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Use of Artificial Wetland for Treatment of Dairy Industry Waste Water for Analysis of BOD and COD

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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, BOD, COD 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 observed near the Neutral also the BOD and COD removal efficiency 85% and 75% of and respectively was observed.***

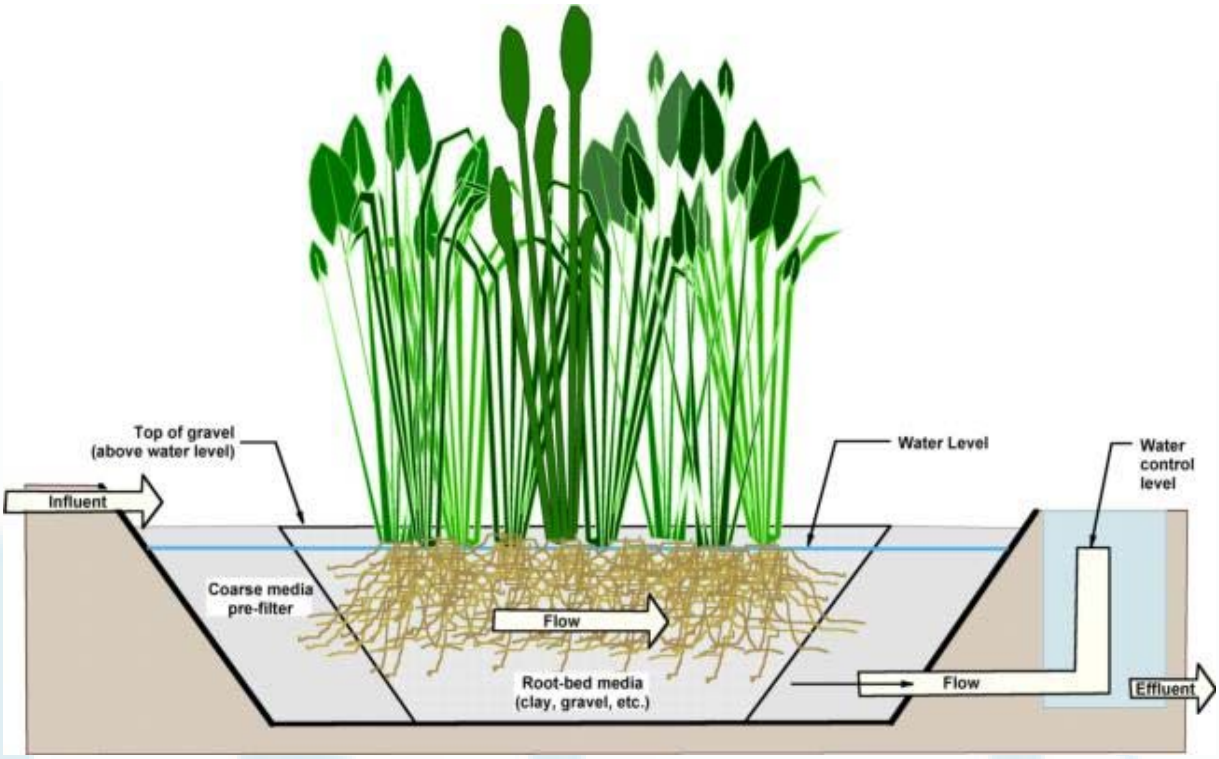
Keywords: chemical oxygen demand, canna indica, biological oxygen demand, dairy, industry

1. 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 m^3 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. 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 [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.

In land 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]. 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 m^3 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 a million dollars as a whole is many millions of dollars. 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. But 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 we have selected a plant from grass family called ***canna indica*** 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. So 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.



2. Materials and Method

2.1. 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 .

2.2. Experimental Setup:

The untreated dairy wastewater was applied on to Constructed wetland in a controlled manner with a flow rate of 50 Lit/day. The dairy wastewater was treated by constructed wetland system. The details of Constructed Wetlands are shown below:

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 on 21 August 2012.The treated wastewater from the outlet were collected and analyzed in laboratory for following parameters like pH, COD,$BOD_{5@20}$, All the test were performed as per the Standard Methods. The CW was under observation for effluent collection from 1st September 2012. All analytical tests were conducted in Environmental Engineering Laboratory of Parikrama College of Engineering kashti .Dist Ahmednagar

Inlet(PH)	8.2	7.6	7.8	7.4	8.1	7.3	8.2
Outlet(PH)	7.6	7.4	7.2	7.2	7.6	7.3	7.9

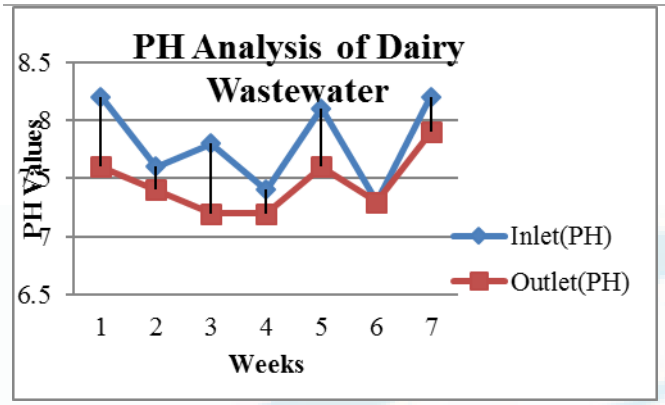
2.3 Physicochemical Analysis

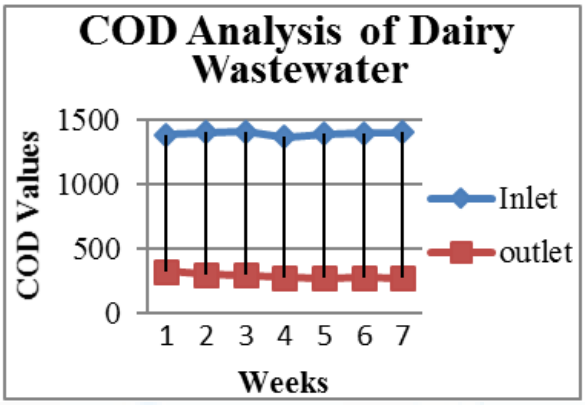
The samples were collected were analyzed for pH, Bio-chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values.

3. Results and Discussion

pH Results

A hydrogen ion (pH) concentration in the wastewater is depicted in graph. 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



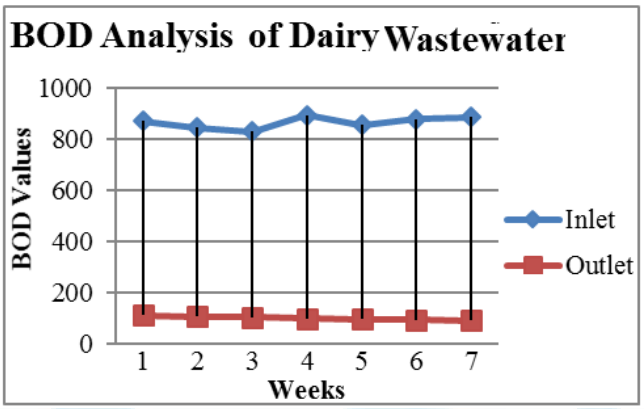


4. BOD Analysis

4.1 Biochemical Oxygen Demand (BOD)

Measured concentrations of BOD for the study period are presented in Graph System performance for the reduction of BODS resulted in a total system reduction ranging between 85 and 90 percent for the milk house influent that was determined to have an average 890 mg/L.

Inlet(mg/lit)	870	843	829	893	853	876	885
Outlet(mg/lit)	110	105	103	98	95	94	90



4.2 Chemical Oxygen Demand (COD)

COD ANLYSIS

The milk house wastewater discharge had a COD average effluent concentration of 1400 mg/L. Chemical oxygen demand concentrations measured during the study period for the wetland effluent are plotted in Graph. The reduction of COD is about 75% to 80%

Inlet mg/lit	1382	1400	1405	1365	1387	1392	1397	1382
Outlet mg /lit	320	300	290	277	270	275	270	320

5. 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 COD is 85-90%, and COD is 75-80%, 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

6. Future Scope

Use artificial wetland for sugar industry, pulp and paper industry to analyze the BOD, COD, phosphates, nitrates parameters

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