

Performance Evaluation of ETP of Raisin Production Unit: A Review

Sujit S. Kamble¹, Parul S. Saler²

PG Scholar, Dept. of Environmental Engineering, KIT's College of Engineering (An Autonomous Institute), Kolhapur, Maharashtra, India¹

Associate Professor, Dept. of Environmental Engineering, , KIT's College of Engineering (An Autonomous Institute), Kolhapur, Maharashtra, India²

ABSTRACT: Most industrial processes use water in one way or another. Once used, the water has to be treated before being disposed of, regardless of whether it is returned to the natural environment or into the sewage network. Almost 80% of water supply flows back into the ecosystem as wastewater without any treatment. This can be a critical environmental and health hazard if not treated properly but its proper management could help the water managers in meeting the city's water demand. Ensuring proper industrial wastewater treatment and disposal is as important for protecting community health as waste water treatment, and immunization programs. Raisin finishing wastewater mainly contains sulfite as a pollutant, is toxic to environment as well as humans. This paper reviewed different treatment approaches of raisin finishing wastewater, the methods employed in these researches are aerobic, anaerobic or the combination of both methods.

KEYWORDS: ETP, Industrial wastewater, Performance Evaluation etc.

1. INTRODUCTION

The water pollution caused by discharge of untreated treated industrial wastewater is most important from the point of view of the community as it contains a large number of causative agents for many dangerous diseases, toxicity and ill effects on health of living species. Thus before disposal, proper treatment of the effluent is necessary. Treatment of wastewater includes removal of contaminants from wastewater generated from households, industries and other sources. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment. There are three main stages of the wastewater treatment process, aptly known as primary, secondary and tertiary water treatment. In some applications, more advanced treatment is required, known as quaternary water treatment. The basic function of wastewater treatment is to speed up the natural processes by which water is purified. There are two basic stages in the treatment of wastes, primary and secondary, which are outlined here. In the primary stage, solids are allowed to settle and removed from wastewater. The secondary stage uses biological processes to further purify wastewater. Sometimes, these stages are combined into one operation.

New pollution problems have placed additional burdens on wastewater treatment systems. Today's pollutants, such as heavy metals, chemical compounds, and toxic substances, are more difficult to remove from water. Rising demands on the water supply only aggravate the problem. The increasing need to reuse water calls for better wastewater treatment. These challenges are being met through better methods of removing pollutants at treatment plants, or through prevention of pollution at the source. Pretreatment of industrial waste, for example, removes many troublesome pollutants at the beginning, not the end, of the pipeline. To return more usable water to receiving lakes and streams, new methods for removing pollutants are being developed.

Advanced waste treatment techniques in use or under development range from biological treatment capable of removing nitrogen and phosphorus to physical-chemical separation techniques such filtration, carbon adsorption, distillation, and reverse osmosis. These wastewater treatment processes, alone or in combination, can achieve almost any degree of pollution control desired. Waste effluents purified by such treatment, can be used for industrial, agricultural, or recreational purposes, or even drinking water supplies.

Raisins are a Greek national product. The annual exported quantities are 110000 tons. Pollution, caused by discharging the wastewater of the product-finishing process into the sea, is equivalent to 100 000 population. Raisin-finishing wastewater contains invert sugar and SO₂ as pollutants. Sulfites are either free or bound to the carbonyl group of reducing sugars. Bound sulfites dissociate to free sulfites in alkaline solutions.

Industrial wastewater treatment covers the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use. Most industries produce some wet waste although recent trends in the developed world have been to minimize such production or recycle such waste within the production process. However, many industries remain dependent on processes that produce wastewaters. A treatment plant between the collection point and disposal point must be provided to treat the wastewater to bring the pollutants in the final effluent to prescribed standards as per the consent granted. Hence it is necessary to evaluate the performance of such treatment plants to have check on proper and desired functioning of the plants for overall protection of environment and health of the people who are likely to get in contact with it.

II. LITERATURE REVIEW

This paper reviews different treatment approaches found in papers.

The treatment of raisins processing wastewater using micellar-enhanced ultrafiltration (MEUF) with two cationic surfactants, hexadecyl pyridinium chloride and Cetyl trimethyl ammonium bromide, has been investigated. The effect of process parameters, such as transmembrane pressure (TMP), temperature, and surfactant concentration, on permeate flux and rejection of the wastewater pollutants have been studied. COD, turbidity, TDS, and electrical conductivity were selected as the indicators of wastewater pollution. The obtained results show that rising TMP or temperature led to rejection decrease and flux increase. However, rejection of pollutants increased and flux decreased with increasing surfactant concentration. Applying surfactants enhanced the rejection of the pollutants, thereby a considerable amount of wastewater pollution was omitted and the turbidity of the wastewater was decreased to a high extent through this process. As a result, the MEUF process can be applied as an efficient method for the treatment of raisins factories' wastewater.

According to the results, turbidity and COD showed the highest and lowest rejections, respectively. Rising TMP or temperature led to the rejection decrease and flux increase. However, rejection of pollutants increased and flux decreased with increasing surfactant concentration. Comparing CPC and CTAB, it is concluded that CPC provided higher rejection of pollutants. Moreover, the initial flux was higher when CPC was applied. [1]

The feasibility of recirculation of currant-finishing wastewater in a currant-wash process was investigated in a laboratory scale plant. Recycle ratios from 0% to 95% were examined. By increasing the recycle ratio, effluent BOD increased from 681 to 5378 mg/l, effluent COD from 3808 to 43,722 mg/l, total suspended solids from 12.3 to 57.7 g/l, total sugars from 2.57 to 42.13 g/l, total phosphorus from 0.79 to 5.14 mg/l, total Kjeldahl Nitrogen from 7.36 to 51.9 mg/l and total phenolic compounds from 0.095 to 1.13 g/l, while fresh water addition decreased from 6 to 0.3 kg/kg of currants processed and total sugars loss from 15.43 to 12.64 g/kg of currants processed. For a recycle ratio of 95%, the mass of currants recovered as a final product increased by 10% due to the proportional decrease in the sugars wasted per kg of currants processed. [2]

A case study of currant-wastewater treatment is analyzed. Chemical coagulation, acidification, mechanization, extended aeration, evapotranspiration are used. Advanced Oxidation of treated effluent using physico-chemical processes was applied to decrease COD and color to values appropriate for irrigation and under-ground aquifer recharge. The biological treatment of currant-wastewater is simple and very effective. The advanced oxidation of biologically treated effluent with physicochemical processes is also effective but expensive. Ozonation is more expensive than H₂O₂/UV radiation. It is estimated that half of the total cost for biologically removing 99% of the total daily amount of COD is equal to the oxidation cost for removing the remaining 1% of the total daily amount of COD. [3]

Two UASB reactors of 9 and 220 liters capacity and one AFB reactor of 9 liters capacity are described. The reactors operated with currant-finishing wastewater. Acclimation period was short provided that the reactors were seeded with active granular sludge. Performance of the AFB reactor was higher than the UASB reactor. Loadings of 16 and 21 kg/m³ day in AFB resulted in COD removals of 95 and 85%, respectively. Loadings of 12.5 and 10.2 kg/m³ day in the 220 and 9 liter UASB reactors resulted in COD removals of 93.5% and 95%, respectively. The acclimation period for the UASB reactor was very long. This is due to the fact that effluent from an anaerobic reactor was used for seeding instead of sludge.

As soon as granulation began to take place, the COD loading was increased rapidly up to 12.5 kg/m³ day. Granulation started when the feed wastewater contained lime used for suspended solids removal. This happened on day 110 after start up with currant-wastewater. COD loading was increased to 15 and 16 kg/m³ day after 55 and 110 day. [4]

Two down flow anaerobic filters with different plastic media of the same specific surface area, treating currant-finishing wastewater are described. COD removal for modular plastic media with a cross-flow design was 80% and 75% for loadings of 8 and 10 kg COD in 3 day respectively. COD removal for pall-rings media gradually decreased from 90% to 57% as loadings gradually increased from 0.6 to 6 kg/m³ day. The down flow anaerobic filters have a low performance compared with other high-rate anaerobic reactors, the UAF, UASB and AFB. [5]

Treating raisin-finishing wastewater in an upflow anaerobic sludge bed reactor, no significant inhibition was observed using feeds with unusually high sulfite contents, 5000-9000 mg liter⁻¹, when the COD concentrations were 38000- 43000 mg liter⁻¹. Moreover, relatively high un-dissociated hydrogen sulfide concentrations (close to 200 mg liter⁻¹) were not an inhibitory factor in COD removal efficiency. Sulfides resulted in a reduction of methane in the biogas. Higher methane concentrations were obtained with relatively average COD and sulfite contents. The toxicity related to the COD (SO⁻S) (amount of SO⁻ expressed as S) ratio was lower at the largest COD values of the influent used (38 000-43 000mg liter⁻¹) than at smaller (7000-14 000 mg liter⁻¹), at similar COD (SO⁻S) ratios of 19-30. [6]

A process and pilot plant, utilizing raisin-finishing wastewater, are described. The wastewater contains invert sugar and SO⁻ as pollutants. The process is a continuous anaerobic digestion of the wastewater. The bacteria were mainly immobilized in the reactor on a large surface area of plastic support media. For best performance of this up flow anaerobic biofilter, sulfites were removed with lime prior to fermentation. High sulfite concentrations in the initial wastewater did not then cause significant inhibition. Removal of COD from lime-treated influent to the reactor was over 90% for loadings up to 13 kg COD per cubic meter of initial reactor volume per day. To determine the purification of wastewater at different flow rates and COD loadings, determinations of BOD₅, COD, S, SO₄⁻, S²⁻ in the influent and effluent were made. Volatile Fatty Acids (VFA) in the reactor and the composition of biogas are also reported. [7]

III. CONCLUSIONS

A brief review on various techniques for raisin finishing wastewater treatment has been considered in present study. The performance evaluation becomes mandatory to check whether treatment plants along with its units are capable of purifying water as per the current industrial water standards. From the above literature review it is concluded that raisin finishing wastewater needs pre-treatment before it is feed into biological treatment units. The kind of pre-treatment depends on the strength and characteristics of raisin finishing wastewater.

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