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A Short Review on Effective Dairy Wastewater Treatment Techniques

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***Abstract*:- Tremendous growth in size and number in most countries of the world have been monitored towards dairy industries. High chemical oxygen demand(COD), biological oxygen demand(BOD5), nutrients, and other pollution loads are indicators used for characterization of the effluent Increased attention for research has been dedicated to reducing the harmful impact of these industries. This review paper discusses the recent treatment technologies of dairy wastewater briefly. Biological treatment like backed bed filters and biofilms and advanced oxidation processes like electrocoagulation and electro-Fenton are examples of reliable treatment methods in degradation of dairy wastewater. In fact, selection of an effective diary wastewater treatment technology is difficult because of the highly variable nature of dairy wastewaters. To emphasis the appliance of each method, the merits and limitation are displayed.**

Keywords:- Dairy Wastewater, Advanced Oxidation Processes, Biological Treatment

Abbreviations:- DW: Dairy Wastewater; COD: Chemical Oxygen Demand; BOD5; Biological Oxygen Demand; HRT: hydraulic Retention Time; AOPs: Advanced Oxidation Processes

I. INTRODUCTION

The increased milk demand with the increase in population enlarges the amount of wastewater produced from dairy industrial operations. Moreover, the effluent from industrial dairy wastewater is considered one of the largest sources of industrial effluents [1]. Boiling plants, cheese plants, and butter and dried milk plants are regarded sources of dairy wastewater. Dairy waste streams may cause dangerous problems because these effluents contain organic matter of high concentrations. The discharge of dairy wastewater (DW) can result in environmental problems. Physico-chemical and biological treatment methods were used to treat DW, such as electrocoagulation, electro-Fenton, biofilms, and backed bed filters, [2–4]. In order to decrease the harmful effects of dairy wastewater on environment, it is preferable to choose suitable techniques [5]. Consequently, recent researches focus on investigating highly effective methods on treatment of dairy wastewater [6]. This review paper aims at concisely presenting some recent advances of various technological methods that have been reported for treatment of dairy wastewater with removal efficiency and exploring new successful substitutional processes for treatment of dairy wastewater influentially.

II. DISCUSSION

A. *Biological Treatment*

Biological methods can be considered one of the most favorable technologies for the removal of organic matter from dairy wastewater because dairy wastewaters are highly biodegradable . Furthermore, they have the ability of combining different types of biological schemes and are still fairly unsophisticated [7]. Javed Iqbal Qazi et al [8] attained maximum percentage removal of 96%, 93%,and 90% of COD, BOD5, and VSS using batch rector filled with gravels with application of 21 kg COD/m3/d loading. Additionally, 89% reduction of Volatile suspended solids (VSS) were obtained after 12 days hydraulic retention time (HRT) in each cycle of repeated batch. Indrajit N. Yadav [9] experienced the performance of packed bed bioreactor in batch and continuous process for treatment of DW. The best result achieved was 83% COD removal efficiency at 26 HRT and an air flow rate of 1 rpm. Ileana Mayela María and Moreno-Dávila et al [10] tested the hydrogen production in packed bed batch reactors and evaluated the operational conditions aver hydrogen production from dairy wastewater. The authors found out that maximum hydrogen production obtained was 12.73 mm H2/g COD when initial COD concentration was 21.1 g COD, dairy wastewater pH with no adjustment and room temperature of 16 ± 3°C. The key limitation of biological treatment methods is the formed sludge, especially during the aerobic biodegradation processes , may cause serious and costly disposal problems.

B. *Advanced Oxidation Processes (AOPs)*

Advanced Oxidation Processes (AOPs) prove as promising methods in destructions most of organic and inorganic matters by converting them into benign end products such as CO2 and H2O [11]. Many researchers frequently employ AOPs since they provide many potential processes for hydroxy radicals production, Which are one of the most powerful oxidants that able to oxidize many organic compounds to CO2 and H2O and inorganic ions [12]. In addition, electrochemical methods like electrocoagulation and electro-Fenton processes which based on the electro generation of hydroxy radical, are eco-friendly processes which have attracted great attention for water treatment [13]. Additionally, electricity used in the process, is considered a clean source of energy, so they don not create secondary pollutants. Add to that, they adapt to the environmental conditions for water and wastewater treatment because they do not cause any harmful reagents [14]. Electrocoagulation has been experienced by many

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researchers and it has highly achieved removal efficiency for many contaminants [15]. Shivayogimath et al. [16] reported that 98.75% COD and 97.82% turbidity can be removed at applied voltage of 7 V and pH 6 within 10 minutes. Another study revealed that removal efficiency of the COD and oil–grease was raised to 98 and 99%, respectively. The optimal current density was 0.6 mA/cm2 within 1 min, the electrode consumption was 0.0204 g electrode/kg COD removed, and the power requirement were 0.003 kWh/kg COD [17]. Electro-Fenton has received high attention due to its highly contribution to remove various recalcitrant organic compounds [18]. Davarnejad et al. [19] investigated the performance of electro-Fenton process for organic compound degradation in dairy wastewater effluent and found that 93.24% COD removal could be obtained at operational conditions of current density of 58.5, pH value of 7.58 H2O2/Fe2+ molar ratio of 3.62 and volume fraction of H2O2 to dairy wastewater of 1.39 mL/L within 87.13 min. The high amount of produced sludge limits the application of Fenton processes, but their high efficiency and low cost make them preferable.

III. CONCLUSION

This review paper aimed at presenting some of the available treatment methods for dairy wastewater briefly. All previous aforementioned treatment methods need to be hybrid with conventional effluent treatment plant with tertiary treatment due to variation in quality and quantity of dairy wastewater. Although there are some limitations about the application of the abovementioned methods, it is concluded that biological treatment methods like packed bed filters and biofilms and advanced oxidation processes like electro-Fenton and electrocoagulation treat dairy wastewater effectively.

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