PHYSICO CHEMICAL ANALYSIS OF DAIRY WASTE WATER AND TREATMENT WITH RICE HUSK

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ABSTRACT- The dairy industries are considered as most polluting industries because generation of wastewater is very large in terms of volume and contamination level. Dairy effluent contains soluble organics, suspended solids, trace organics. All these components contribute largely towards high biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Dairy wastewaters are generally treated using aerobic and anaerobic biological methods. In this project, waste water was collected from the Sangam dairy industry and characteristics of effluent and influent are analyzed and compared with the Indian Standard for discharge of effluent. An experimental investigation was carried out for removing excess nitrates contents which was more than the effluent discharge norms prescribed by IS10500 using waste material which is rice husk ash and a little amount of sugar. Modified treatment method is suggested in order to get environmental friendly effluent by doing characterization of waste water, treatability studies and planning of proper units and processes.

Keywords: **Dairy effluent, rice husk, coagulation, dosage, nitrates**

1. INTRODUCTION

Water is a valued natural resource for the existence of all living species. Clean and plentiful water provides the foundation for prosperous life. Industrialization activities for the development of nation contribute to serious water pollution problems by over loading the water body with thousands of water pollutants and subsequently polluting the environment. Indian rivers are polluted due to the discharge of untreated sewage and industrial effluents. Management of the quality of this precious resource is, therefore, of special importance.

The dairy processing is generally considered to be the largest industrial waste water source. Milk is an important component of food all over the world particularly in India milk and milk products are considered to be essential constituent of food. Water plays a key role in milk processing. It is used in every step of the technological lines, including cleaning and washing, disinfection, heating and cooling. Water requirements are huge. Contaminated water, including sanitary activities, reaches 50–80% of the total water consumed in the dairy factory, whereas the remaining 20–50% is conditionally clean. It has been estimated that the amount of wastewater is approx. 2.5 times higher than that of processed milk in units of volume[(2).]

Dairy industries produce unstable waste streams with increased temperatures, variable pH values, high COD, BOD, nitrates and phosphates concentrations. The effluents coming out of dairy industry needs to be treated properly prior to disposal in the prescribed limits so as to control any possible environmental hazards. Apart from the traditional methods of treatment of wastewater, dairy industry needs special treatment techniques as it has contents having high proteins. Enormous studies were conducted to treat dairy effluent and so many sophisticated techniques were developed. With regard to increasing wastewater disposed standards to the environment, high considerations should be made when selecting proper treatment processes. Any of chemical, biological and physical treatment processes have its own advantages and disadvantages. Employing environment friendly methods for treatment is emphasized much more these days.

In this study, dairy effluent is collected and analyzed for different parameters such as pH, TSS, BOD and nitrates, chlorides, alkalinity, hardness etc. and compared with effluent discharge standard norms in India. Suitable treatment method is suggested and performed for those parameters which exceed the permissible limit.

2. MATERIALS AND METHODS

Characteristics of the influent and effluent of dairy industry are analyzed to check whether the treated effluent parameters are within the standard limit prescribed by IS 10500. An attempt is also made to remove the parameters which exceeded the standard using waste materials.

2.1 Physical and chemical examination of waste water

In this study, dairy effluent from Sangam dairy industry located at Guntur district of Andhrapradesh was collected and physico chemical parameters such as pH, electrical conductivity , solids, alkalinity, hardness, chloride, total solids, sulphates, nitrates ,iron, dissolved oxygen and BOD were tested as per standard procedure ie. IS 3025.

2.2 Removal of Nitrates from waste water using Rice husk ash and sugar:

Rice husk ash and sugar were used to treat the effluent from dairy industry for safe dispose and reuse. The effect of rice husk ash on effluent nitrate content was evaluated. Suitable quantities of rice husk are collected, washed; sun dried and is converted to

ash by placing in muffle furnace at 500°C. The varying dosage of rice husk ash (0.2gm, 0.4gm, 0.6gm, 0.8gm and 1gm and 2gm) and one fourth of table spoon of sugar are added to the sample of 500ml of effluent and are taken for coagulation for a period of 30minutes (150 rpm for 10min and 20 rpm for 20min).After coagulation the samples are allowed to settle for 1 hour and are filtered and the changes in nitrate content is recorded. Comparative analysis is done by studying the variation in the properties by the addition of 1gram of rice husk ash and a little amount of sugar with different coagulation period (30min and 60min).

3. RESULTS AND DISCUSSIONS

3.1 Physical and chemical examination of dairy waste water

Influent and effluent characteristics of dairy waste water were analyzed to check whether the disposal of effluent into environment is safe or not .Study was also done to check the efficiency of treatment method. If any characteristics are exceeding the standard limit prescribed by IS: 10500, existing treatment plant has to be modified. Test results are shown in figure 1to11. In the first part of each figure Influent and effluent characteristics are shown wheras in second part effluent is compared with the IS 10500 effluent standards for discharging in to rivers .

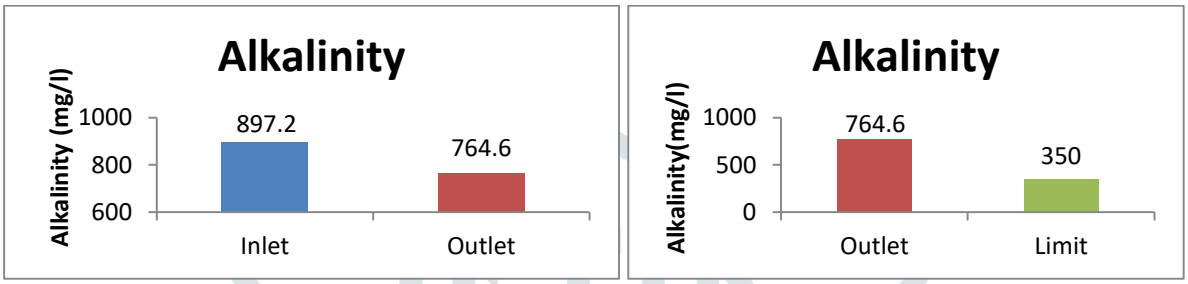


Fig .1. Alkalinity content of influent and effluent in Sangam dairy compared with IS 10500

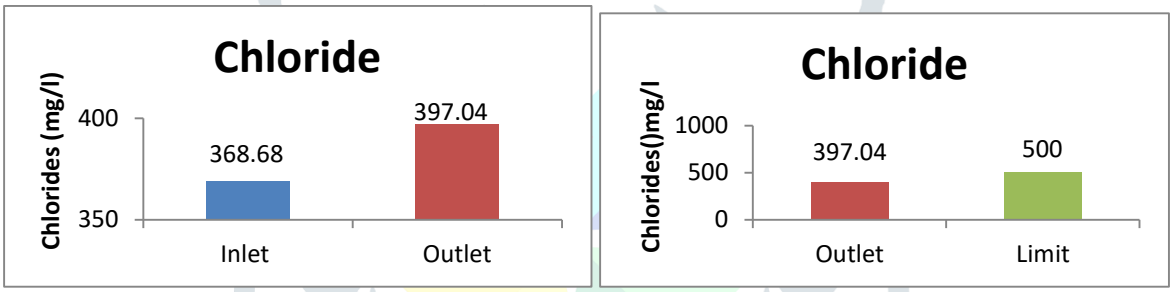


Fig.2. Chloride content of influent & effluent in Sangam dairy compared with IS 10500

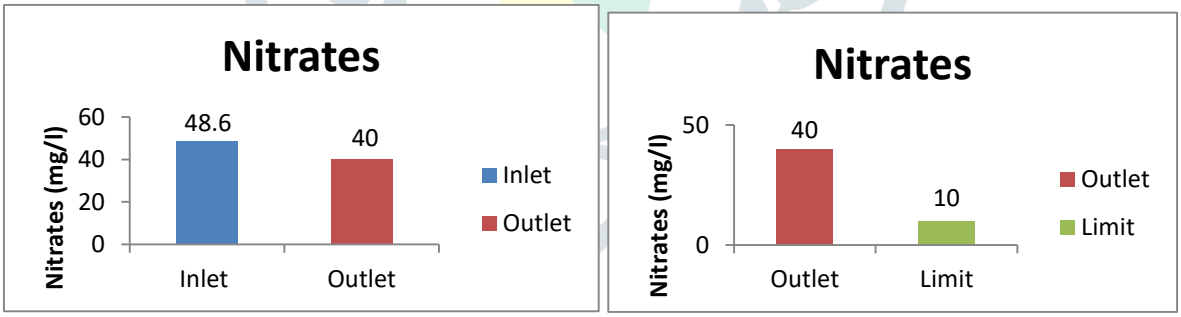


Fig.3. Nitrates content of influent & effluent in Sangam dairy compared with IS 10500

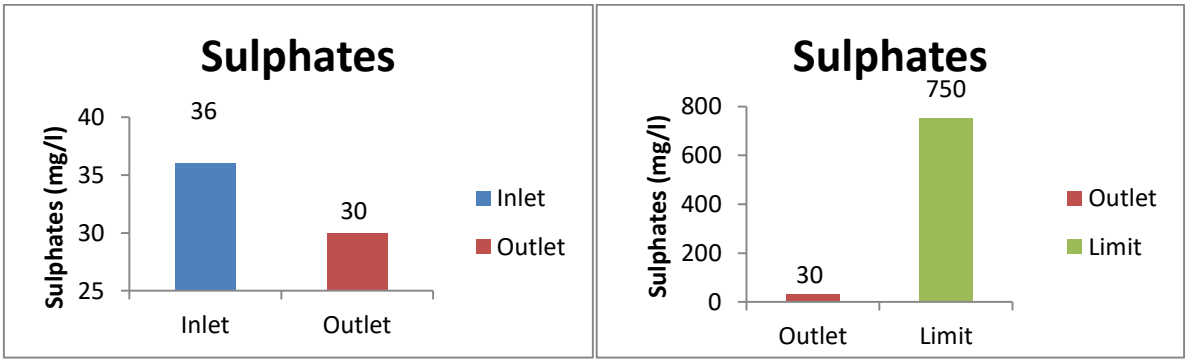


Fig.4.Sulphates content of influent and effluent in Sangam Dairy compared with IS 10500

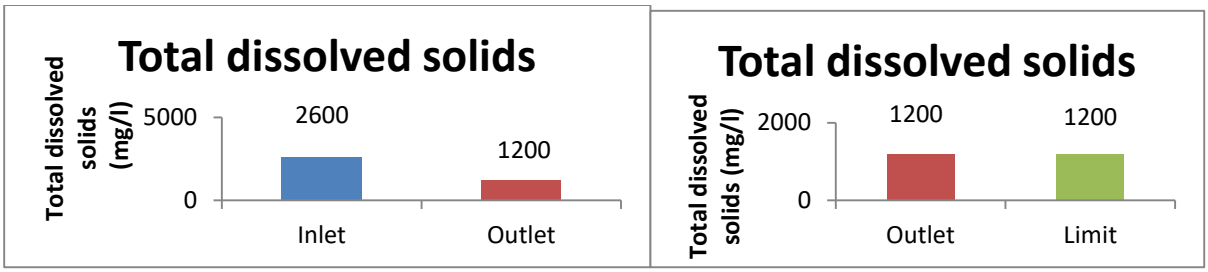


Fig.5. Total dissolved solids content of influent and effluent in Sangam dairy compared with IS 10500

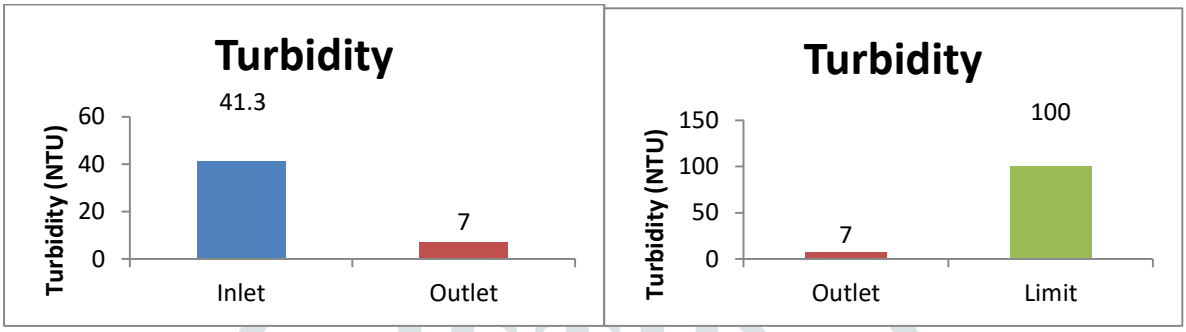


Fig.6.Turbidity content of influent and effluent in Sangam dairy compared with IS 10500

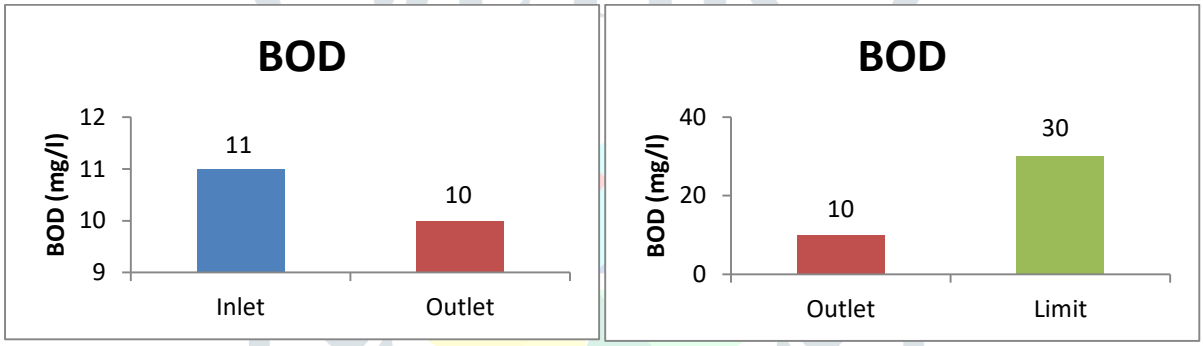


Fig.7. BOD content of Influent and effluent in Sangam dairy compared with IS 10500

Fig.8. Iron content of Influent and effluent in Sangam Dairy compared with IS 10500

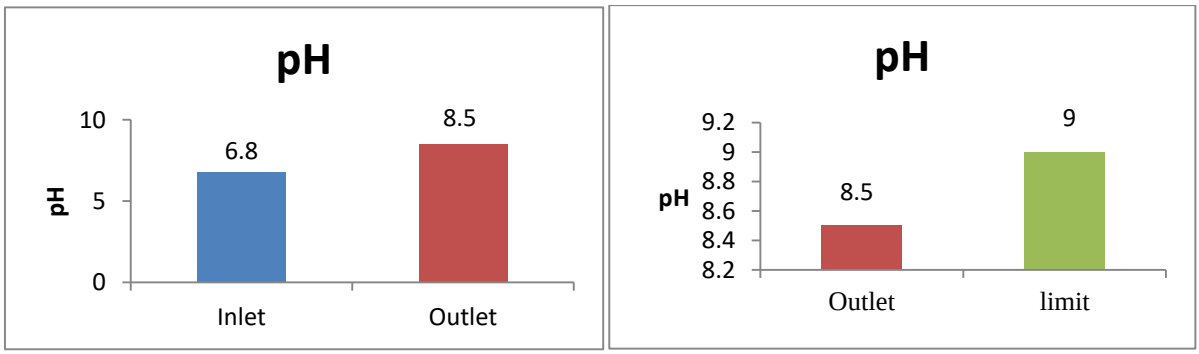


Fig.9. pH of influent and effluent in Sangam dairy compared with IS 10500

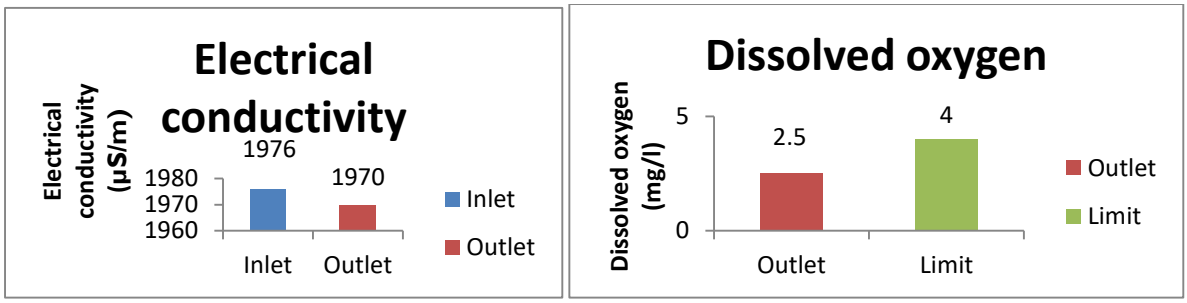


Fig.10. Dissolved oxygen and Electrical conductivity of influent and effluent in Sangam dairy compared with IS 10500

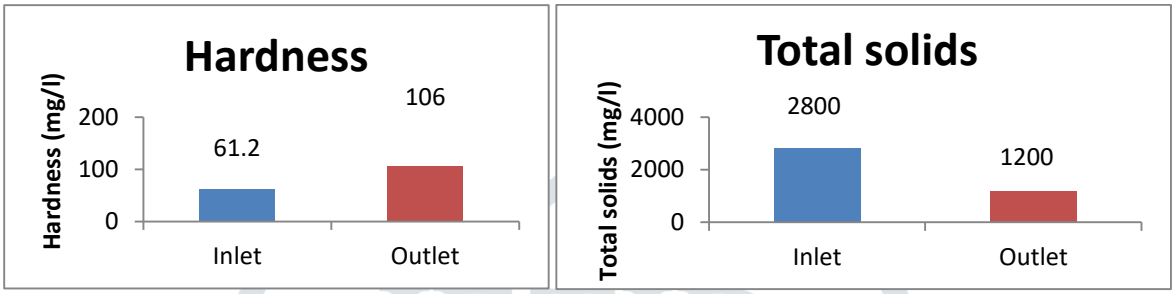


Fig.11. Hardness and total solids content of influent and effluent in Sangam dairy compared.

After comparing the characteristics of effluent with IS 10500 it was observed that chloride,sulphate, total dissolved solids, turbidity,BOD,Iron, and pH of the effluent are within the permissible limit(Figure 2 to11). So these parameters do not cause any negative impact on environment. DO content of effluent is less than the desirable range (Figure10). So DO level must be incresed by using any appropriate method for survival of aquatic life. It was also observed that alkalinity and nitrate content of effluent are exceeding the standard value prescribed for discharge of effluent into inland surface water (Figure 1 and 3). So efforts have to be made in order to remove the excess quantities of nitrates and alkalinity from the treated waste water.

3.2 Removal of nitrates from waste water using rice husk ash and sugar

After analyzing the characteristics of dairy waste water it was observed that nitrates content of the treated effluent exceeds the permissible limit as per IS 10500.If it is disposed into river directly it will create environmental problems like eutrophication which is dangerous for the survival of aquatic life .To avoid this problem dairy effluent must be treated further to remove excess nitrates content. In this study rice husk ash with a little amount of sugar was used to remove the nitrate content by adopting coagulation method. This test was conducted by varying coagulant dosages .The results obtained during the tests are given in figure12.

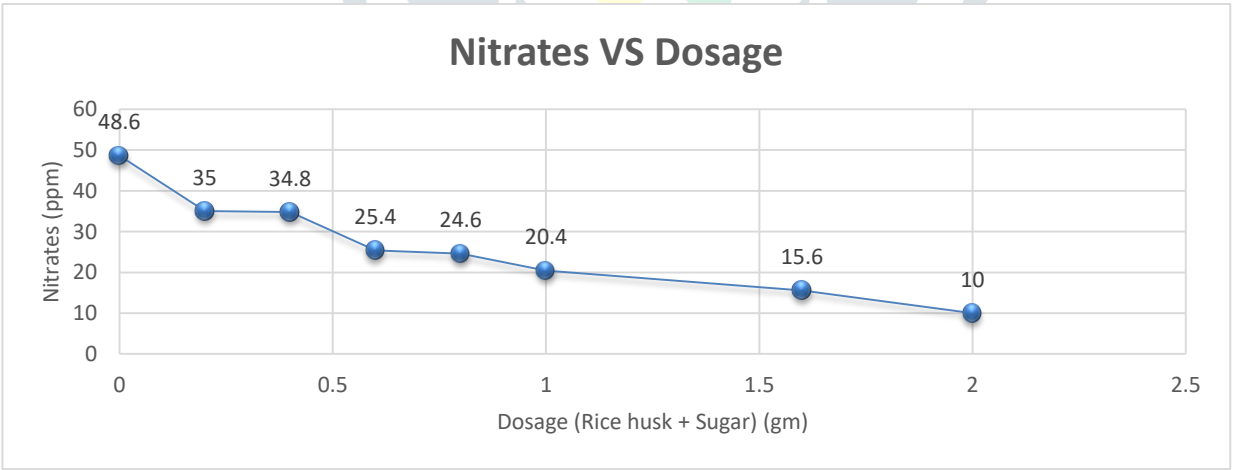


Fig.12.Nitrates vs Coagulant dosage

Six number of jar tests were conducted with ash of rice husk and sugar to analyze nitrates concentration in dairy waste water. Results showed that there was a significant reduction in nitrates when rice husk ash and a little amount of sugar were added followed by coagulation. The nitrates removal improved further with increased coagulation time. The results of the study indicate that naturally obtained substances can be used as effective coagulants.

3.3 Effect of coagulation period

For a coagulant dosage of 0.5gram per liter, coagulation was done for a period of 30min and 60min respectively in order to study the effect of coagulation period on nitrate content. It was found that efficiency of removal of nitrates is increased with the increase of coagulation period (figure13).

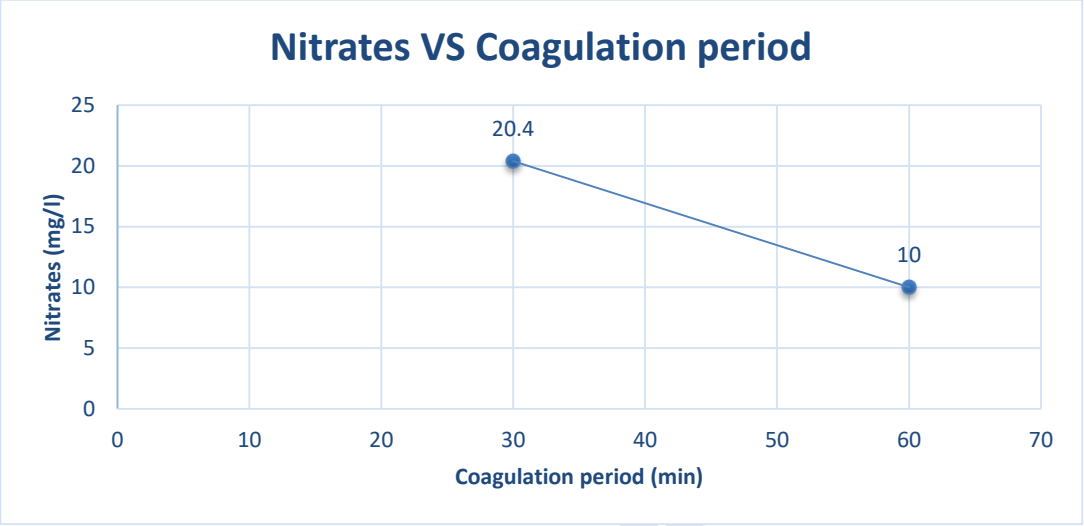
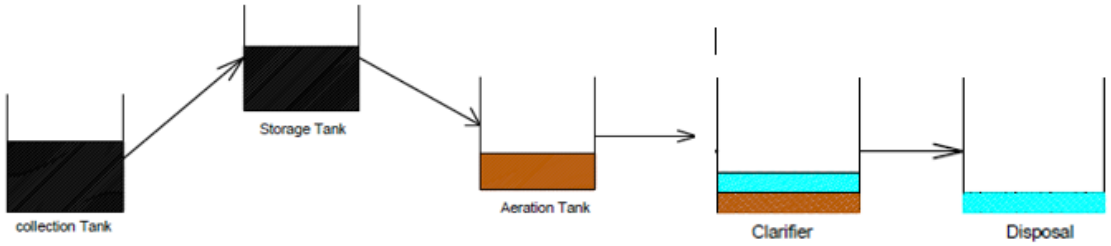


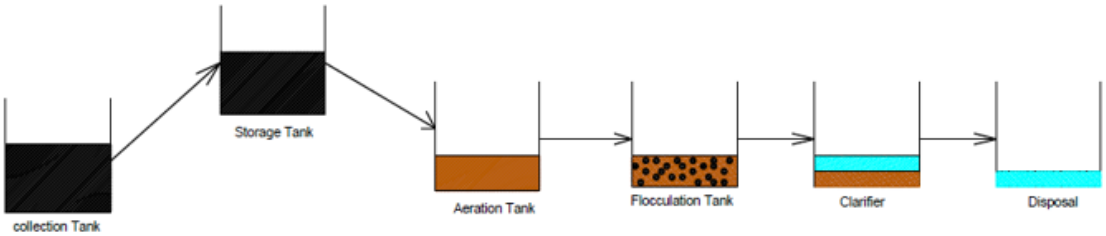
Fig.13. Nitrate VS Coagulation period

3.4 Treatment plant

The first part of figure 14 represents the actual treatment process in Sangam dairy industry. After completion of actual treatment process effluent contains approximately 48.6 mg/l of nitrates. But as per IS 10500 nitrates content in effluent must be 10 mg/l in order to avoid environmental pollution. To bring down the nitrate content in effluent to 10 mg/l dairy waste water is suggested to treat with rice husk ash. To get proper mixing of rice husk ash flocculation tank is incorporated in between aeration tank and clarifier as shown in second part of figure 14. After completion of second treatment process we can get effluent in such a way that it will not cause any environmental problems.



Actual Treatment plant in Dairy Industry before using coagulants



Suggested Treatment plant in Dairy Industry using coagulants

Fig.14. Treatment plant

Sangam dairy release around 7 lakh liters of waste water per day. The present study shows that rice husk ash can be used as adsorbent for treatment of dairy wastewater as it could bring about 48.6 mg/l of nitrates into 10 mg/l .This was achieved using an adsorbent dosage of 4g/l, So 2800kg/day of rice husk ash is required in Sangam dairy to treat 7 lakh liters of waste water so that treated effluent will not cause any environmental pollution once it is released into the river.

4. CONCLUSION

Characteristics of influent and effluent of Sangam dairy industry are analyzed and various characteristics are compared with the Indian effluent standards limits. Among those characteristics some parameters such as nitrates and DO are not within the limit prescribed by IS 10500. DO content can be increased by aeration and nitrates content can be removed by using rice husk ash with a little amount of sugar. The present study shows that rice husk ash can be used as adsorbent for treatment of dairy wastewater as it could bring about 48.6 mg/l of nitrates into 10 mg/l .This was achieved using an adsorbent dosage of 4g/l with coagulation period of one hour. Moreover it is cost-effective process since it is cheaply available. Modification to the present treat plant is suggested as per this study for more effective treatment by integrating coagulation and flocculation unit. Rice husk ash with a little amount of sugar is suggested as coagulant.

5. REFERENCES

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