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CHEMICAL INVESTIGATION OF EFFLUENT FROM MILK PROCESSING UNIT

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Abstract:
This research work was carried out to compare the physicochemical parameters of treated and untreated effluent samples from Sonhira co-operative dairy Ltd. Kadegaon. Dist –Sangli.(M.S.) India.Treated and untreated effluent samples were collected and analyzed for physicochemical investigations viz. pH, temperature, color, DO, BOD, COD, TDS,TSS, TS, chloride sulphate, oil & grease . It was observed that, the Color of untreated effluent sample was Whitish while Colorless for treated effluent sample. The temperature of treated and untreated effluent samples at the time of sampling were found to be 26°C and 28°C respectively .The pH value for treated and untreated effluent samples were 7.9 and 8.4.The Dissolved Oxygen for treated effluents was found to be 3.9 mg/lit. The BOD 754 &27.59 mg/lit, COD 1264 & 89 mg/lit, TDS 969 & 456 mg/lit, TS 1257 & 523 mg/lit, TSS 289 & 78 mg/lit, Chloride 619 & 84 mg/lit, Sulphate 401& 69 mg/lit, Oil and grease 79 & 2.4 mg/lit. respectively for untreated and treated effluent samples of milk processing unit under study. Waste water quality was found to be maintained within safe limits and result shows that the experience of better handling of plant during the course of this research work. Lastly it is concluded that the treatment plant of milk processing unit was working with satisfactory efficiency.

Key words- Milk processing Unit, dairy industry, Physico-chemical parameter, Effluents

Introduction:

A dairy is an industry which is a place for handling milk and milk products, which deals with processing of milk and the manufacture of milk products on an industrial scale. The rural areas were identified for milk production and the urban centers were selected for location of milk processing plants and products manufacturing factories. In India dairy has been practiced as a rural cottage industries. Dairy technology has defined as that branch of dairy science which deals with processing of milk and manufacture of milk agro based industries have came up in India. The milk processing industry is one such industry during the last two decade due to enormous increase in milk production. The number of the dairy plants of medium and large size has increased. For the efficient handling and processing milk. Consequent to the increased milk production and processing waste water generation has also increased. The dairy industry in India on an average has been reported to generate six to ten liters of waste water per liter of the milk processed. Depending upon the process employed, product manufactured and housekeeping exercised. The waste water of dairy contain large quantities of milk constituents such as casein, lactose, fat, inorganic salt, besides detergents & sanitizers used for washing[8]

Material and Method:

For the present study the effluent samples were collected from Sonhira co-operative Dairy Ltd. Kadegaon Dist –Sangli. at the sources and were analyze the Physico-Chemical parameter in the laboratory. Colour of the effluents was noted by visual observation. Temperature was measured at the site of collection by using thermometer. pH was recorded immediately at the site of effluents collection with the help of pH meter. The physico-chemical parameters were analyzed according to reported procedure [1, 10].All the chemicals of pure grade and distilled water was used throughout the investigation.

Results and Discussion:

Color: In the present investigation the color of untreated effluents was whitish and treated effluents appears colorless. Color is very important factor of the aquatic life making food from sunlight. Thus, photosynthetic activity reduced due to dark coloration and aquatic ecosystem is totally changed. Color also affects the parameter like temperature, DO, BOD etc.

Temperature: Temperature is an important factor for its effects on certain chemical and biological reactions taking place in water and in organisms inhabiting aquatic media and will depend upon time of sampling and varying seasons. There is no specific limit for temperature of the water quality used for the domestic purpose is prescribed by WHO and ISI. In the present study, the temperature of untreated effluents was 28°C and treated effluents were 26°C. It is used for calculating solubility of O_2 and CO_2, HCO_3 and CO_3. During the summer, water temperature is higher because of decrease in water table, clear atmosphere and great solar radiation. While in

rainy and winter season can be explained on the basis of cloudy atmosphere, high % of humidity and high water levels.

pH: It indicates the acidity and alkalinity of water samples. The hydrogen ion concentration is influenced by biological activities. Instead of the addition of chemical substance, the % of organic matter in large quantity may lower the pH value due to release of CO_2 and SO_2. The pollution load in most of the chemical industries is in large quantity in the form of acid and alkali in manufacturing unit. The wide variation in the pH value of effluent can affect the rate of biological reaction and survival of various micro-organisms. The presence or absence of various ionic species can have the direct relation with pH of the effluent. Subsequently, such effluent can influence the quality of soil. The reaction between effluent flowing from open drainage system and the soil has direct relevance to the pH of the effluent. It is therefore necessary to evaluate with respect to the pH value. In the present investigation the pH value of untreated effluent was 8.4 and treated effluent was 7.9. [09] observed the pH of the sludge sample was 8.4. [8] observed the pH of the textile industry effluent varied from 11.0 to 8.0. [6]recorded the pH of Sugar industry untreated effluent was 6.5 and that of treated was 7.5

Dissolved oxygen (DO): Its presence is essential to maintain a variety of forms of biological life in water and the effect of the water discharge in water body are largely determined by oxygen balance of the system. Non-polluted surface water remains normally saturated with the dissolved oxygen. Inorganic reducing agents such as H_2S, NH_3, NO_2 and certain available oxidisable substances also tent to decrease oxygen in water. The solubility of atmospheric oxygen in fresh water ranges from 12.0 mg/L at 0°C to about 6.0 mg/L at 35°C under at 1 atm/p. The higher solubility of oxygen is mainly observed in winter season due to low temperature. Unlike the lake system river water quality cannot be characterized by concentration of nutrients and value of dissolved oxygen. Most of the fishes require at least 5 mg/l dissolved oxygen for at least 16 hours/day near less than 3 mg/l for 8 hour is natural water containing 8 to 10 mg/l. In the present investigation dissolved oxygen of untreated effluent was totally Nil. Due to Oil and grease in effluent from milk which inhibits or prevents the entrance at atmospheric oxygen into effluent and the amount of dissolve oxygen present in treated effluent was 3.9 mg/l.[2] observed the DO of sugar mill is ranging between 0-2.0. This causes respiratory distress of fish & fish show erratic movements.

Biochemical oxygen demand (BOD): It is defined as an amount of oxygen required by microorganisms while stabilizing biological decomposable organic matter in a waste under conditions. Since the test is mainly a bioassay procedure, involving measurement of oxygen consumed by bacteria. While stabilizing organic matter under the aerobic conditions. It is necessary to provide standard conditions of nutrient, supply, pH. Absence of microbial because of the low solubility of oxygen in water strong wastes are always diluted to ensure that the demand does not increase in available oxygen. Low value of BOD is comparatively in winter months may be due to lesser quality of total solids, suspended solids in water as well as to the quantitative number of microbial population.[2]. In the present study BOD of untreated effluent was 754 mg/l and that of treated effluent was 27.59 mg/l. waste water of dairy industry contain large quantities of milk constituents such as casein, lactose, Fat, inorganic salts. Besides detergents and sanitizers used for washing. All these components contribute largely towards their high biochemical oxygen demand. Trivedi et al. (1986)[11] observed the effluents of textile industry. From the different unit BOD value of mixed effluent ranged between 320 mg/l to 720 mg/l and final effluent 80 mg/l to 640 mg/l.

Chemical oxygen demand (COD): It determines, the oxygen required for chemical oxidation of organic matter with 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 measure in terms of equality of oxygen required for oxidation of organic matter to produce CO_2 and H_2O. It is a fact that all organic compounds with a few exceptions can be oxidizing agents under the acidic condition. The test is useful in pinpointing toxic condition and presence of biological resistant substances. Importance of organic matter in the ecology of bloom. Firming cynobacteria has also reported by many workers. In the present study the value of COD of untreated effluents was 1264mg/l and that of treated effluent was 89 mg/l. Trivedi et al. (1986)[11] observed COD value of textile industry ranges from 300 ppm to 2400 ppm.

Total dissolved solids (TDS): The maximum concentration of total dissolved solids in summer, which increased in rainy seasons. While the minimum value was found in winter

probably because of stagnation. In summer most vegetation is decaying, so rise in the amount of dissolved solids was neutral as the products of decaying matter which were settled in the water. The total solid concentration in waste effluent represents the colloidal form and dissolved species. The probable reason for the fluctuation of value of total solid and subsequent the value of dissolved solids due to content collision of these colloidal particles. The rate of collision of aggregated process is also influenced by pH of these effluents. In the rainy season less concentration of total dissolved solids are obtained, due to the concentration of the dissolved solids are obtained due to the dilution of waste effluents with rain water. Hoselti et al. (1994)[5] reported that total dissolved solids in range 488 ppm in the waste water from Jayanthi Nalla. In the present study the total dissolved solid of untreated effluent was 969 mg/l.[8] while for treated effluent was 456 studied textile industrial effluent and recorded total dissolved solid value which ranges from 8500 mg/l to 10,000 mg/l.

Total solids (T.S) : The term solid refers to the either filterable or in filterable that remains as residue upon evaporation and subsequent drying at a defined temperatures employed for drying and on ignition. Different forms of solids are defined on the basis of method applied for their determination. The total solids are sum of the values of the total dissolved solids and that suspended solids. The solid varying in proportion to temperature and rarely varied inversely to the H_2O level. High concentration of total solids during summer was probably due to low level ofH_2O. The direct relationship between rainfall and total solids was attributed to an increased load of soluble salts from the catchments areas as a result of surface run off. In effluent, total solids, total dissolved solids, total suspended solids are composed mainly ofCO_3, HCO_3, Cl^-, SO_3, PO_4, NO_3, Calcium, Magnesium, Sodium, potassium, Magnesium and organic matter. Stills and other particles, polluting water increases the concentration of total solids. In the present study the value of total solid present in untreated effluent was 1297 mg/l and treated effluent was 523 mg/l.

Total suspended solids (T.S.S.): Suspended solid do not mean that they are floating matters and remain on top of water layer. They are under suspension and remain in water samples. BIS has not set any limit of total suspended solid for drinking water. Total suspended solids play an important role in water and waste water treatment. Their presence in water sample cause depletion of oxygen level. Devi (1980)[3] reported total plankton, which showed a sterling parallelism with suspended solids. Effluent from the different industries may have the different amount of solid particulate matter. When the effluent flows through the open drainage system particulate matter is expected to show greater degree of variance. If the effluent is highly acidic then the solid may dissolved in it, therefore it is necessary to evaluate effluent for the particulate matter. In the present study suspended solids content of untreated effluent was 289 mg/l. and that of treated effluent was 78 mg/l.Avsan & Rao [2] observed the T.S.S. & sugar mill effluents is 220 to 790 mg/lit.

Chloride: Chlorides are generally present in natural in water. The presence of chloride in the natural water can be attributed to dissolution of salts deposits discharge of effluents from chemical industries, oil well operation sewage discharge of effluent from chemical industries, oil well operation sewage discharge, and irrigation drainage sea water intrusion in coastal areas. The chloride content in the river water has been investigated by Hancock [4] working on Vionis River pointed the significance of chloride and stated that for principle source is animal matter, sewage and drainage from refuse and animal matter. In the present study chloride of untreated effluent was 619 mg/l and treated effluent was 84 mg/l. Kolhe et al. [6] observed that the effluent from sugar from sugar mill is having 205 mg/l untreated effluent chloride and the treated effluent was 170-180 mg/l.

Sulphate: Sulphate in one of the major cation occurring in natural water. Sulphate being a stable, highly oxidized, soluble form of sulphur and which is generally present in natural surface and ground waters. Sulphate itself has never been a limiting factor in aquatic systems. The normal levels of sulphate are more than adequate to meet plants need. When water is over loaded with organic waste to point that oxygen is removed then sulphate as an electron acceptor is often used for breakdown of organic matter to produce H_2S and produce rotten egg smell[13]. In the present study the values of sulphate for untreated effluent was 401 mg/l and that of treated effluent was 69 mg/l. Kolhe et al.[7] observed the sugar mill effluent was having sulphate of untreated effluent is 660 mg/l and treated effluent showed 220 mg/l.

Oil and grease: The oil and grease content of domestic and certain industrial waste and of sludges is an important in handling and treatment of this material for ultimate disposal.

Oil and grease may influence waste-water system. If present in excessive amount, itmay interfere with an aerobic and anaerobic biological process and lead decreased waste water treatment efficiency. Knowledge of quantity of oil and grease present in effluent is helpful in proper design and operation of waste water. Industrial waste contains high quantity of oil grease which may cause a serious problem if discharged into water body without treatment. In the present study oil and grease of untreated effluent was 79 mg/l and treated effluent was 2.4 mg/l. Trivedi et al.[11] reported oil and grease in textile industry effluent various from 230 to 1897 mg/l.

Table 1

Sr.	Particulars	Untreated Effluents	Treated Effluents	I.S.I. value (mg/lit)
1.	Colour	Whitish	Colourless	-
2.	Temperature	28°C	26°C	-
3.	pH	8.4	7.9	6.5-8.0
4.	Dissolved Oxygen	Nil	3.9 mg/lit	4-6
5.	Biochemical Oxygen Demand (BODS	754mg/lit	27.59 mg/lit	50
6.	Chemical Oxygen demands (COD)	1264 mg/lit	89 mg/lit	250
7.	Total Dissolved Solids	969 mg/lit	456 mg/lit	1500
8.	Total Solids	1297 mg/lit	523 mg/lit	1100
9.	Total suspended Solids	289 mg/lit	78 mg/lit	Not above upto
1o.	Chloride	619 mg/lit	84 mg/lit	450
11.	Sulphate	401 mg/lit	69 mg/lit	600
12.	Oil and grease	79 mg/lit	2.4 mg/lit	Not above upto

Conclusion:

Waste water quality can be maintained within safe limits by better handling of plant. For treatment plant all the necessary units are there. The treated water is used for gardening purpose. After analysis of effluent sample, some repair and maintenance work of treatment plant, unit which was found to be necessary. As far as the treatment plant is concerned, it is also efficient for handling any kind of variation in water. Lastly it is concluded that the treatment plant is working with satisfactory efficiency.

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