

# **Comparison of Conventional Tertiary Wastewater Treatment With Respect To Root Zone Technology Adopted As Tertiary Treatment for Dairy Industries: A Review**

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**ABSTRACT :** India is leading in production of milk and also in processing and manufacturing of various products from it like buttermilk, whey, and their derivatives. Dairy industries are growing tremendous in size and number. Dairy industries discharge wastewater which is characterized by high COD, BOD, TDS, TS, and organic wastes. Such wastewaters become dangerous when released into water bodies. The dairy industry wastewaters are primarily generated from the cleaning and washing operations in the milk processing plants. 2 % of the total milk produced is wasted into drainage systems while washing. The study undertaken involved the characterization of wastewater and the dairy waste is selected for this purpose. By which the pH, suspended solids, TDS, and the significant reduction in the parameters were observed and hence found more useful. In the study we found that initially the waste water sample was alkaline but after the treatment the pH was observed near the Neutral also the TSS and TDS removal efficiency of 81% and 42% respectively was observed.

**KEYWORDS:** Root Zone; COD; BOD; colocaliaesculanta; Dairy effluent.

## **I. INTRODUCTION**

The waste water treated from secondary clarifiers goes to the drying bed which behaves as tertiary treatment. Various methods to dispose the dairy waste water from the large dairy factories can be included as, disposal of waste water into the municipal sewers, cases of wastewater disposal into the sea or disposal by means of land irrigation are also eminent. Also it is observed that, in smaller dairy factories, disposal criteria of the wastewater follows by disposing it into the irrigated lands and plain lands. It is observed that by practise of such methods there is occurrence of surface and groundwater pollution which may lead to serious harmful consequences.

Microbes which originated from plant or associated are the reason to contamination from soil or water. The remediation can be done by three methods, by retaining, by eliminating and by degradation. This process happens in an ecosystem naturally. Many plants have ability to treat soil, water and air pollution. The basic principle behind phytoextraction is the plants ability to accumulate various metals (essential or nonessential).

## **II. OBJECTIVES TO BE ACHIEVED**

1. Check and predict the chemical properties of the dairy waste water.
2. Comparing the conventional tertiary wastewater treatment system with new emerging technique of root zone treatment system.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 7, Issue 5, May 2018

3. To check the workability and serviceability of the root zone technology system with respect to conventional tertiary wastewater treatment system.

### III. LITERATURE REVIEW

- Trevor J. Britz et al, published in 2006 by Taylor & Francis Group, LLC, "Treatment of Dairy Processing Wastewaters" stated that the dairy industry uses and generates large amount of water it is therefore necessary to reuse their water.
- K. Sri Lakshmi, published in 2017 by International Journal of Scientific Research and Management (IJSRM) , stated that the Root zone technology converts this waste water into reusable water with the help of plants. The method is a very eco-friendly technique which eliminates the waste water in a very economical way.

### IV. METHODOLOGY-

**Material required for conventional tertiary wastewater treatment.  
Sludge drying bed:-**

The sludge drying bed plays an important role in the tertiary treatment of dairy wastewater by filtration and evaporation by dewatering the sludge.

**Root zone technology system as tertiary treatment for wastewater.**

- Coarse Aggregate: - 10 to 20mm size of aggregate is to be preferred by acting the same as a filtering agent.
- Activated carbon: - Used as hardness reducing agent of dairy wastewater.
- River sand: - 0.4 to 0.6mm size sand to be used for the equipment. The size of sand promotes movement of water and prevents it from logging.
- Black cotton soil: - Black cotton soil preferably to be used for the growth of plants and also to remove the fats in the dairy effluents. Also black cotton soil is good in high nutrient value.
- *ColocasiaEsculenta*: - To destroy harmful micro-organism by their roots and providing oxygen to dairy effluent.

**Process methodology of sludge drying bed:-**

Sludge produced from the treatment of wastewater basically consists of two basic forms which can be said as raw primary sludge and secondary sludge. The sludge drying bed operates in three steps which are as follows

- **Thickening**: - In sludge thickening the dry and solid content of sludge is increased by reducing the water content with low energy input. This task is carried out in a tank called as gravity thickener.
- **Dewatering**: - This process aims to reduce the water content further so that solids content of the sludge remains about 20%. It can be handling like a solid material. There are two process of dewatering which can be said as mechanical method filter press or by using drying bed.
- **Sludge drying bed**: - This is basically a thermal drying process where thermal energy is provided for evaporation process of the water to the sludge.

Process methodology of root zone technology: -

- In this method, layering of materials on a rectangular tub is carried out on sequential manner; aggregate layer being the bottom most layer followed by activated carbon, river sand, black cotton soil and on the above layer, plants of *colocasiaesculanta* are planted.

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Vol. 7, Issue 5, May 2018

- The plant species needs to get matured for which the time required for the process is about 15-30 days.
- The equipment of Root Zone Treatment System needs to be placed after the secondary clarifier tank.
- The samples of wastewater coming from the inlet as well as outlet needs to be analysed and characterized, by carrying out various tests on the wastewater sample by grape method.
- The pH, BOD<sub>5</sub>, COD, TS, TDS and TSS values needs to be determined for obtaining the characteristics property of the waste water.

### V. COMPARISON OF CONVENTIONAL METHOD OF TERTIARY TREATMENT AND ROOT ZONE TECHNOLOGY

Conventional method of tertiary treatment	Root zone technology
This method is not feasible for small cities and towns.	Root zone technology method is suitable for small cities and towns.
The method seems to be hazardous, causing damage to the environment conditions.	The method is not hazardous and balances the environmental conditions.
This method is time consuming.	This method consumes comparatively less time.
50 to 70 days are required for 100 % results.	25 to 30 days required for 100% results.
More land is acquired in this method. (About 3.5 acre)	The method acquires minimum land as compared to conventional method. ( 1 acre or less than 1 acre)
More equipment's are required for this method. (filters, settlement chamber, screen)	Material and equipment's used are less.
Construction cost turns around to be 18 to 20 lacs.	Equipment cost is less.
Number of equipment maximizes equipment cost and thus increasing the overall cost.	Construction cost is less than conventional method.
BOD removal efficiency ranges from 79 % to 86%.	BOD removal efficiency ranges from 82% to 92%.
COD removal efficiency ranges from 82% to 92%.	COD removal efficiency ranges from 76% to 85%.
Application - 1. pH control 2. Flow and Composition Balancing	Application - 1. Treatment of polluted streams, Nallas, rivulets and water bodies.

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Vol. 7, Issue 5, May 2018

3. Treatment of Dairy Processing Wastewaters	2. Polishing treatment for brewery, sugar factories, and paper and pulp factories. 3. Treatment of Dairy Processing Wastewaters
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## VII. CONCLUSION

Conventional method of tertiary treatment of wastewater follows traditional method of treating the waste water by letting the waste water to pass at sludge drying bed and getting it dewatered evaporated and by eliminating its harmful constituents. Whereas on other hand the root zone technique is very useful for small scale work and can be used as tertiary treatment for several agro based industries. Usually in root zone treatment system use of planted filter beds consisting of several earthen materials along with activated carbon. This technology uses the natural way to effectively treat industrial wastewater dairy being its prime important application.

## ACKNOWLEDGEMENT

We would like to express our gratitude sincere thanks and deep sense of appreciation to our guide prof N. P. Jajoo for continually assessing our work and also providing great and valuable guidance throughout the paper work and research work by timely suggestion and discussion at every stage of work . We would like to express our sincere thanks and deep sense of gratitude to Prof I. M. Jain (HOD of civil department).

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