Use of Root Zone Technology as Tertiary Treatment for Dairy Waste Water

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Abstract— A large amount of water is consumed by dairy industry for the processing of dairy products. Hence there is a need to recover and recycle the water from the effluent which was discharged from these industries. One of the natural methods to treat this kind of wastewater is Reed Bed System (or) root zone technique. In this study colocasia esculenta which is locally known as Nanal was used to treat the wastewater. The experiment was conducted with dairy wastewater collected from the effluent treatment plant of dairy industry. From the experimental study it was found that the Root Zone Technique gives a better quality of treated effluent with considerable percentage of reduction in Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The other monitoring parameters such as pH, and Total Dissolved solids (TDS), were found well within the permissible limits. In this study it is found that RZTS gives better results when it is used as a tertiary treatment rather than in conventional waste water treatment.

Keywords: Colocasia Esculenta, Reed Bed System, Tertiary Treatment

I. INTRODUCTION

Root Zone technology is a solution to the modern industrialized world's water pollution problems. Growth of wetland plants called reeds in specially designed bed provides ecofriendly mode to use nature to Protect Nature. The root zone i.e. a filter plant is a biological filter, where the biological treatment of wastewater takes place in a soil volume, which is penetrated by the roots of Phragmites australis. This technology is also called as Root-zone system or Bio-Filter or Reed Bed System or Constructed wetland (CW) system or Treatment wetland system. (A. A. Raval* et al, 2015) (Vymazal, 2005, 2007).

A. *Preamble*

Root Zone System uses ecologically natural processes for treatment of wastewater. It is a self-cleaning biological filter which removes disease organisms, nutrients, organic loads and a range of other polluting compounds. The treatment of wastewater and breakdown of organic pollutants is done by passing the pollutants through a root-zone of plants. Organic pollutants are broken down as a food source for the various microorganisms that are present in the soil and plants. Other contaminants like heavy metals are fixed in THhumic acid and cation exchange bonds in the soil or mineral substrate in which these plants are rooted. (Sunil N. Jadhav, et al, 2017)

The microbial life and the powerful reaction in the Root zone of the plants result in cleansing the contaminated particles. Root zone treatment systems utilize particular combinations of plants, soil, bacterial and hydraulic flow systems to optimize the physicochemical and micro-biological processes present within the root zone. The design of system depends upon the specific wastewater or sludge characteristics and the required level of treatment. Consequently, every application has a custom design according to effluent, flow rates and location. The approach of wastewater treatment in Root zone filters is similar to conventional biological, chemical and mechanical treatment plants. The system consists of properly designed treatment tank with proper soil, sand and gravel layers & selected indigenous plants. (Sunil N. Jadhav, et al, 2017)

B. *Types of Root Zone Technology System*

Depending on the types of flow, root zone treatment system can be classified.

There are two types of constructed wetland:

1) Free water surface constructed wetlands
2) Sub-surface constructed wetlands

These all types are well explained

1) Free Water Surface Constructed Wetlands

In free water surface constructed wetlands, waste water flows as a shallow water layer over a soil substrate.

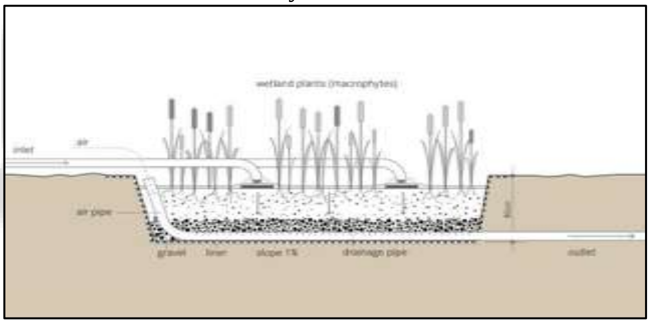

Fig. 1.1: Free water surface constructed wetlands (A. A. Raval and P. B. Desai, 2015)

2) Sub-Surface Constructed Wetlands

Sub-surface constructed wetlands are further classified as

1) Horizontal flow
2) Vertical flow

a) Subsurface Horizontal Flow:

In subsurface horizontal flow the constructed wetlands, waste water flows horizontally through the substrate.

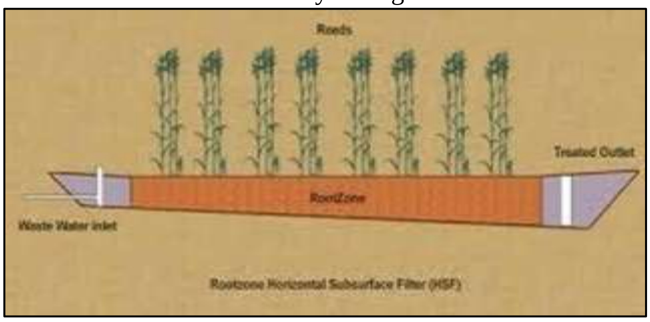

Fig. 1.2: Root zone Horizontal Subsurface Filter Reed bed filled with gravel, sand or soil with horizontal flow of wastewater (A. A. Raval and P. B. Desai, 2015)

b) Sub-Surface Vertical Flow:

In subsurface vertical flow the constructed wetlands, waste water is dosed intermittently surface of sand and gravel filters and gradually drains through the filter media before collecting in a drain at the base.

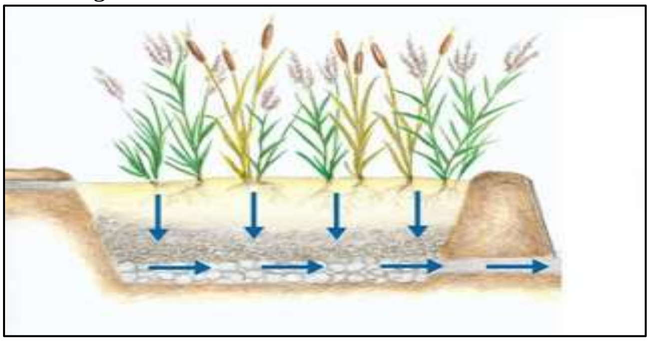

Fig. 1.3: Sub-surface vertical flow
(A. A. Raval and P. B. Desai, 2015)

Constructed wetlands may be planted with a mixture of submerged, emergent and, in the case of free water surface constructed wetlands, floating vegetation.

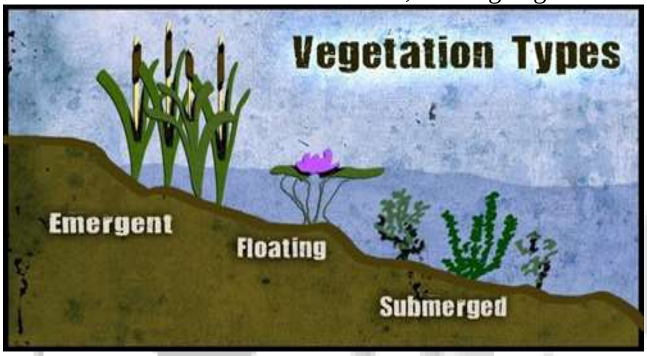

Fig. 1.4: Types of Vegetation
(A. A. Raval and P. B. Desai, 2015)

3) Nutrient Removal Mechanism

In the wetlands, nutrient removal from waste water occurs due to different mechanisms:

1) Plant uptake
2) Microorganisms residing on the plant roots which transform nutrients (mainly nitrogen) into inorganic compounds (ammonium and nitrate)
3) Physical processes, such as sedimentation and filtration. The treatment processes are numerous and differ according to the type of flow (surface flow, subsurface vertical flow, and subsurface horizontal flow), species of plant, conception of the system (dimensions and number of beds) and structure of substratum (soil or gravel). Constructed wetlands have been widely used in treating different types of contaminants found in domestic sewage, storm water, various industrial waste waters, agricultural runoff, acid mine drainage and landfill leachate. For sub-surface vertical flow different beds are laid down (G. Baskar*, V.T. Deeptha and A. Abdul Rahaman,2008).

Fig. 1.5: Different Layers in Root Zone Technology
(A. A. Raval and P. B. Desai, 2015)

4) Execution of Dairy Industry

The dairy industry is one among the important food industry among all and major source of waste water. It generates between 3.739 and 11.217 million m3 of waste per annum (i.e. 1 to three times the quantity of milk processed), Waste water is generated in milk processing unit, mostly in pasteurization, homogenization of fluid milk and therefore the production of dairy products like butter, cheese, powdered milk etc. Most of the milk processing unit use “clean in place” (CIP) system which pumps cleaning solutions through all equipment during this order water rinse; caustic solution (sodium hydroxide) wash, water rinse, acid solution wash, water rinse, and sodium hypo-chlorite disinfectant. These chemicals eventually become a neighborhood of waste water. The resulting waste water can contain detergent, sanitizers, base, salts and organic matter, depending upon source, Climate of the world and production of the dairy plant are two major reasons, liable for changing waste water character. This variation isn't only from one industry to a different dairy industry but also from season to season and even hour to hour. Inland received waste water affect the soil quality and soil structure and a part of waste water also can leach is to underlying groundwater and affect its quality.The annual cost of treatment and disposal for the standard plant appears to be within the order of thousands of Rupees. Disposal of untreated water is rapidly becoming a serious economic and societal problem faced by the dairy processing industry in many respects. most the dairy factories face the matter of water treatment, disposal and utilization of the waste water. Disposal of the waste water into the rivers, land, fields and other aquatic bodies, without or with partial treatment, in crude tanks, will soon offer a significant problem to health and hygiene. (Ashutosh Pachpute, Sandeep Kankal, Sanjivan Mahadik).

It is also reported that higher concentration of dairy wastes is toxic to certain sorts of fish and algae. The casein precipitation from the waste which decomposes further into a highly odorous black sludge at a certain dilutions the dairy waste is found to be toxic to fish also. Dairy effluent contain a soluble organics, the suspended, solids, trace organics. They decrease do, promote release of the gases, cause taste and odor, impart color or turbidity, promote eutrophication. (Asst. Prof. Kalyani Kenkar, Prof Vishwajeet Kadlag).

Aquatic plants play a crucial role in structural and functional aspects of aquatic ecosystems by various ways and phytoremediation is one among them. Phytoremediation includes the utilization of plants also as microorganisms of the rhizosphere to get rid of or render harmless pollutants from contaminated sites (Bhutiani. R., Khanna. D. R., Varun Tyagi, Faheem Ahamad) The term 'Root Zone' encompasses the life interactions of varied species of bacteria, the roots of reed plants, soil, sun and water. they're also referred to as constructed wetlands or subsurface flow systems. during this system, these plants conduct oxygen through their stems into their root systems and make favorable conditions for the expansion of bacteria.The processes are alleged to happen within the rhizosphere region, which consists of the plant roots, the plant rhizomes, and therefore the linked microbial communities (Preethi M. Abinaya. R. Loganath). Sustainable wastewater treatment is related to low energy consumption, low cost of capital , and, in some situations, low mechanical technology requirements.

II. Literature Review

Different researchers have successfully done their study on Root Zone Technology. they need published their literature on Root Zone Technology with their different conditions and using different plants which are discussed below.

1) A. A. Raval (et al) 2015 presented that the present criterion for wetland design are supported either empirical or first. The performance of Constructed Wetlands Treating Domestic Waste water are often judged on the idea of varied parameters like BOD, COD, TSS, nitrogen, phosphorus and coliform removal. The BOD removal efficiency in India when reed beds utilized in horizontal flow mode varies from 80 96%. Several samples of organic material removal are sited here. just in case of Phragmites in North Europe studied for phenol removal 72% was metabolized by soil organisms, 16.7% by plant part and 9% was volatilized.
2) G. Baskar (et al) 2009 found the results over a 6-month period for the characterization of waste water. there's considerable change within the values of TSS, BOD and COD during peak activity within the university. Treatment efficiencies of obtainable sewage treatment plant (STP) and root zone treatment (RZT) are given in Table 1.

Parameter	Sewage treated by STP	Sewage treated by RZT
pH	6.71	6.965
TSS, mgl-1	27.7	15.7
TDS, mgl-1	739	650
TN, mgl-1	6.92	4.2
TP, mgl-1	2.175	0.85
BOD, mgl-1	79.85	7.6
COD, mgl-1	192	145.5

Table 1: Comparison of waste water treated by conventional sewage treatment plant

3) Kumer S. Makvana (et al) 2013 stated that Salmonella bacterium reduction altogether three seasons was assessed and it had been found that 96% was decease in number of cells during summer season while it had been lowest in season (85%). the very best Shigella reduction (96%) was during season and lowest reduction (85%) was observed during summer season. the very best Vibrio reduction (96%) was during winter season, followed by summer season (94%) and lowest reduction (89%) was observed during season . Two sampling points (inlet/untreated and outlet/treated) designed within the present investigation.
4) Ms. J. Kalaiselvy (et al) 2016 stated that the treated dairy wastewater using root zone technique by using Phragmites australis has the subsequent inferences at the top of 4 days for every sample are as follows: For a maximum influent BOD concentration of 310 mg/l, there was a greater reduction within the treated effluent with 94 mg/l. The treated effluent has BOD of 85 mg/l for the minimum influent BOD concentration of 280 mg/ l. a discount in COD concentration at the outlet of the RZT for a maximum influent COD concentration as was observed to be 86 mg/l. Similarly, for a minimum influent COD concentration of 690 mg/l the treated effluent by RZT was found to be 83 mg/l. The turbidity of the treated effluent was reduced to the range of two to 4 NTU as maximum and minimum influent value (26 to 30 NTU). Hardness of the treated effluent vary from 216 to 243 mg/l for max and minimum influent values. a substantial decrease within the value of alkalinity was observed for the varied influent characteristics. It accounts to 379 to 410 mg/l after passing through the basis Zone
5) Binita Desai (et al) 2014 stated the most objective of this study was to spot energy-efficient design parameters for a standard STP and comparison of construction, operation and maintenance cost of STP by phytorid technology. Low cost, natural and energy saving technologies are tons of attention lately thanks to their low installation cost, their simple maintenance and fewer dependence on external inputs like power and chemicals, their potentially longer cycles and their ability to recover a spread of resources including treated effluent fir irrigation, organic humus for soil amendment and biogas etc. However, intensive research is required during this area especially in developing countries to perfect the planning factors and test the technologies at pilot and field level.
6) Mahesh Mane (et al) 2017 stated that the basis zoning technique is extremely useful for little scale work while we will plan it for huge network also. This has resulted in pollution of water bodies thanks to increased generation of domestic waste, sewage, industrial waste etc. This Seminar reviews the basis Zone Treatment System (RZTS) which are planted filter beds consisting of soil. This Technology uses a natural thanks to effectively treat domestic and industrial effluents.
7) Masaru Sakamoto (et al) 2015 stated that, although suboptimal root-zone temperature tends to limit plant growth, responsiveness to root-zone temperature depends on the plant species. as an example , six Cucurbitaceae species exhibited different responses within the sort of changes of biomass, photosynthesis, and stomatal conductance at root-zone temperatures between 14˚C and 34˚C. within the present study we

showed that exposure of red leaf lettuce roots to coldness significantly reduced leaf area, stem diameter, and fresh weight of tops and roots. These findings suggest that coldness treatment of roots triggers stress responses within the whole plant, leading to the reduction of leaf and root growth. Our experiment showed that root-zone heating led to no significant changes of plant biomass.

In contrast to our results, root-zone cooling at 20˚C increased the biomass of aeroponically grown lettuce from that in plants with ambient conditions (24˚C - 38˚C) during a tropical greenhouse. Because these experimental air and ambient root-zone temperatures were presumably above ours, root-zone cooling at 20˚C therein report may have optimized plant growth instead of triggering low-temperature stress responses. the share efficiency achieved under this study was within 95%.

8) M. Preethi Abinaya (et al) 2015 stated that the plant used taro has the power to transfer oxygen to root zone. Large population of microorganism found in root zone. Pollutants digested and rendered innocuous by a variety of organisms almost like conventional sewage system . the primary layer of 0.07m consisted of coarse aggregate gravel. The second layer of 0.035m consisted of newspaper which I incinerated at 500 °C for 3 hrs and activated physically to extend its pore size. 0.025 m freeboard. After arranging the layers, the taro were planted. The results indicate the concentration of 5 parameters for Grey water treatment by Horizontal subsurface flow root zone. it's clear that there's an interesting reduction in pH, B.O.D, C.O.D by Root zone treatment system. The treated Grey water has end up to be fit enough to offer out directly into a receiving water body. this is often possible since the concentrations of the pollutants were beneath the allowable limits. (M. Preethi Abinaya, R. Loganath, February-2015)
9) Ms. Brunda D.M. (et al) stated the unit was constructed by placing separate layers of coarse aggregate (10 to 20cm), stone dust (10 to 15cm) and sand (20 to 30cm), after arranging the layers the plants were planted within the unit. Further the expansion of plants was monitored. During the expansion period of 1 month, only plain water was sprinkled. Then sewage water was let into the basis zone system and therefore the samples were collected. Plant used for this eco-friendly treatment is water plant (Phragmitis australis) that's collected from an agricultural land near Halekote. These plants are easily available in agricultural land, thrown as a waste from crops. Especially, this plant has pores in rootage hence transports oxygen through it. Preliminary treatment is completed by screening. The concentration of BOD before treatment is 138 mg/l whereas after treatment, the removal efficiency is 76.81% which indicates the utilization of grey-water are often put to use in agricultural practices. the utilization of reed bed to get rid of nutrients and micro pollutants from domestic sewage is more cost effective than conventional sewage treatment system.
10) M.G. Healy (et al) 2006 stated that, plant ditch reed (Phragmites australis(Cav.) Trin. ex Steud.) and customary cattail (Typha latifolia L.) are mainly planted in CWs, a modified version of the SSVF CW, the 2 stage vertical flow constructed wetland (VFCW), has been gaining popularity in France, where there are currently around 400 VFCWs operational . the primary stage of this technique comprises three parallel vertical flow sand filters which are alternately intermittently dosed with raw wastewater at an organic loading rate of 300 g COD m_2 d_1. during this first stage, COD and SS removal takes place. They contain a 30 cm-deep fine gravel layer (2–8 mm in size) which overlies a 10–20 cm-deep transition layer (5 mm in size) and a 10–20 cm-deep drainage layer (20–40 mm in size). The second stage comprises two identical vertical flow sand filters which contain a 30 cm-deep fine gravel layer (effective grain size, d10 < 0.40 mm) which overlies a 10–20 cm-deep transition layer (3–10 mm in size) and a 10–20 cm-deep drainage layer (20–40 mm in size). Nitrification mainly occurs within the second stage. Results from these systems are good with COD and SS removals of 90% and 95%, respectively, being measured and nitrification at 85%.
11) A. Arivoli (et al) 2013 allowed for gravity settlement for six hours during a sedimentation tank and clear supernatant wastewater of 20 liters from the sedimentation tank was sieved and transferred to the constructed wetland. The waste water was treated at different hydraulic retention time of 12, 24 and 36 hours. VFCW had a mean pH of seven .70, 7.65, 7.57 and unplanted bed had a mean pH of seven .80, 7.74 and 7.70 during different retention time of 12, 24 and 36 hours respectively. The Chemical Oxygen Demand (COD) of domestic wastewater and influent samples were observed to be 412.32 and 374.34 mg/l. The effluent from the planted VFCW had as mean COD of 85.64,73.90, 63.84 mg/l and the unplanted bed had a mean COD of 126.4, 117.78 & 111.70 mg/l during the different retention time 12, 24 and 36 hours respectively. The Biological Oxygen Demand (BOD5) of domestic wastewater and influent samples were observed to be 157.20 and 128.44 mg/l. The effluent from the planted VFCW had a mean BOD5 of 38.86, 33.74, 30.74 mg/l and the unplanted bed had a mean of BOD5 of 66.08, 61.20 and 55.94 mg/l during different retention time 12, 24 & 36 hours respectively.

A. Aim

To check the feasibility of root zone technology as tertiary treatment for the dairy industry waste water.

B. Objective

1) Analyze characteristics of waste water of dairy industry at the outlet of secondary treatment unit.
2) Development and installation of RZTS model.
3) Analyze characteristics of treated waste water at the outlet of RZTS model.
4) to match the treatment efficiency of constructed wetland system with conventional treatment plant.
5) Investigate the feasibility of applying a constructed wetland system to treat the dairy waste water.

C. Scope of the Project:

The root zone technology system utilizes nature's way of biological and physiochemical processing of domestic & industrial effluents. This effective technology called Decentralized Wastewater Systems (DEWATS). Rapid urbanization requirement in dairy industry will need proper utilization of land as Root Zone Technology is far suitable for secondary or tertiary treatment diary waste water.

III. METHODOLOGY

A. Materials

Materials which are required for laboratory model of Root Zone Technology are easily available and their costs are low. The materials required are as follows:

1) Effluent: -

The constructed wetland treatment installations are constructed consistent with the specified level of purification, the concentration of the pollutants and hydraulic and the organic loadings. The plants are often set-up as secondary or tertiary treatment for domestic and industrial wastewater treatment systems. The dairy waste was collected.

2) Plant: -

colocasia esculenta: - There should be used for killed bacteria from root and obtain oxygen mixed in waste water

Fig. 3.1: Colocasia plant.

3) Soil: -

There should be wont to growth of plant and take away the oil from waste water.

Fig. 3.2: Soil required as a layering medium being the topmost layer.

4) Sand: -

0.3-0.5 mm size sand is employed for RZTS. This size of sand promotes movement of water and stop clogging.

Fig. 3.3: Sand required for layering medium, below the soil layer.

5) Coal: -

To scale back the hardness of waste water.

Fig. 3.4: Coal makes the foremost important layer in root zone treatment system acting because the waste absorbing agent, layer to be provided below sand layer.

6) Gravel: -

0.6mm size & it's used remove the sediment, odor and smell of waste water

Fig. 3.5: Aggregate i.e. gravel layer to be provided because the bottom-most layer of the basis zone treatment system for straightforward filtration of the waste effluent.

B. Methodology

The horizontal sub-surface flow constructed wetland system employed within different layers of various materials viz. Aggregate, Char coal, sand, black cotton soil of various thickness is laid for sub-surface Root Zone Formation. Provision of thickness as follows (from bottom to top):

1) the primary layer of 75 mm consisted of coarse aggregate gravel 10 mm size
2) The second layer of charcoal 55 mm of size 6 mm,
3) The third layer of 45 mm consisted of fine aggregate sand 0.3–0.5 mm size.
4) Last layer of black cotton soil of thickness 100 mm provided.

5) 25 mm freeboard.
6) The plants age increased from ½ to 1 months. Plant density and height of colocasia plant were 10 plants m2

1) Sowing and Biomass growing

The stems of taro plants were collected from the encompassing natural and were transplanted on an equivalent day within the artificial bed hospitable atmosphere. Each stem comprising a bit of 0.1 m length was established within the bed. The bed was flooded with water on alternative days. One month later, each plant, of 0.2 m length rhizome and stem, was established within the larger bed at a density of 10 plants per square metre . The plants were allowed to determine themselves in water . One month later, the plants measuring 0.3 m rhizome and stem were transplanted into the pilot-scale wetland unit. The plants were allowed to determine themselves in water . One month later, raw waste water replaced the freshwater because the influent to the beds. The taro exhibited an honest survival from 9 plants. Within 1 month, the plants began to sprout.

2) Maturity of plants

Vegetation is that the principal component of a wetland system. the power of the plants to remain healthy and thus to still grow is a crucial think about the selection of plants for phytoremediation. The common plants in wetlands are ditch reed (However, the foremost common plant species worldwide is taro . the foremost commonly used macrophyte in subsurface flow wetlands is additionally taro . The experiment was conducted to watch the pollutant removal performance of the wetland plant colocasia at 1-day Hydraulic Retention Time (HRT).

3) Wetland system and operation

Colocasia species from the sector were transplanted. The unit was planted with several colocasia species in random order. The microcosms were monitored 3 times per week, and invasive seedlings like ordinary grass were immediately removed. Each microcosm was fed with freshwater daily at begin . Then, the system was continuously fed at the flow of 20/day. The influent into the bed was controlled manually a day by measuring the flow and adjusting the inlet valve to take care of endless daily flow . Once in two days RZTS must be acclimatizing the soil microbes and to support growth of the plants. before the discharge into the wetland, Secondary clarifier’s outlet of waste water was tested for 3 months to characterize its quality.

4) Water sampling and analysis

Four liters of water samples were taken 3 times during a month from inlet chamber and outlet chamber of the RZTS unit. Sampling was usually performed at around 2 p.m. on each sampling date at the month of March-April having atmospheric temperature of 27°C. The samples were collected by putting a clean plastic bottle below the inlet and outlet pipe of RZTS unit. The samples were analyzed for pH, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Solids (TS), BOD and COD consistent with Standard Methods for Waste and Waste Water Examination. The measurements were performed from samples which were immediately transferred to the laboratory. All the analyses were completed within 5 days of sample collection. For the sampling Grape method was adopted.

Fig. 3.6: BOD Incubator

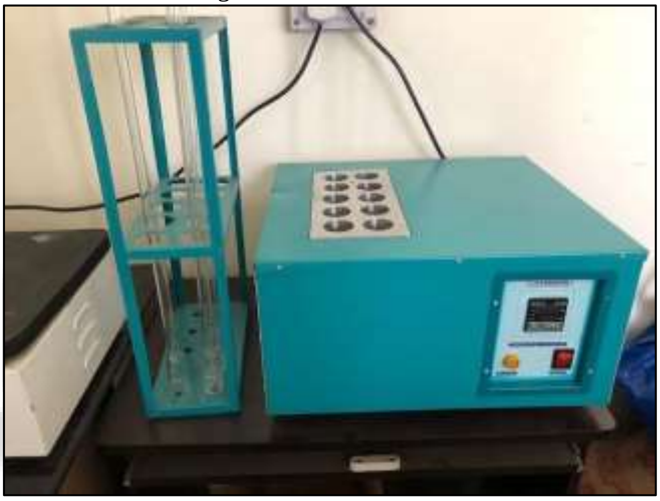

Fig. 3.7: COD Incubator.

5) Maintenance of vascular plant

All the plants were observed throughout the experimental period for the general appearance and the health. The plant growth was monitored and located to be 0.1 m per month. Values within the table correspond to mean values of two samples. pH, TSS; total suspended solids; TDS, total dissolved solids; BOD, biochemical oxygen demand; COD, chemical oxygen demand. it's clear that there's an interesting reduction in pH, B.O.D, C.O.D by Root zone treatment system. The treated dairy water has end up to befit enough to offer out directly into a receiving water body. this is often possible since the concentrations of the pollutants were beneath the allowable limits. As a result, the basis zone treatment are often used independently or as an addition to standard treatment so on make the ultimate output fit enough for discharge into a natural water body. During the preliminary phase, the basis zone system shows quite low efficiency in B.O.D and C.O.D thanks to minimum growth of the plant. within the later stage the basis zone bed showed greater efficiency. Further efficacy are often enhanced by using aerators to rise the oxygen supply alternatively hybrid root zone system (an arrangement of horizontal and vertical root zone system) are often used for zero discharge efficacy.

C. *Working of root zone technology*

The functional mechanisms within the soil matrix that are liable for the mineralization of biodegradable matter are characterized by complex physical, Chemical and biological processes, which result from the combined effects of the filter material, wetland plants, micro-organisms and wastewater. The treatment processes are based essentially on the activity of microorganisms present within the soil. Smaller the grain size of the filter material and consequently larger the interior surface of the filter higher would be the content of microorganisms. Therefore, the efficiency should be higher with the finer bed material. This process, however is restricted by the hydraulic properties of the filter bed; finer the bed material, lower the hydraulic load and better the clogging tendency. The optimization of the filter material in terms of hydraulic Load and biodegradation intensity is therefore the foremost important think about designing RZTS. The oxygen for microbial mineralization of organic substances is supplied through the roots of the plants, atmospheric diffusion and just in case of intermittent wastewater feeding through suction into the soil by the out flowing Wastewater. The roots of the plants intensify the method of biodegradation also by creating an environment within the rhizosphere, which reinforces the efficiency of microorganisms and reduces the tendency of clogging of the pores of the bed material caused by a rise of biomass. RZTS contain aerobic, anoxic and anaerobic zones. This, along side the consequences of the rhizosphere causes the presence of an outsized number of various strains of microorganisms and consequently an outsized sort of biochemical pathways are formed. This explains the high efficacy of biodegradation of drugs those are difficult to treat. The filtration by percolation through the bed material is that the reason for the very efficient reduction of pathogens, counting on the dimensions of grain of the bed material and thickness of the filter, thus making the treated effluent suitable for the reuse. Conversion of nitrogen compounds (Nitrification / Denitrification) occurs thanks to planned flow of wastewater through anaerobic and aerobic zones. Reduction of phosphorous depends on the supply of acceptors like iron compounds and therefore the redox potential within the soil. (Varne Ashok L. and Wagh K. K., November 05, 2014)

IV. CONCLUSION

The report introduces constructed wetland waste water treatment system with some required modification in design. This new modification is employed for the treatment of dairy waste water.

The findings of present study discussed in earlier chapters also are summarized below.

1) System performance for the reduction of COD resulted up to the 90%.
2) With regard to the points disused in previous chapter shows that wetland effluent meets the characteristics of waste water effluent discharged into land for irrigation.
3) From this study, the emergent plant Colocasia based constructed wetland has proved as a promising technology for dairy effluents.

V. FUTURE SCOPE

- This modification in design of constructed wetland are often considered for other industrial wastewater.
- To study nitrogen & phosphorous removal.
- Study wetland efficiency for other industrial waste.
- Given the shortage of experiences with the appliance of constructed wetland technology to high strength wastes, it's most apparent that additional research is required, along side more innovative designs and configurations.

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