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Use of Artificial Wetland for Treatment of Dairy Industry Waste Water

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***Abstract*— The consumption of large volumes of water and the generation of organic compounds as liquid effluents are major environmental problems in milk processing industry. The volume of freshwater required by this industry can be significantly reduced by recovering the intrinsic water present in dairy industry. This amount of freshwater will depend on the process technology. In recent years, the environmental effects of industrial activities have increased considerably, and current perspectives indicate that the trend for this problem is to be worsening. In this regard study is to treat the waste water generated from the dairy industry by constructed wetland Physico-chemical and organic parameters of water samples of the dairy were examined to determine the quality and extent of pollution. 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 too alkaline but after the treatment the pH was observerd near the Neutral also the TSS and TDS removal efficiency of 81% and 42% respectively was observed.**

Keywords*— chemical oxygen demand , canna indica , biological oxygen demand.

I. INTRODUCTION

The dairy industry is one of the important food industry among all and major source of waste water [1]. It generates between 3.739 and 11.217 million m3 of waste per year (i.e. 1 to 3 times the volume of milk processed) [2]. Waste water is generated in milk processing unit, mostly in pasteurization, homogenization of fluid milk and the production of dairy products such as butter, cheese, milk powder etc. Most of the milk processing unit use "clean in place" (CIP) system which pumps cleaning solutions through all equipment in 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 part of waste water [3]. Large amount of water is used to clean dairy processing plants; hence, the resulting waste water can contain detergent, sanitizers, base, salts and organic matter, depending upon source [4]. Waste water volume and strength fluctuated widely from day to day due to partly differences in production, therefore, data of effluent or waste water volume per unit of product processed (liters waste water/kg product), waste water concentration (mg/litre) and weight of waste generated per unit of product processed (g waste/kg product) also changes [5,6]. Climate of the area and production of the dairy plant are two major reasons, responsible for changing waste water character. This variation is not only from one industry to another 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 part of waste water can also leach is to underlying groundwater and affect its quality [7].

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The problem is more serious, when it concerns waste water discharge before treatment from dairy or milk processing industry. It is one of the largest sources of industrial effluents in many countries like (Europe and India). A typical European dairy factory generates approximately 50 m3 waste water daily with considerable concentration of organic matter (fat, protein and carbohydrates) and nutrients mainly (Nitrogen and phosphorous) originating from the milk and the milk products [8, 9]. The annual cost of treatment and disposal for the typical plant appears to be in the order of thousands of Rupees. Disposal of untreated water is rapidly becoming a major economic and societal problem faced by the dairy processing industry in many respects [10]. Almost all the dairy factories are facing the problem of water treatment, disposal and utilization of the waste water. Disposal of waste water into rivers, land, fields and other aquatic bodies, without or with partial treatment, in crude tanks, will soon offer a serious problem to health and hygiene [11, 12]. In this regard's it is very necessary to treat the diary waste water to protect the environment and ecology. But due high cost of chemical and equipment and typical design/arrangement, the industries are not willing/interest to treat the waste water.

Here some natural and affordable methods are also present like Rootzone [13]. The constructed wetland treatment is the method by which the waste water is fed to the plant along its root zone there by it degrades the wastes along its intake and then the water percolates through the soil layer towards the outlet by collecting the water. The arrangements are simple. The hollow stem plants such as Bamboo and others from grass family can be used since they take water in large quantity than other family plants for this study. For experiment canna indica plant was selected. The experiments are conducted. The water can be made ready for reuse after experiment. The root analysis of the plant before and after the study has been done so that it

can be evaluated that the plant had taken the water for its photosynthesis process. Hence the aim of this study is to degrade the dairy waste in a natural environment without using chemicals and to make the water for reuse [14].

II. MATERIALS AND METHOD

A. *Effluent*

The constructed wetland treatment installations are constructed according to the desired level of purification, the concentration of pollutants and hydraulic and organic loadings. The plants can be set-up as secondary or tertiary treatment for domestic and industrial wastewater treatment systems. The dairy waste was collected from Shakti dairy plant located at Kashti Tal Shrigonda.

B. *Experimental setup*

The untreated dairy wastewater was applied on to constructed wetland in a controlled manner with a flow rate of 100Lit/day.The dairy wastewater was treated by constructed wetland system.The details of Constructed Wetlands are shown below.:

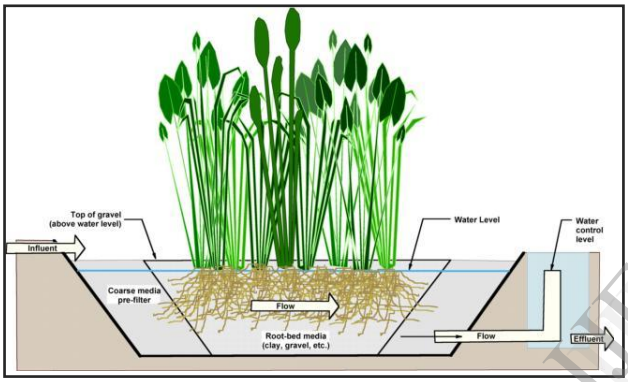

Fig.I canna indica cultivation in wetland

The constructed wetland area is 2.5 M x 2.5 M x 1 M depth .All the side of constructed wetland were covered by polythene paper .The bottom layer is 30 cm of gravel size 5-6 cm .The middle layer is 30 cm the sand is 1-2 cm and the top layer is 40 cm of soil .The outlet pipe is two feet from the wetland at depth of 1 m.The applied flow pattern to the CW was surface flow type. Plants of ***canna indica*** were planted on the top layer of CW in the month of August 2012.The treated wastewater from the outlet were collected and analysed in laboratory for following parameters like pH,total suspended solids (TSS),Total Dissolved solids (TDS) .All the test were performed as per the standard Methods i.e APHA . The CW was under observation for effluent collection from the month of September 2012 .All analytical tests were conducted in Environmental Engineering Laboratory of Parikrama college of Engineering, Kashti, Dist. Ahmednagar.

C. *Physico chemical Analysis*

The samples were collected and analyzed for, pH, Total Suspended Solids (TSS), Total Dissolved solids (TDS), values.

III. RESULTS AND DISCUSSION :

A. *pH results*

A hydrogen ion (pH) concentration in the wastewater is depicted in Fig II. During the study pH values were measured throughout the study period except when equipment failed. The settling basin pH values fluctuated with pH values that ranged from a low of 7.6 to a high of 8.2

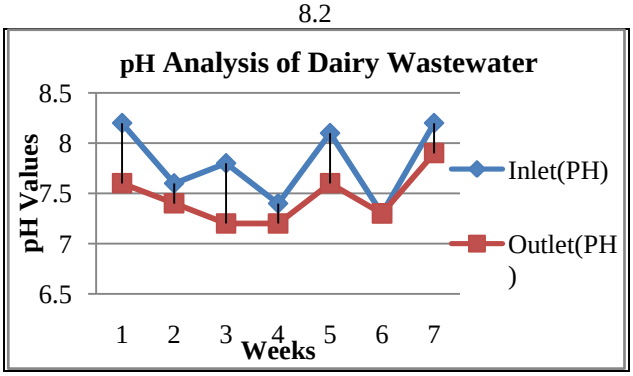

Fig.II pH variation for dairy waste sample

Table-I.pH values

Inlet pH	*Outlet pH*
8.2	7.6
7.6	7.4
7.8	7.2
7.4	7.2
8.1	7.6
7.3	7.3
8.2	7.9

B. *Total suspended solids analysis(TSS)Analysis*

The milk house wastewater discharge had a Total suspended solids (TSS)average effluent concentration of 1280 mg/L or 92.08% of the Total Dissolved solids (TSS) concentration. This is consistent with what is found with highly organic wastes. The suspended solidsconcentrations measured for the study period is plotted with the TSS concentrations in graph.

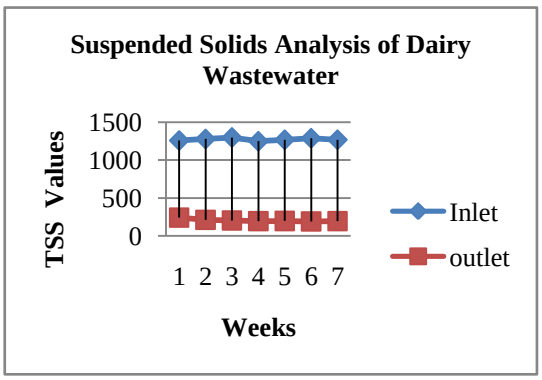

Fig.III TSS values for dairy waste sample

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Table-II.suspended solids

Inlet pH	*Outlet pH*
1260	240
1280	210
1300	201.5
1250	195
1270	196
1290	190
1270	195

C. Total Dissolved solids(TDS) Analysis

Using flow-based composite sampling the dairy's wastewater effluent was estimated to have an average TDS concentration of 1390 mg/L. This value was utilized in evaluating the removal efficiency of the system components and is plotted along with the effluent TDS concentrations and TDSremoval efficiencies graph the total system performance never recorded a month with an average below 49% removal.

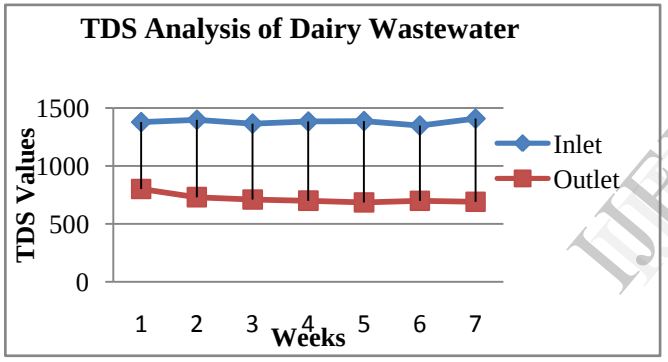

Fig.IV TDS values for dairy Waste sample

Table-III.Total dissolved solids values

Inlet	*Outlet*
1380	800
1400	730
1367	709
1385	700
1389	685
1350	699
1410	690

IV. CONCLUSION

In the Consructed Wetland treatment process of dairy wastes, various quality characteristics were studied and it was found that initially the pH of Dairy waste sample was more alkaline but due to the techniques implemented the pH was brought up much near to the neutral axis also the removal efficiency of Total suspended solids is 81%, Total dissolved solid is 42%, so the treated waste can be effectively used for irrigation and local purpose. Hence, the constructed wetland treatment process may prove to be a handy solution for the organic effluents from food based industries

V. REFERENCES

1. T.j.Britz, C.Van Schalkwyk, Y.Hung, "Treatment of dairy processing wastewaters", Waste Treatment on the food processing Industry, (2006)1-28.
2. H.O.Monroy, M.Vazquezz, J.C.Derramadero, J.P. Guyot, "Anerobic-aerobic treatment of Dairy waste water with national technology in Maxico: the case of 'El Sanz'," 3rd international symposium on waste management problems in Agro-industries, Mexico City, 4-6 October (1995), 202-209.
3. T.G.Thompson, E.George, Waste management issues for dairy process state of Wisconsin/Department of Natural Resources, (1998) 1-10.
4. Belyea.R.L, J.E.Williams, L.Gieseka, T.E.Clevenger, J.R. Brown," Evaluation of Dairy waste water solids as a feed Ingredient, Journal of Dairy Science, 73 (7) (1990):1864-1871.
5. Braio V.B. and C.R.Granhem," Effluent generation by the dairy industry: preventive attitude and opportunities", Journal of chemical Engineering, 24(4) (2007) 487-497.
6. Gaikar R.B., Uphade B.K., Gadhave A.G. and S.R. Kuchekar," Effect of Dairy Effluent on Seed Germination and Early Seedling Growth of Soyabeans", 3(1) (2010), 137-139.
7. Tripathi, B.D. and A.R. Upadhyay, "Dairy effluent polishing by aquatic macrophytes", Water Air Soil Pollution, (2003) 143:127-133.
8. Vinita vipat , " Efficiency of rootzone technology for treatment of domestic waste"
9. Cynthia gitiri kamau, "Constructed wetlands: potential for their use in treatment of grey water in kenya" march, (2009)
10. XIA Ning "Research on Nitrogen Removal and Microorganis in a Subsurface Flow Constructed" Journal of China Univ. of Mining & Tech Vo1.16 Dec (2006)
11. Changbing Y, "Study on ABR Stage-Constructed Wetland Integrated Systemin Treatment of Rural Sewage",Procedia Environmental Sciences 12 pp (2012) 687 – 692.
12. Andrea Ghermandi "The Values of Natural and Constructed Wetlands: A Meta-analysis" ,Tinbergen Institute Paper (2009)
13. Indian Council of Medical Research (ICMR) Manual of Standards of Quality for Drinking Water Supplies, (1975)
14. J.D.Hem, "Study and Interpretation of Chemical Characteris-tics of Natural Water", 3rd ed., U.S. Geological Survey, Washington (1985)

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