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# Wastewater Treatment of Dairy Effluents by Natural and Chemical Coagulants

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**ABSTRACT:** Dairy wastewater treatment is a big issue as dairy wastewater releases a high amount of Chemical Oxygen Demand, inorganic and organic particles, Biological Oxygen Demand and nutrients. Such contaminated water if not handled appropriately, it pollutes water bodies and largely affects our ecosystem and biodiversity. Dairy Industries play important role in the water pollution and the quality of the water.

Thus, Suitable treatments for wastewater are required to use effective disposal methods as the large amount of the water is used during the dairy processing and making of milk related products and this large amount of water is not longer useful as it has very high amount of the contaminants which make it non-recyclable. In this review article, it is briefly discussed about the processes in the dairy industry and work done in such processes, amount of wastewater and, major sources of wastewater as well as the harmful effects of wastewater on the environment.

## I. INTRODUCTION

Water is the most valuable natural resource for existence for living species. Clean and contaminants' free water is our necessity for a prosperous life. Our industrial development leads to contribute a large amount of contaminated water and seriously affects water bodies by releasing high quantity pollutants in water. Which in turn can affect living being lives by entering the pollutants in the food chain and adversely damages the ecosystem. So, handling wastewater and treatment has high importance for a sustainable environment.

Food processing industries can introduce some serious problems for the environment by producing wastewater with high biological oxygen demand (BOD) and chemical oxygen demand (COD). Among food processing industries, dairy product industries produce one of the most pollutant wastewaters. This is due to wastewater volume per day and also the volume of wastewaters per liter of produced milk (0.2 to 10 L wastewater per liter of produced milk). Wide range of complex ways for treatment of wastewater exists in the wastewater treatment plants. One of the most important subjects related to the food industry wastewaters is quality assurance of discharged effluent.

IS 8682 is the Indian Standard code, specifically IS 8682:1977 (Reaffirmed 2019), from the Bureau of Indian Standards (BIS) that provides a guide for the treatment and disposal of effluents from the dairy industry, covering sources, characteristics, treatment methods, and environmental protection. It's a key document for managing dairy wastewater, offering guidance on preventing pollution from milk processing plants

The main aim of dairy wastewater treatment is to remove pollutants like fats, oils, grease (FOG), suspended solids, and high levels of organic matter (BOD/COD) to prevent water pollution, protect the environment, and meet strict discharge regulations, often allowing for water reuse or safe disposal. By treating these complex effluents, dairy plants minimize their environmental footprint, reduce health risks (like antibiotic residues), and operate sustainably.

## II. LITERATURE SURVEY

Baisali Sarkar, PP Chakrabarti :- The reuse of wastewater from the dairy industry was investigated using coagulation, adsorption and membrane separation. The coagulant treatment was performed at various pH using different dosages and it was followed by activated charcoal treatment. The combined effects of these two pretreatment methodologies were evaluated. The color and the odor were removed completely and permanently after charcoal treatment.

Ashish Tikariha, Omprakash Sahu :- Milk has important place in human life. The dairy industry involves processing of raw milk into products like consumer milk, butter, cheese etc. 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.

Navneet Kaur :- Dairy Industry is enlisted as one of the top most industries among the entire industries food arena. Apart from high consumption of water in multiple milk products like cheese, curd, butter, yogurt, dry milk powder; dairy industry further involves in some other processes like sanitary, cooling of milk products, cleaning and washing of the processing equipments. During the making and process of these products a large amount of water is used. But the problem with this water is its reuse and toxicity as it cannot be used again as it is. Dairy wastewater

Bharati S Shete, NP Shinkar :- Dairy industries have shown tremendous growth in size and number in most countries of the world. These industries discharge wastewater which is characterized by high chemical oxygen demand, biological oxygen demand, nutrients, and organic and inorganic contents. Such wastewaters, if discharged without proper treatment, severely pollute receiving water bodies. In this article, the various recent advancements in the treatment of dairy wastewater have been discussed and stress is given on the lowest cost of the best possible treatment.

Taner yohnar :- The dairy industry is generally considered to be the largest source of food processing wastewater in many countries. As awareness of the importance of improved standards of wastewater treatment grows, process requirements have become increasingly stringent. Although the dairy industry is not commonly associated with severe environmental problems, it must continually consider its environmental impact-particularly as dairy pollutants are mainly of organic origin

Dogan Karadag :- The dairy industry produces significant quantities of wastewater that have a high potential to pollute the environment if it is not properly treated. Dairy wastewater is rich in organic materials along with other pollutants, and anaerobic treatment technologies have been successfully applied due to its high biodegradability. Several research papers have been published on the application of anaerobic biofilm technologies for dairy wastewater under different operational conditions. This paper provides a critical review focusing on biofilm reactors

### III. METHODOLOGY

(The Jar Test)The standard method for determining the effectiveness of this treatment is the Jar Test, which simulates a full-scale treatment plant .Chemical Dosing (Stage 2): Add the Lime Slurry incrementally until the desired pH (typically 8.5 to 10.5) is reached. Slow Mixing (Flocculation): Reduce the speed to 30–40 RPM for 20–30 minutes. This allows the neutralized particles and lime precipitates to collide and form large, heavy "flocs ."Sedimentation: Turn off the paddles and allow the mixture to settle for 60 minutes.

Turbidity and PH test Measures the cloudiness due to suspended matter; primary focus for coagulation efficiency. Coagulation is an essential process in the treatment of both surface water and industrial wastewater. Its application includes removal of dissolved impurities and turbidity from the water by the addition of conventional chemical-based initial value is around 5 after treatment it is 7.5

Alum (AlCl<sub>3</sub>).The application of these coagulant increases the size of the particles and then settles down at the bottom in the coagulation sedimentation

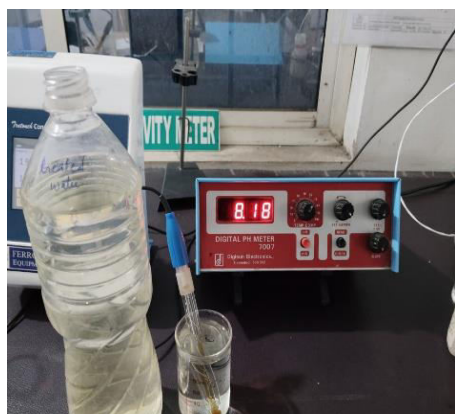
BOD :- the primary method for measuring Biochemical Oxygen Demand (BOD) is the standard 5-day dilution method . Other methods include and rapid sensor-based techniques The sealed, airtight BOD bottles are incubated in the dark at a standard temperature of 20°C (68°F) for five days to prevent photosynthesis from affecting DO levels. Initial -200 mg/L Final-50mg/l the final BOD concentration in the treated effluent is 50 mg/L. absolute amount of BOD removed during treatment is 150 mg/L. The BOD removal efficiency of the treatment process is 75%.

Chemical Oxygen Demand (COD) Principle: Measures the total oxygen required to chemically oxidize all organic matter (both biodegradable and non-biodegradable). Method: Open Reflux or Closed Reflux (Colorimetric) method .Add a strong oxidizing agent (Potassium Dichromate) and Sulfuric Acid to the sample. Digest the mixture in a COD reactor at 150°C for 2 hours.

Total Dissolved Solids (TDS) Method: Gravimetric Method (most accurate) or Conductivity Meter (fastest). Filter the sample to remove suspended solids. Pour a measured volume of the filtrate into a pre-weighed evaporating dish. Evaporate the water in an oven at 105°C–180°C until only dry residue remains. Weigh the dish again; the increase in weight represents the TDS. Titrate the remaining dichromate or use a spectrophotometer to measure the color change. Importance: COD provides results in hours rather than days, making it the primary tool for adjusting coagulant dosages.

#### IV. EXPERIMENTAL RESULTS

SL NO	parameter s	units	Test method	Limits	Results obtained
1	PH	-	IS 3025(P-11)	6.5 to 8.5	8.18
2	Turbidity	NTU	IS 3025(P-50)	1 NTU Up to permissible limit 5 NTU	1.7
3	BOD	Mg/l	IS 3025(P-44)	30 MAX	27
4	COD	Mg/l	IS 3025(P-53)	250 MAX	67.8
5	Jar test	Mg/l	IS 3025(P-39)	-	30
6	Total dissolved solids	Mg/l	IS 3025(P-17)	2100 MAX	1489



#### V. CONCLUSION

The hybrid treatment of milk effluent using cow dung, Fermsept, and lime proves to be a highly effective and sustainable "green" engineering solution. The process meets the primary environmental objectives by achieving over 90% turbidity removal and substantial organic reduction. Most importantly, it supports a circular economy, transforming hazardous liquid waste into clear water for irrigation and a nutrient-rich, pathogen-free bio-fertilizer.

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