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Study of Characteristics and Treatments of Dairy Industry Waste Water

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Abstract Milk has important place in human life. The dairy industry involves processing of raw milk into products like consumer milk, butter, cheese etc. The quantity of water required in a milk processing plant depends upon the size of the plant, generally expressed in terms of the maximum weight of milk handled in a single day, and the processes involved. The daily volume of water required may vary widely, depending mainly on the availability of water and the control of all water using operation in the plant. The operations where the process involves continuous flow, the amount of water needed for rinsing and washing is not necessarily proportional to the amount of product processed. Most of the waste water discharged into water bodies, disturbs the ecological balance and deteriorates the water quality. The casein precipitation from waste decomposes further into highly odorous black sludge. Effluent from milk processing unit contains soluble organics, suspended solids, trace organics which releases gases, causes taste and odor, impart colour and turbidity, and promote eutrophication. Which affect and disturb the environment in this regard's aimed to study the physicochemical characteristics of waste water generated from dairy industry with suitable treatment.

Keywords: *biodegradation, pollutions, rention time, reduction*

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1. Introduction

Industrialization is backbone for development of country. But pollution caused by industrial is a serious concern in throughout the world [1]. Of all industrial activities, the food sector has one of the highest consumptions of water and is one of the biggest producers of effluent per unit of production in addition to generating, besides to generate a large volume of sludge in biological treatment [2]. The dairy industry is an example of this sector. Dairy industry is one of the major food industries in India, and India ranks first among the maximum major milk producing nation [3]. The dairy industry is one of a major source of waste water [4]. The milk industry 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) [5]. 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 (phosphoric or Nitric acid) wash, water rinse, and sodium hypo-chlorite disinfectant. These chemicals eventually become a part of waste water [6]. 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. (Floor spills vs regular equipment cleaning) [7]. 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 [8]. 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. 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 $50m^3$ 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 [9,10]. 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 [6]. 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.

There are so many investigations underway to finding solution for cheaper treatment, easy disposal and utilization of waste water from milk processing unit, in India as well as in abroad. Dairy factory sludge characterized by low heavy metal content and high amounts of degradable carbon can prevent the depletion of soil nutrients that results intensive harvesting in forest plantation studied by [11]. Anaerobic bi hydrogen production as a source of energy from dairy waste water treatment in sequencing batch reactor was investigated by [12]. Dairy industry sewage sludge as a fertilizer for an acid soil was investigated by [13]. The utilization of dairy waste effluent provides nutrients and water for crop growth was studied by [14]. 5% dairy waste solids in feeding diet of sheep and swine is an alternative means for combating solid disposal problem of dairy industry [6].

To cater to increased water demand due to urbanization and industrialization, reduced rainfall, increase in standard of living, depletion in natural water resources, water recycling is necessary, which is known as zero effluent discharge. Photocatalytics detoxification method for zero effluent discharge in dairy industry was studied by [15]. Reed bed treatment method can be used for the treatment of dairy waste water and microbe was demonstrated by [16]. In such a situation, finding of present research on study of waste water quality may become very useful for milk processing industry to plan its proper disposal, recycling and utilization strategy in order to avoid pollution as well as keeping environment clean.

2. Material and Methods

2.1. Area of Study

The study was carried at the Sachi Milk Product Ltd, which is one of the most rapidly developing and heavily polluted industrial in Bilaspur belts of Chhattisgarh. The industries is spread over 163.18 hectares of land. The study area lies between latitude 19°3'39"N longitudes 73°6'57"E. The main water source for the industry consumption is river Arp. The industries utilize about 5,000 m3/day of fresh water. The treated and un-treated effluent discharge amounts was 2,750 m3/day i.e., 55% of the total water used. This has created health hazards not only for local population but also resulted in disturbances of aquatic life of the Arap River flowing near the industrial area [17].

2.2. Climatic Conditions

The weather of the study area is typical dry. The average rainfall records from 500 mm to 1,500 mm. The place experiences the onset of the monsoon in the month of June and experiences monsoon till the end of September. The average temperature recorded varies from 25 to 42 degrees.

2.3. Requirements

All the glassware, casserole and other pipettes were first cleaned with tape water thoroughly and finally with de-ionized distilled water. The pipettes and burette were rinsed with solution before final use. The chemicals and reagent were used for analysis were of analytical reagent grade. The procedure for calculating the different parameters were conducted in the laboratory.

2.4. Industrial Effluent Sampling and Preservation

Waste water quality was determined by estimating physical, chemical and biological characteristics of waste water in monthly interval for the period of year 2012. Waste water sample was collected by fabricated water sampler of 1L capacity and transported to lab, where analysis was done during the period of 2 days. The b sampler were thoroughly cleaned with hydrochloric acid, washed with tape water to render free of acid, washed with distilled water twice, again rinsed with the water sample to be collected and then filled up the bottle with the sample leaving only a small air gap at the top. The sample bottles were Stoppard and sealed with paraffin wax. Preservation of waste water sample and methodology of analysis was referred from APHA-AWWAWPCF [18].

2.5. Physico-Chemical Study

The samples were collected were analyzed for temperature, pH, Total Solids(TS), Total Dissolved Solids(TDS), Total Suspended Solids (TSS), chloride content, oil /grease, Bio-chemical Oxygen Demand (BOD) and Chemical Oxygen Demand(COD) values. The techniques and methods fol-lowed for collection, preservation, analysis and interpretation are those given by Rainwater and Thatcher [19], Brown et al [20], ICMR [21], Hem [22] and APHA [23].

2.6. Experiment Setup

To treat the waste water three reactors were used. They consisted of glass columns 1 m in height, 9-5 cm diameter and 6 liters in total volume. The first reactor (R1) operated with raw waste, the second one (R2) operated with diluted wastewater (diluted 1:1 with tap water), and the third reactor (R3) operated with wastewater diluted 1:2 with tap water. The dilutions were done in order to evaluate the system in the range of concentrations found in dairy industry wastewaters. The columns were packed with gravel of 3 cm average size. The bed had a porosity of 0"53 and a surface area of 450 cm^2. The influents were pumped into the tops of the reactors continuously by a peristaltic pump and the effluents were collected by gravity through syphons, allowing the bed to be completely covered with water. The setup is shown in Figure 1.

The tops of the reactors were closed by rubber caps provided with connections for influent inlet and biogas outlet. The volumes of biogas produced were measured by floating plastic gas holders in saturated solutions of sodium chloride in water. The reactors operated at hydraulic retention times (HRT) of 0"5, 1, 2 and 4 days. Each run had duration of 2 months in steady state conditions. The reactors were inoculated with digested piggery sludge. The acclimatization was obtained by an increase of the influent concentration and volume step by step until the operational conditions of 4 days of HRT were attained. During the accliaitisation period biogas production and COD removal were checked daily. The influent pH was adjusted to 7"0 by addition of lime (4%). During steady-state experiments COD, BOD and pH of the effluents were determined three times a week. Influent COD, BOD and pH were determined once a week. Biogas production was measured daily, while methane concentration was determined three times a week.

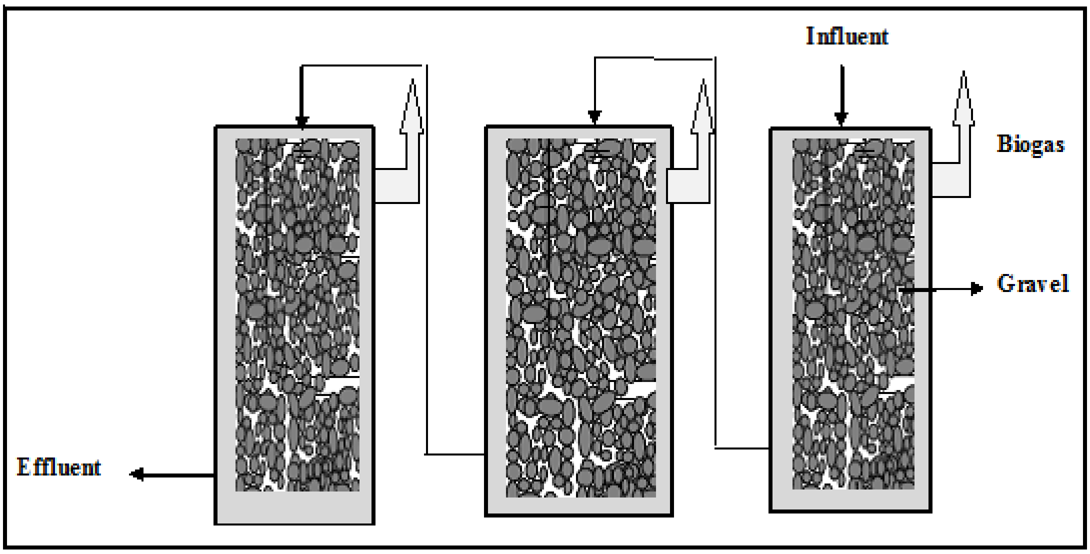

Figure 1. Experimental setup

3. Result and Discussion

Water quality of waste water from milk processing unit was assessed by analyzing physico-chemical characteristics of wastewater in monthly interval, during the year 2012.

3.1. Physical Charterstices of Waste Water

3.1.1. Temperature

Temperature is basically important in its effect of certain chemical and biological radiations taking place in water for organism and inhabiting aquatic media. It depends upon season, time sampling, etc. The water temperature plays an important role in influencing abundance of phytoplankton. The water discharged from industries, which has a generally higher temperature, affects the land adversely. Discharging not effluents also cause loss of heat energy. This may affect the economy of the product produced by the industries. Temperature of waste water was ranged from 26.2-35.4°C. The observed temperature of waste water had a general conformity with atmospheric temperature; hence higher temperature was recorded in the summer months and lower in the winter months.

3.1.2. Colour

Colour is a qualitative characteristic that can be used to assess the general condition of wastewater. Wastewater that is light brown in colour is less than 6 h old, while a light-to-medium grey colour is characteristic of wastewaters that have undergone some degree of decomposition or that have been in the collection system for some time. Lastly, if the colour is dark grey or black, the wastewater is typically septic, having undergone extensive bacterial decomposition under anaerobic conditions. The blackening of wastewater is often due to the formation of various sulphides, particularly, ferrous sulphide. This results when hydrogen sulphide produced under anaerobic conditions combines with divalent metal, such as iron, which may be present. Colour is measured by comparison with standards. At present study color was blackish and became dark when season change ie. in monsoon it was some light yellow, winter brownish to light blackish but in summer due temperature it became almost dark black.

3.1.3. Hydrogen Ion Concentration (pH)

PH is one of the important biotic factors that serves as an index for pollution. The factors like photosynthetic exposure to air, disposal of industrial water and domestic sewage effect pH is the value expressed as the negative logarithm of the hydrogen ion concentration. Its range is given between 0 to 14.7 being neutral less than 7 being acidic and above 7 being basic or alkaline. The wide narration in the pH value of effluent can affect the rate of biological reaction and survival of various microorganisms. The presence or absence of various ionic specials can have direct relation with pH of the effluent. Subsequently, such effluent can influence the quality of soil. The reaction between effluent flowing from an open drainage system in the soil has direct relevance to the pH effluent. It is therefore, necessary to evaluate effluent with respect to the pH value. The pH value of waste water was varied from 6.1-7.7. The pH of waste water indicated the acidic nature of effluent in most of the months of investigation. Acidic nature of waste water was due to break down of milk lactose in to lactic acid.

3.1.4. Turbidity

Turbidity was varying form 35.9-97.1 NTU in waste water. The difference between the minimum and maximum value was more than the double. The turbidity depends up on the strength of waste water. The stronger or more concentrated the waste, the higher is the turbidity.

3.1.5. Salinity

Salinity value had ranged from 0.254-0.639 ppm in waste water. Higher salinity values were due to increase in solubility of solids, while the value lowered due to decrease in temperature which lowered the solubility of solids.

3.1.6. Electrical Conductivity

Electrical Conductivity values were varying from 352.7-954.0 μ mhos/cm in waste water. Higher value of electrical conductivity was obtained during the rainy months due to increase in concentration of solids, while the value lowered in winter months due to less discharge of solids from milk processing plant.

3.1.7. Total Dissolved Solids (TDS)

Total dissolved solid values were varying from 180.2-445.4 ppm in waste water. Increase in concentration of TDS was due to greater input of dissolved solids in water, while the minimum TDS value was noted in the month of October and November due to lower dissolution of solids in water in lower temperature.

3.2. Chemical Charterstices

3.2.1. Alkalinity

Phenolphthalein alkalinity was estimated nil, throughout the study period; hence, the value of total alkalinity was similar to the methyl orange alkalinity determined Total alkalinity values were varying from 198.45-376.80 mg $CaCO_3$/L in wastewater. A higher value of total alkalinity was obtained during rainy months due to addition of buffering material by surface runoff. As Phenolphthalein alkalinity was absent in the waste water therefore, following the formula prescribed in APHA-AWWA-WPCF [18]. The Carbonate and Hydroxide alkalinity was calculated zero and the value of Bicarbonate alkalinity was similar to the total alkalinity value. The reason for variation was similar as registered for Total alkalinity.

3.2.2. Free Carbon Dioxide

Free CO_2 values were ranging from 22.00-108.41 mg/L for waste water. The higher values of free CO_2 was due to higher rate of addition of organic matter in to waste water, while the reduced value was due to addition of lower quantity of organic matter in to waste water.

3.2.3. Total Carbon Dioxide

Total CO_2 values were ranging from 196.63-398.95 mg/L for waste water. Total CO_2 was comparatively higher in rainy months due to addition of higher concentration of bicarbonate ions, while lowered during the winter months due to less concentration of bicarbonates in waste water.

3.2.4. Chloride

Chlorides are generally present in natural water. The presence of chloride in natural water attributed to dissolution of salt deposits discharge of effluents from chemical industry's oil well operations, sewage discharges initiation drainage, contamination from refuse leachates, and sea water intrusion in coastal area. The chloride content above the river water has been investigated by Singh [24] & Hanock [25], and also working on Join is river painted the significance of chlorides and stated that its principal source was animal matter, sewage and drainage from refuse and animal matter. Chloride values ranged from 24.85-92.91 mg/L in waste water. Chloride concentration in waste water had a random change in the value due to gradual increase/decrease in concentration as well as change in quality of water in fluxed.

3.2.5. Dissolved Oxygen (DO)

Dissolved oxygen values were varying from 0.38-1.42 mg/L in waste water. The lower value of dissolved oxygen in waste water was due to higher biological and chemical oxygen demand and presence of greater quantity of organic matter in waste water.

3.2.6. Biochemical Oxygen Demand

B.O.D. is defined as the amount of oxygen required by microorganism while stabilizing biological decomposable organic matter in waster aerobic conditions. The biological oxidation is a very slow process during oxidation organic pollutants are oxidized by certain microorganism into carbon dioxide and water using to dissolve oxygen. Hence lowering in dissolved oxygen value is the measure of BOD relation [26]. The chemical kinetic factor like temperature pressure palette can favorably affect the BOD reaction. Beruch et al., [27], suggested that oxidation of the organic waste by natural microorganisms create high level of BOD (1920 mg/lit of 2100 mg/lit) with a man of 8000. Biological oxygen demand is an important parameter that indicates the magnitude of water pollution, by the oxidizable organic matter and the oxygen used to oxidize inorganic materials such as sulphides and ferrous ions. In natural source, the oxidizable matter on oxidation enters into the biogeochemical cycle BOD does not work independently hence it performs to well depend on so many called factors; low value of BOD in comparatively wider months may be due to lesser quantity of total solids, dissolved solids, suspended solids in water as well as to the quantitative number microbial pollution [32]. In the present study BOD was 9033mg/l observed.

3.2.7. Chemical Oxygen Demand

The COD test determines the oxygen required for chemical oxidation of organic matter without the help of strong chemical oxidant. The COD is a test, which is used to measure pollution of domestic and industrial waste. The waste is measured in terms of quality of oxygen required for oxidation of organic matter to produce carbon dioxide and water. It is a fact all organic compounds with few exceptions can be oxidized by the action of strong oxidizing agents under acidic conditions COD is a useful in pinpointing toxic condition and presence of biological resistance substances. The ratio of the BOD and COD can provide more information on the wastewater sample. Usually, for industrial wastewaters, COD is higher than BOD because many organic substances, which are difficult to oxidise biologically can be oxidised chemically. If the COD value is much bigger than the BOD value, the organic compounds in wastewater are slowly biodegradable. The conjugation of BOD test, with COD test is helpful in indication of toxic conditions and the presence of biological resistance. The chemical oxygen demand values were 4958mg/L for the waste water. COD values were higher during the winter months and lower in rainy months. These results were obtained because of input of higher concentration of organic matter during winter, while the value lowered in the rainy months due to dilution of wastewater by rainwater.

3.2.8. Total Hardness

Total hardness was found to vary from 145.50-293.40 mg CaCO3/L for the waste water. Higher value of total hardness recorded in the month of April in the waste water was because of more evaporation in the month of April due to increase in temperature, while the value lowered in the month of December due to lower temperature.

3.2.9. Calcium

Calcium values were fluctuated from 40.40-83.39 mg/L for waste water. Higher and lower value was due to the same reasons as described for the fluctuation of calcium hardness value.

3.2.10. Magnesium

The Magnesium value in waste water was found to range from 10.01- 19.11 mg/L. Comparatively Magnesium value was ¼ of the Calcium value. Higher and lower value was due to the same reasons as described for the fluctuation of calcium hardness value.

3.2.11. Ammonical Nitrogen (NH4 - N)

Ammonical form of nitrogen values were varying from 2.10-6.50 mg/L in waste water. Lower values in August was obtained due to dilution of waste water by rain water, while , higher concentration of waste water in April was responsible for higher concentration of Ammonical nitrogen.

3.2.12. Nitrite Nitrogen (NO2 - N)

Nitrite nitrogen was ranged from 0.0375-0.7000 mg/L in waste water. Value indicated random fluctuation due to different in oxidation – reduction potential of waste water.

3.2.13. Nitrate Nitrogen (NO3 - N)

Nitrate nitrogen ranged from 10.24-15.52 mg/L in waste water. The higher values were obtained due to greater rate of oxidation, while lower value was obtained due to lowering in oxygen, which reduced the rate of the oxidation.

3.2.14. Total Ortho Phosphate (TOP)

Total ortho phosphate values were varying from 2.00-7.42 mg/L in waste water. Higher and lower value of ortho phosphate was dependent on the amount of discharge and the temperature suitability for breakdown.

3.2.15. Acid Hydrolyzable Phosphate (AHP)

Acid hydrolyzable phosphate values were varying from 5.14-9.00 mg/L in waste water. Higher values of acid hydrolysable phosphate was noted because of less settlement of condensed phosphate, while lower values were obtained due to more settlement of condensed phosphate at the bottom.

3.2.16. Total Phosphate (TP)

Total phosphate value had a variation in values from 18.00-26.42 mg/L in waste water. Total phosphate value exhibited a random monthly variation in values, which could not be explained but probably was due to variation in the influx of phosphate.

3.2.17. Organic Phosphate (OP)

Organic phosphate value had ranged from 7.00-11.72 mg/L in waste water. Lower values were obtained in rainy months due lower rate of breakdown and greater dilution of waste water; nevertheless, higher values were obtained both in summer and winter, dependent on rate of breakdown of organic matter in waste water.

3.2.18. Protein

Protein value determined in mg/L was ranging from 13.78-72.12 in waste water of milk processing unit. Lower value of protein was observed in rainy months due to dilution of waste water, while, higher value was obtained in winter as well as in summer, because of difference in influx of protein in to waste water as well as difference in the rate of decomposition.

3.2.19. Carbohydrate

Carbohydrate value determined was varying from 0.1007-0.2958 mg/L in waste water of milk processing unit. Lower value of carbohydrate was observed in June due to dilution of waste water, while, higher value was obtained in winter, because of difference in influx of carbohydrate and its rate of breakdown.

3.2.20. Fats

Fats value determined in % was changing from 0.01-0.06 in waste water of milk processing unit. Lower value of Fat was observed in rainy months due to dilution of waste water, while, higher value was obtained in winter month November, because of difference in influx of milk in to waste water.

3.2.21. Sulfate

Sulfate value determined in mg/L was ranging from 124.0-186.0, in waste water of milk processing unit. Higher value of sulfate was noted during rainy months July and August due to influx of sulfate from surface runoff water during rains, while, random variation was observed in the value, when there was no contribution of surface runoff sulfate.

3.2.22. Sodium

Sodium value was varying from 21.0-83.0 ppm in waste water of milk processing unit. Higher value of sodium was obtained in the month of October and lower value in the summer months. Lower value was obtained due to lower influx of sodium in water used in milk industry for various works.

3.2.23. Potassium

Potassium value was ranging from 5.0-16.0 ppm in waste water of milk processing unit. Higher value was obtained due to higher influx of Potassium in water used in milk industry for various works.

3.2.24. Most Probable Number (MPN)

MPN value obtained was > 2400 for most of the months from March to November, while in 03 winter months of December, January and February value recorded (1600) was comparatively low. Higher MPN value reflects greater presence of bacteria as well as higher rate of growth and breakdown of organic matter present in the waste water of Milk Processing Unit.

3.3. Effect of Reactor

Characteristics of the influents and effluents are given in Table 1. Influent COD and BOD values showed little variation during the experiments. It was found that the raw waste concentrations did not change significantly during the sugar-cane processing period so an anaerobic process could operate under stable conditions.

Table 1. Characteristics of influent and effluent

	Hydraulic Retention Times							
	0.5		1		2		4	
Parameters	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
BOD								
R1	9033 ± 741	8323 ± 655	10450 ± 1030	8115 ± 850	10191 ± 997	4790 ± 515	8399 ± 911	379 ± 61
R2	4517 ± 393	4040 ± 323	5225 ± 431	2849 ± 306	5095 ± 63	3 813 ± 121	4200 ± 512	147 ± 32
R3	3011 ± 288	2503 ± 263	3483 ± 323	1315 ± 269	3397 ± 379	239 ± 28	2800 ± 315	100 ± 22
N	9	21	8	23	10	21	8	22
COD								
R1	4958 ± 613	3015 ± 422	5103 ± 725	2714 ± 367	5091 ± 729	1630 ± 246	4641 ± 715	125 ± 43
R2	2480 ± 294	1213 ± 188	2511 ± 315	988 ± 124	2603 ± 381	397 ± 95	2389 ± 377	35 ± 13
R3	1653 ± 199	865 ± 113	1714 ± 186	468 ± 73	1678 ± 269	97 ± 39	1562 ± 21	20 ± 7
N	8	20	9	19	9	21	8	20
pH								
R1	6.9 ± 7.1	6.9 ± 7.2	6.9 ± 7.1	6.9 ± 7.3	6.9 ± 7.1	6.9 ± 7.4	6.9 ± 7.1	6.9 ± 7.4
R2	6.9 ± 7.1	7.1 ± 7.3	6.9 ± 7.1	7.2 ± 7.1	6.9 ± 7.1	7.3 ± 7.5	6.9 ± 7.1	7.4 ± 7.5
R3	6.9 ± 7.1	7.2 ± 7.4	6.9 ± 7.1	7.3 ± 7.4	6.9 ± 7.1	7.3 ± 7.6	6.9 ± 7.1	7.6 ± 7.7
N	9	21	8	23	10	21	8	22
Biogas Production								
R1	3.8 ± 0.8		3.5 ± 0.3		3.5 ± 0.3		3.4 ± 0.4	
R2	3.6 ± 0.5		3.6 ± 0.4		3.2 ± 0.3		3.0 ± 0.3	
R3	2.3 ± 0.3		3.5 ± 0.4		3.1 ± 0.3		2.6 ± 0.3	
N	57		60		59		60	

Effluent COD and BOD decreased with HRT. Obviously, effluent concentration was also a function of influent strength. However, differences in quality of effluents decreased with HRT and were lowest at 4 days, and the effluent waters could be reused if a simple aerobic

The biogas production was higher for R1 than R2 and R3 at the same HRT. On the other hand, methane concentration was higher in R3 than R2 and R1. Higher COD removals were obtained in R3 than in R2 and R1. However, the differences decreased with the HRT and were not appreciable at 4 days. An HRT of 2 days was sufficient to give more than 80% COD removal in R2 and R3, while 4 days HRT was required in R~ to obtain more than 90% COD removal. Dairy wastewater is mainly composed of simple carbohydrates and the product of carbohydrate decomposition (volatile acids) is mainly acetic acid. During the anaerobic degradation more volatile acids are produced and at high substrate concentration and short HRT the volatile acids could have increased to values that affected the anaerobic process causing lower COD removal.

4. Conclusion

From physicochemical studied of dairy waste it was concluded that Waste water discharged from milk

pond were applied as a final treatment. Effluent pH was also functions of the HRT and influent concentration. This parameter is an index of the concentration of free volatile acids. Biogas production decreased with HRT and was dependent on the influent concentration. processing unit is white, acidic with higher Turbidity, Salinity, Electrical conductivity and total dissolved solids. Alkalinity recorded was due to Bicarbonate alkalinity. Higher values of carbon di-oxide and lower value of Chloride was noted for the waste water. Dissolved oxygen in waste water was recorded low value due to higher organic matter and BOD and COD. BOD and COD value were quite higher in the waste water indicates its polluted nature. Higher quantity of inorganic nutrients like nitrogen & phosphorus was found present in the waste water. Waste water was rich in Protein and Fat content, which can be used as a feed for animals. MPN value was higher again indicates the polluted nature of waste water. All the studied physico-chemical and Biological parameter proved that the water discharged from milk processing unit is of polluted nature. Its disposal without any treatment in to fresh water body may impose the danger of eutrophication as well as serious problems of health and hygiene. After experiment it was find that BOD 100mg/l, COD 20mg/l reduced and pH was increase to 7.7. So the down flow fixed bed reactor was found to be suitable for the treatment of dairy waste water.

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References

[1] Braio V.B. and C.R.Granhem, 2007. Effluent generation by the dairy industry: preventive attitude and opportunities. Journal of chemical Engineering, 24 (4): 487-497.

[2] Ramjeawon T., 2000. Cleaner Production in Mauritian Cane-sugar factories, Journal of cleaner production, 8: 503-510.

[3] Tripathi, B.D. and A.R. Upadhyay, 2003. "Dairy effluent polishing by aquatic macrophytes", Water Air Soil Pollut., 143: 127-133.

[4] Britz T.J., Van Schalkwyk C., Hung Y., 2006. Treatment of dairy processing wastewaters, Waste Treatment on the food processing Industry, 1-28.

[5] Monroy H.O., Vazquezz M., Derramadero J.C. and J.P. Guyot, 1995. 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, 202-209.

[6] Thompson T.G. and George E., 1998. Waste management issues for dairy process state of Wisconsin / Department of Natural Resources 1-10.

[7] Belyea R.L., Williams J.E., Gieseka L., Clevenger T.E. and J.R. Brown, 1990. Evaluation of Dairy waste water solids as a feed Ingredient. Journal of Dairy Science, 73 (7): 1864-1871.

[8] Carawan Roy E., Jones. V.A. and A.P. Hanseen, 1979. Waste water characterization in a Multiproduct Dairy. Journal of Dairy Science, 62 (8): 1243-1251.

[9] Omil B., Mosquera R., Reigueiro A., Merino A., 2002. Chemical and biological properties of an agroforestry soil treater with dairy-plant waste. Proc. Intl. Symp. Managing Forest Soils for sustainable productivity. 18-22 September, Vila-Real, Portugal, 231-232.

[10] Demirel, B., Yenigun, O., & Onay, T. T. 2005. Anaerobic treatment of dairy wastewaters: a review. Process Biochemical, 40, 2583-2595.

[11] Omil F., Garrido, J. and M. Debowski, 2007. Biodegradability evaluation of dairy effluents originated in slected section of dairy production. Bioresource Tech., 99: 4199-4205.

[12] Venkata Mohan S., Bhaskar Y.V., Sarma P.N., 2007. Bihydrogen Production from chemical wastewater treatment by selectively enrichel anaerobic mixed consortia in biofilm confingured reactor operated in periodic discontinuous batch mode. Water Res., 41 (12): 2652-64.

[13] Suarez. P., Conde, Seoane S., Mosquera O., Lopez E., Solla-Grullin, F. and A. Merino, 2004. Dairy industry sewage sludge as a fertilizer for an acid soil: a laboratory experiment with Lolium Multiflorium L., Spanish Journal of Agriculture Research, 2 (3): 419-427.

[14] Macoon B., Woodard K.R., Slooenberger L.E., French III Edwin, Portier M. Graetz D.A., Prine G.M. and Horn Harold H. Van, Jr., 2002. Dairy Effluent Effects on Herbage Yield and Nutritive value of Forage Cropping Systems. Argon. J., 94: 1043-1049.

[15] Inamdar J. and S.K. Singh, 2008. Photocatalytic Detoxification Method for zero effluent dicharge in Dairy Industry: Effect of operation parameters. International Journal of chemical and Biomslecular Engineering, 1:4.

[16] Mantovi P. and S. Piccinini, 2002. Pollutant and Microbe removal from dairy parlour waste water using reed bed treatment, Proceedings of the 10th International conference of the Ramiran, Network, Italy, France, 365-370.

[17] Lokhande, R.S., Singare, P.U., and Pimple, D.S., 2011, Quantification Study of Toxic Heavy Metals Pollutants in Sediment Samples Collected from Kasardi River Flowing along the Taloja Industrial Area of Mumbai, India., The New York Science Journal 4 (9), 66-71.

[18] APHA-AWWA-WPCF, 1980. Standard Methods for the Examination of Water and Wastewater. 15th edition. American Public Health Asssosation. New York.

[19] Rainwater, F.H., and Thatcher, L.L., 1960, Methods for Collection and Analysis of Water Samples, U.S. Geol. Surv. Water Supply Papers, 1454, 1-301.

[20] E. Brown, M.W. Skougstad, M. J. Fishman, 'Methods for collection and analysis of water samples for dissolved min-erals and gases', Techniques of Water Resources Investiga-tions of the U.S. Geological Survey, Vol. 160, Book 5, Chapter A1 (1970).

[21] Indian Council of Medical Research (ICMR) Manual of Standards of Quality for Drinking Water Supplies, (1975).

[22] J.D. Hem, 'Study and Interpretation of Chemical Characteris-tics of Natural Water', 3rd ed., U.S. Geological Survey, Washington (1985).

[23] American Public Health Association (APHA) Standard Me-thods for Estimation of Water and Wastewater, 19th ed., American Water Works Association, Water environment Federation, Washington, (1995).

[24] A.K. Beruch, R.N. Sharma, G.C. Barach Impact of Sugar mills and distilleries effluents on water quality of river Gelabil, Assam. Indian J. Environ, Health. 35 (4) (1993): 288-293.

[25] A.V. Rao, B.L. Jain, I.C. Gupta, Impact of taxtile Industrial effluents on agricultural land – A case study. Indian J. Environ Health. 35 (2) (1993): 13-138.

[26] S. Rajagopalan, A.K. Basu, R.S. Dhaneshwar, G.C. Rao, Pollution of river sabarnarekhar at Ranch: Asuruey. Indian J. Environ. Health 12 (3) (1980): 246-260.

[27] A. Devi Ecological studies of limon plankton of three fresh water body, Hyderabad. Ph.D. thesis Osmania University, Hyderabad 1980.