eudrilus Eugenie: (length 90-165 mm, width 4-8 mm)**

- Behavior: Active with rapid escape response, if captured become very placid and can be readily handled - Color: Red-brown dorsum, anterior bright blue/green iridescent

**On removal of BOD and COD:**

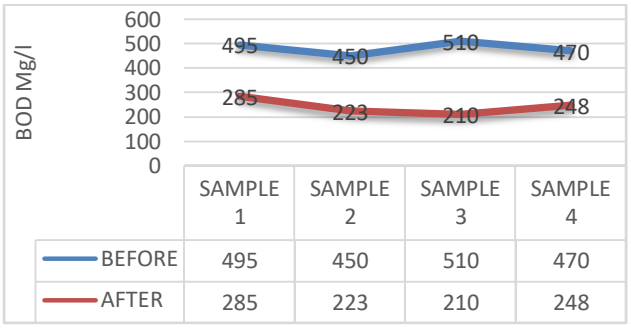
Vermi bio-filtration is a combination of conventional filtration process along with vermicomposting. Earthworms body act as a „bio-filter" and they were found to decrease BOD-97.95%, COD-91.64%, TSS-76.39%, TDS-84.27%. Oil and grease content was also found to be reduced by 84.13%. They treat the wastewater by the mechanism of „feeding" and „biodegradation. Also increase the hydraulic conductivity and natural aeration by grinding the soil particle

## 4. RESULT & DISCUSSION

**Lab Testing parameter.**

### 1. BIOLOGICAL OXYGEN DEMAND

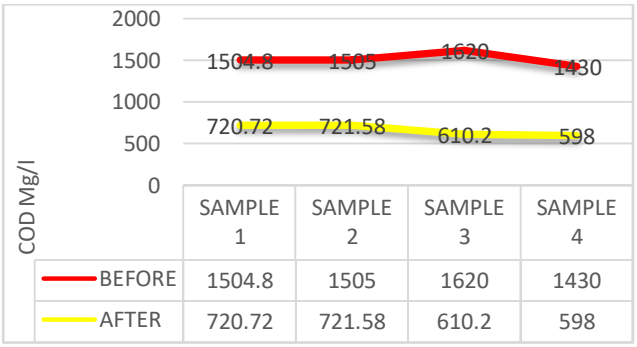
It is a measure of oxygen required to oxidize the organic matter present in sample through the action micro-organism contain in sample of waste water. It is the most widely use parameter organic pollution applied to both waste as well as surfaced water. The BOD taste results are used for the following purpose.




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 495 | 450 | 510 | 470 |
| AFTER | 285 | 223 | 210 | 248 |

### 2. CHEMICAL OXYGEN DEMAND

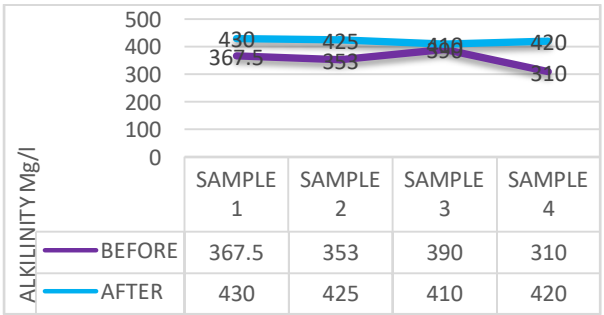
The COD value indicates the amount of oxygen which is needed for the oxidation of all organic substances in water in mg/l or g/m$^3$. The COD (**Chemical Oxygen Demand**) is closely related to the laboratory standard method named Dichromate-Method




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 1504.8 | 1505 | 1620 | 1430 |
| AFTER | 720.72 | 721.58 | 610.2 | 598 |

### 3. ALKALINITY

Alkalinity refers to the capability of water to neutralize acid. This is really an expression of buffering capacity. A buffer is a solution to which an acid can be added without changing the concentration of available H+ ions (without changing the pH) appreciably. If any changes are made to the water that could raise or lower the pH value, alkalinity acts as a buffer, protecting the water and its life forms from sudden shifts in pH. This ability to neutralize acid, or H+ ions, is particularly important in regions affected by acid rain.



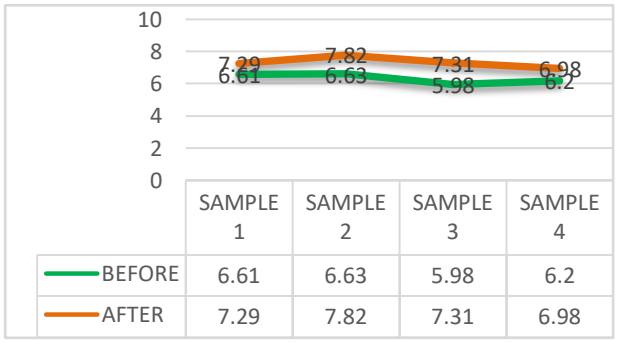

| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 367.5 | 353 | 390 | 310 |
| AFTER | 430 | 425 | 410 | 420 |

### 4. pH

Potential of hydrogen is a numeric scale used to specify the acidity or basicity of an aqueous solution. More precisely it is the negative of the logarithm to base 10 of the activity of the hydrogen ion. Solutions with a pH less than 7 are acidic and solutions with a pH greater than 7 are basic. Pure water is neutral, at pH 7, being neither an acid nor a

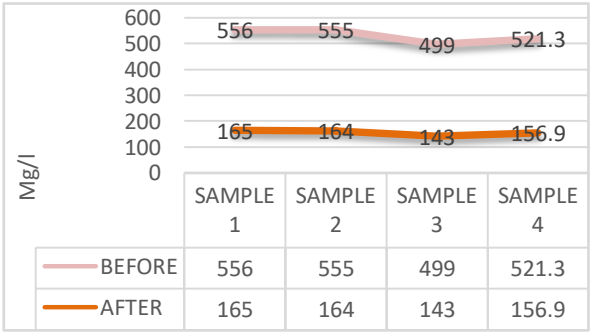
base. Contrary to popular belief, the pH value can be less than 0 or greater than 14 for very strong acids and bases respectively.




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 6.61 | 6.63 | 5.98 | 6.2 |
| AFTER | 7.29 | 7.82 | 7.31 | 6.98 |

## 5. TOTAL SUSPENDED SOLID

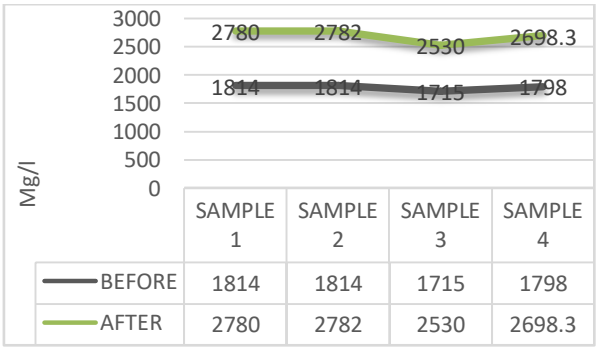
It is dry weight of partials trapped by filter. It is water quality parameter use for example to assess the quality of waste water after treatment in waste water treatment plant it is listed as conventional pollutant in the U.S. clean water act.




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 556 | 555 | 499 | 521.3 |
| AFTER | 165 | 164 | 143 | 156.9 |

## 6. TOTAL DISSOLVED SOLIDS

Levels of total dissolved solids (TDS) are often overlooked in these non-potable sources, resulting in challenges for end-uses such as cooling tower makeup and irrigation. Excessive levels of TDS can result in corrosion, fouling and scale in cooling towers and in toilet fixtures, and mortality to irrigated plants.Dissolved solids" refer to any minerals, salts, metals, cautions or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulphate's) and some small amounts of organic matter that are dissolved in water.

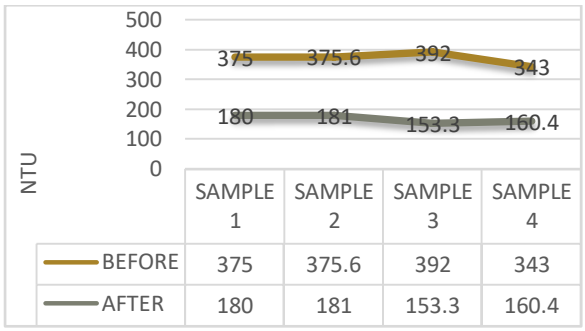



| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 1814 | 1814 | 1715 | 1798 |
| AFTER | 2780 | 2782 | 2530 | 2698.3 |

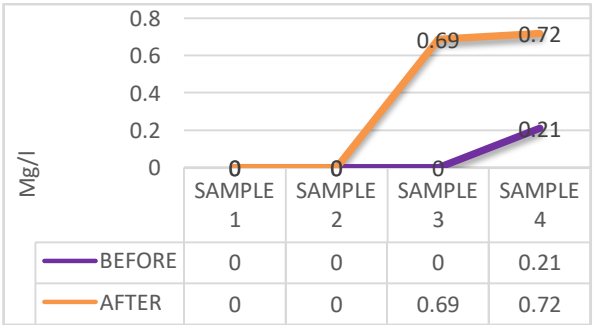
## 7. TURBIDITY

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.Turbidity can be measured directly with a turbidity meter/sensor, or indirectly with a secchi disc/tube. Turbidity is caused by particles and colored material in water. It can be measured relative to water clarity, or directly with a turbidity instrument such as a turbid meter or turbidity sensor.

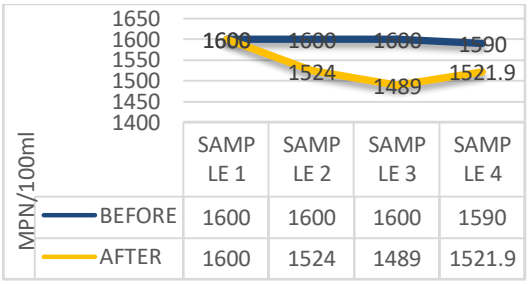
 




**8. DISSOLVED OXYGEN** Dissolved Oxygen is the amount of gaseous oxygen (O2) dissolved in the water. Oxygen enters the water by direct absorption from the atmosphere, by rapid movement, or as a waste product of plant photosynthesis. Water temperature and the volume of moving water can affect dissolved oxygen levels.Oxygen gets into the water when: Oxygen from the atmosphere dissolves and mixes into the water's surface. Algae and bay grasses release oxygen during photosynthesis. Water flows into the Bay from streams, rivers and the ocean.External bubbles (emphysema) can also occur and be seen on fins, on skin and on other tissue. Aquatic invertebrates are also affected by gas bubble disease but at levels higher than those lethal to fish. Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life.



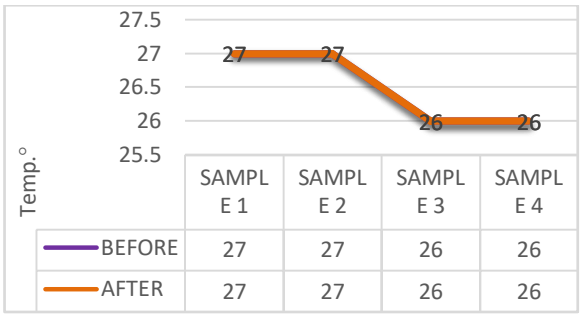

**9. Total coliform (MPN)** Focal coliform bacteria are a sub-group of total coliform bacteria. They appear in great quantities in the intestines and faces of people and animals. The presence of these bacteria indicates that your well water is contaminated with faces or sewage, and it has the potential to cause disease.Coliform is a rod-shaped bacteria which are always present in the digestive tract of warm-blooded animals, including humans. Coliforms are found in human and animal waste, and are also found in water, plants and soil.Most coliform bacteria do not cause disease. However, some rare strains of E. coli, particularly the strain 0157:H7, can cause serious illness. Recent outbreaks of disease caused by E. coli 0157:H7 have generated much public concern about this organism.




**10. Temperature**

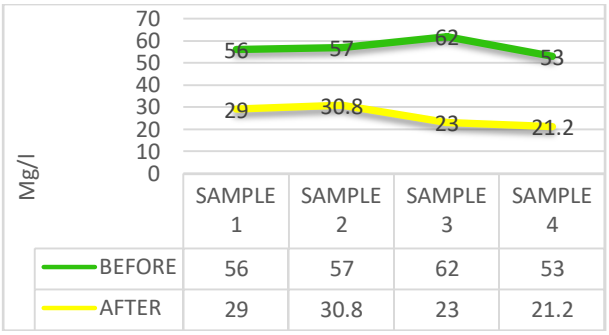
Temperature is a physical property and most important effluent parameter. Ahring et.al. (2001) studied the effect of temperature on performance and microbial population dyanamic of an anaerobic reactor treating cattle manure. The effect of temperature on anaerobic digestion is of great importance because the rate of biochemical reaction is directly affected by temperature. There are two group of organism that can affect digestion, namely the mesospheric organism that works best in the temperature range 30 to 38 degree C and thermophiles organism that thrive in higher temperature but have optimum reaction rates of 50 to 60 degree C.




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 27 | 27 | 26 | 26 |
| AFTER | 27 | 27 | 26 | 26 |

**11. OIL AND GREASE** The Concentration of disperse oil and grease is an important parameter for water quality and safety OG in water can cause surface films and shoreline deposits leading environmental degradation can induce human health risk when discharge in surface on ground water. Addionally OG may be interfere with aerobic and anaerobic biological process and lead decreased waste water treatment efficiency. Regulatory bodies worldwide set limits in order to control the amount of OG entering natural bodies of water or reservoir through industrial discharge and also to limit the amount present in drinking water.




| | SAMPLE 1 | SAMPLE 2 | SAMPLE 3 | SAMPLE 4 |
|---|---|---|---|---|
| BEFORE | 56 | 57 | 62 | 53 |
| AFTER | 29 | 30.8 | 23 | 21.2 |

ACTUAL FILTER & DESIGN

**5. CONCLUSION: -**

After filtering Dairy water from filter we get good results as compare to other vermifiltration because of phytoremediation technic used in vermifilter .because of phytoremediation used in filter we can reduce their pH value and can reduce toxic elements and metals from impure water. And we can increase the oxygen content of water.

As per testing results of anacon laboratories we can say that this Dairy water can be usable for agriculture purpose as per IS2490:1981 after filtration of water.
From the experimental data, it was found that vermi-filter using phytoremediation is more efficient than existing vermi-filter.

Vermifiltration using phytoremediation is a logical extension of 'soil filtration 'which has been used for 'sewage silviculture' (growing trees) since ancient days. Healthy soil is a bio geological medium acting as an 'adsorbent' of organics, inorganic, pathogens, and parasites. Vermifiltration technology (VFT) can be a most cost-effective and odor-free process for sewage treatment with efficiency, economy, convenience and potential for decentralization. Any wastewater from the households and commercial organizations can be successfully treated by the earthworms and the technology can also be designed to suit a particular wastewater

The major conclusions drawn from the project for vermi-filter using phytoremediation are given below:

1. Zero sludge produce.
2. Efficiency is achieved up to 90%.
3. Convenient to use.
4. It has an in-built pH buffering ability and hence can accept waste water within a pH range 4 to 9 without any pH adjustment.
5. Economical & Eco-friendly.
6. The vermi-filtered water is clean and can be recycled in many industrial plants for production Processes & various secondary uses.
7. Filtered water can also be used for irrigation.

**FUTURE SCOPE:**In our present study dairy wastes water is collected for recycling from Thakur dairy located at area Ramnagar,wardha is reused for Irrigation,washing,flushing government urinals,gardaing etc. And also reduce future water scarcity problem for certain extent.

**REFERENCES:-**

1. Dairy Water Reuse in Ruler School–Wise Water Management Manual (NEERI) JAN-2007

2. Sinha R.K., Bharambe G., Bapat P "Removal of High BOD and COD Loading of Primary Liquid Waste Product from Dairy Industry by Vermifiltration Technology Using Earthworm" Indian Environmental Protection, Vol 27, No. 6 June 2007.

3. Gajalakshmi S., Abbas S.A, Earthworm and Vermicomposting, Indian Journal of Biotechnology Vol.3, Oct-2004, pp 486-494

4. BC Green Building Code Background Research, Dairy water Recycling Oct-2007

6. Aalok Asha, Tripathi A.K, .Soni P, (2008), "Vermicomposting Is Better Option for Solid India on Environmental & Human Rights (Volume I).Prakriti Publications

7. RohitPathania et al. 2012: A review of vermifiltration and related low cost alternatives for waste water management

8. A.M. Kharwade, comparison of vermifilter and non-vermifilter.

9. Bhawalkar U (1995) Vermiculture eco-technology. Pub. Of Bhawalkar Earthworm Research Institute (BERI), Pune, India

10. Edwards CA, Fletcher KE (1988) Interaction between earthworms and microorganisms in organic matter breakdown.