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PHYSICO-CHEMICAL ANALYSIS OF EFFLUENT FROM DAIRY INDUSTRY

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ABSTRACT

The research is done to study physico-chemical parameters like pH, temp. colour, DO, BOD, COD, TDS of effluent from Jaipur dairy Industry. Effluent discharged from Dairy Industry is collected in the month of Jan and July 2011. As no such high toxic compounds used in milk processing, the physico-chemical analysis reveals that all the samples have the values within the permissible limits.

Key words: Dairy Industry, Physico-chemical analysis, Treated waste, Milk processing.

INTRODUCTION

Globally, the dairy sector is one of the most important sectors of the world. Dairy companies all over the world face a number of changes and challenges, which are forcing them to reconsider their strategies. The most important challenges are a growing demand for dairy products, with world demand growing by 2 percent a year. Dairy technology has been defined as that branch of diary science, which deals with processing of milk and the manufacture of milk products on an Industrial scale. The milk processing industry is emerging during the last two decades due to enormous increase in the milk production. The number of the diary plants of medium and large size has increased. For the efficient handling and processing of milk proper handling of dairy industries should be done. The waste water of diary contain large quantities of milk constituents such as casein, lactose, fat, inorganic salt, besides detergents and sanitizers used for washing[1].

The waste water discharge form industries are major source of pollution and affect the ecosystem[2]. The degradation of environment results by the adverse effect of industrial waste on living organism and agriculture[3].

Outcome of effluent treatment plant is sludge and scum, a huge problem occurs in

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disposal of such waste discharged from these industries. Research reported that the use of caustic soda, phosphoric acid, and nitric acid for cleaning had a significant impact on wastewater characteristics, despite the implementation of changes in chemical usage practices during recent years. It was determined that most of the onsite treatment facilities require renovations and/or operational changes to comply with current and future discharge regulations, especially with respect to nutrient (nitrogen and phosphorus) levels in their waste streams. It was concluded that biological nutrient removal of dairy wastewaters should be feasible given relatively high concentrations of easily degradable organics, the generally favorable organic matter to total phosphorus ratio, and the very favorable organic matter to nitrogen ratio[4].

EXPERIMENTAL

Materials and methods

Sample area and sample collection

Samples were collected at the discharge point at Jaipur dairy in a clean plastic container, transferred to laboratory and stored at 4^{o}C until use for analysis. Sampling was done in the month of Jan. and July'11.

Physico-chemical analysis of effluent

Effluent samples were analyzed for physico-chemical parameters such as pH, temperature, salinity, conductivity and total dissolved solids (TDS) by water analyzer kit. Biological oxygen demand (BOD) was analyzed by membrane electrode method as given in American Public Health Association (APHA)[5]. All these parameters were analyzed within 24 hrs. in each of three replicates. Results are shown in Table 1.

Table 1: Analysis of different physico-chemical parameters of dairy effluent

Parameter	in Jan'11	in July'11
Temp. (^{o}C)	25	27
Turbidity (NTU)	20	20
TDS (ppt)	1.1	1.77
Salinity (ppt)	1.12	1.75

Cont…

Parameter	in Jan'11	in July'11
Conductivity(mS)	3.26	359
pH	8.8	7.4
BOD (mg/L)	28.55	28.45
Colour	Colorless	Colorless
1 ppt = 1000 mg/L		

RESULTS AND DISCUSSION

Colour

It the present investigation the colour of treated effluent appears colorless. Colour also affects the other parameters like temperature, DO, BOD etc.

Temperature

Temperature is an important factor and has its effect on certain chemical and biological reactions taking place in water and in organisms inhabiting aquatic media and will depend upon seasons and time of sampling. No specific limit for temperature is prescribed by WHO or ISI for the water quality use for the domestic purpose. In the present research temperature of treated sample in month of Jan'11 is 25^{o}C and in month of July'11 it is 27^{o}C. Slight change is due to seasonal variation. It is an important factor for calculating solubility of oxygen and carbon dioxide, bicarbonates and carbonates. Temperature of drinking water has an influence on its taste. During the summer, water temperature is higher because of decrease in water level, clear atmosphere and great solar radiation. While in rainy and winter season can be explained on the basis of cloudy atmosphere, high percentage of humidity and high water levels.

pH

pH is defined as the negative log of hydrogen ion concentration. It indicates the acidity and alkalinity of water samples. The hydrogen ion concentration is influenced by biological activities. The pollution loads in most of the industries are in large quantity due to the use of sanitizers, acidic and alkaline detergents in manufacturing unit. The wide variation in the pH value of effluent can affect the rate of biological reaction and survival of various microorganisms. In the present investigation the pH value of treated effluent in month of Jan'11 was 8.8 and July'11 it is recorded to be 7.4.

Dissolved oxygen (DO)

Dissolved oxygen is one of the important parameter in water quality assessment. Its presence is essential to maintain a variety of forms of biological life in water and the effects of the water discharged in water body are largely determined by oxygen balance of the system. Non-polluted surface water remains normally saturated with the dissolved oxygen. Oxygen can be rapidly removed from the water by discharge of oxygen demanding waste. Inorganic reducing agents such as hydrogen sulphide ammonia, nitrites and ferrous ions and certain available oxidisable substances also tend to decrease oxygen in water. The solubility of atomospheric oxygen in fresh water ranges from 14.0 mg/L at 0^oC to about 7.0 mg/L at 35^oC under at 1 atm[6].

The importance of DO in aquatic ecosystem in bringing out various biological changes and its effect of metabolic activities of organisms has been discussed by many ecologists. The winter can be attributed to the higher solubility of oxygen at low temperature.

Biochemical oxygen demand (BOD)

Biochemical oxygen demand (BOD) is defined as the amount of oxygen required by microorganisms. It is a chemical procedure for determining the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. It is not a precise quantitative test, although it is widely used as an indication of the organic quality of water. It *is* most commonly expressed in milligrams of oxygen consumed per L of sample during 5 days of incubation at 20^oC and is often used as a robust surrogate of the degree of organic pollution of water[7].

Low value of BOD is comparatively in winter months may be due to lesser quantity of total solids, suspended solids in water as well as to the quantitative number of microbial population[8].

In the present study, the BOD treated effluent was 28.55 mg/L. Waste water of dairy industry contain large quantities of milk constituents such as casein, lactose, fat, inorganic salts. Many detergents and sanitizers used for washing. All these components contribute largely towards their high biochemical oxygen demand. Trivedi et al.[9], observed the effluents of textile industry 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.

Total dissolved solids (TDS)

The maximum concentration of total dissolved solids is 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. In the present study, the total dissolved solid of treated effluent in the month of Jan'11 is 1.1 ppt and in July'11 is 1.77 ppt. Rao et al.[10], studied textile industrial effluent and recorded total dissolved solid value, which ranges from 8500 mg/L to 10,000 mg/L.

CONCLUSION

The study has provided information about the waste water quality status released by Dairy Industries. Waste water quality can be maintained within safe limits better handling of plant. Waste water from dairies and cheese industries contain mainly organic and biodegradable materials that can disrupt aquatic and terrestrial ecosystems. Hence the importance of carrying out a whey treatment as a starting point in order to optimize a simple and economic method to treat the whole dairy effluent. Watery effluent discharged can be used for gardening purposes, while a proper and usable alternative should be researched for oily and greasy sludge discharged.

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