International Journal of Applied Engineering and Technology ISSN: 2277-212X
An Open Access, Online International Journal Available at http://www.cibtech.org/jet.htm
2022, Vol.12, pp.8-10/Bharud et al.
Research Article

APPRAISAL OF THERMAL TREATMENT OF DISTILLERY SPENT WASH USING PLASMA TECHNOLOGY FOR END USE APPLICATIONS

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ABSTRACT
The effluent generated by distilleries, commonly referred to as slop, spent wash, wash, vinasse, or stillage, is the focal point of the current investigation. This study aims to thoroughly characterize and treat the distillery spent wash from Samson's Distilleries, located in Duggavathi, Harpanahali Taluk, Vijayanagar district, using plasma technology. The primary objective is to evaluate the suitability of the liquid effluent produced by the distillery industry for various applications. Key parameters under scrutiny include pH, electrical conductivity (EC), total dissolved solids (TDS), calcium, magnesium, chloride, sulphate, dissolved oxygen (DO), chemical oxygen demand (COD), and biological oxygen demand (BOD). Notably, the pH measures at 7.5, while the levels of EC, TDS, calcium, magnesium, chloride, sulphate, DO, COD, and BOD all surpass the permissible limits for use in irrigation, aquaculture, and drinking water standards. Consequently, the findings indicate that the liquid effluent is contaminated and unsuitable for drinking purposes, necessitating further treatment even for potential irrigation use.

Keywords: *Thermal, Distillery Spent Wash, Vinasse, Plasma Technology, End Use*

INTRODUCTION

Distillery spent wash represents a potential source of water pollution due to its high organic and volatile content. The specific characteristics of distillery spent wash are influenced by the quality of the feed stocks used and various stages of ethanol production. Typically, it appears as a dark brown, foul-smelling liquid with an acidic nature and exhibits elevated levels of biological oxygen demand (BOD), chemical oxygen demand (COD), and mineral salts (Shojaosadati, et al., 1999 and Jimenez, et al., 2003). Although it does not contain toxic substances, releasing it into water bodies without appropriate treatment can result in discoloration and a decline in dissolved oxygen levels within the receiving water course (Mane, et al., 2006). Various physical, chemical, and biological techniques are employed for treating distillery spent wash before it is discharged into the aquatic ecosystem. A common approach involves bio-methanation followed by aerobic treatment (Thakur, et al., 2009). However, even after biological treatment, the effluent still contains a significant amount of organic matter, necessitating further treatment prior to its release into the water body. Ongoing efforts include the incorporation of modifications into existing treatment processes and the development of new techniques for managing industrial distillery effluents.

The adverse impact of wastewater discharged by fermentation industries, particularly distilleries, on a water body is primarily attributable to the high concentration of easily decomposable organic substances within these effluents. The breakdown of soluble and suspended organic materials in the wastewater leads to elevated levels of BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand), resulting in the rapid depletion of oxygen in the water. Consequently, this depletion causes a foul odor and facilitates the proliferation of undesirable organisms. As a consequence, the affected water body becomes unsuitable for supporting aquatic life, as well as for various activities such as drinking, personal hygiene, recreation, and more.

When distillery effluents are introduced into a water source, they create an environment conducive to the growth of harmful microorganisms, potentially causing significant biological hazards, including the spread of waterborne diseases. Therefore, it becomes imperative to either treat or find profitable uses for the effluents from distilleries to mitigate these adverse effects. The literature survey with respect to

industrial effluent on seed and seedling quality properties irrespective of crops are reviewed (Kalaiselvi, et al., 2010). The previous studies (Rameshwari and Karthikeyan, 2005) on distillery spent wash gives as an alternative requires for poultry industry. The field study (Selvamurugan et al., 2011) to appraise the effect of different levels and techniques of distillery spent wash and press mud bio compost application on soil and enzymatic activity revealed the application of distillery spent wash encourages the soil fertility (Saliha et al., 2005).

Keeping in view the agricultural background of Industry located region of Karnataka, it is proposed to study the wastewater by removing the COD, BOD, colour and the contaminants from distillery spent wash by thermal treatment using plasma technology. Experiments are conducted at different operating pressures. The results are presented for the waste effluent samples collected from the local distillery industries.

MATERIALS AND METHODS

Study area: The study area contains Samson's Distilleries private limited. Duggavathi, Harpanahalli Taluk, Vijayanagara district, distillery is located between the latitudes 12.98^{O}C N to 77.57^{0}C E. The samples of the effluent samples before and after treatment were collected and given for determined as per the standard analytical procedures by APHA (2012), NEERI, India. The determined variables includes pH, Electrical Conductivity, TDS, calcium, magnesium, chloride, sulfate, dissolved oxygen (DO), chemical oxygen demand (COD), and biological oxygen demand (BOD). Standard analytical procedures (APHA, 2012, NEERI, India) were adopted for the estimation of these variables.

RESULT AND DISCUSSION

The analytical data to the characterized variables is given in the Table 1 - 3

Table 1: Properties of Variables in Distillery spent wash

Variable	Effluent (BT)	Effluent (AT)	CPCB standards IS 10500(1992)
pH	4.9	7.5	6. 5 – 8.5
EC(µmohs cm^{-1})	54,800	14,900	--
TDS (mg/L)	66,400	19,800	500
Chloride (mg/L)	6452	2642	250
Fluoride (mg/L)	20	BDL	1.0
Sulphate (mg/L)	1298	324	200
Nitrate (mg/L)	38	28	45
Phosphate (mg/L)	0.58	14.6	--
Nitrite (mg/L)	26.8	3.8	--

Table 2: Properties of Analytical data of alkalinity, total hardness

Variable	Effluent (BT)	Effluent (AT)	CPCB standards IS 10500(1992)
Alkalinity (mg/L)	1049	3400	200
Hardness (mg/L)	8900	4100	300
Calcium (mg/L)	3100	5800	75
Magnesium (mg/L)	240	657	30

Table 3: Properties of Analytical data to DO, BOD and COD

Variable	Effluent (BT)	Effluent (AT)	Irrigation standards CPCB:1995	CPCB standards IS 10500(1992)
DO (mg/L)	BDL	BDL	200	5.0
COD (mg/L)	75,742	10870	--	250.0
BOD (mg/L)	35,000	4500	100	30.0

The pH value of the spent wash is 4.9 before treatment and 7.5 is within the no issue range of 6.5 to 8.5 (Ayers and Westcot, 1975: IS 10500, 1992). A maximum value of EC (14,900 µmohs cm-1) represents the excessive saline condition. TDS levels (19,800 mg/L) show the occurrence of salts. Fluoride level is

at below detectable level (BDL), Nitrate and Nitrite levels are within the accessible limits while sulphate level is marginally higher than the IS:105900 of drinking water quality standards. DO is at below the dateable level. BOD (4500) and COD (10879) levels are greater than the accessible limits indicting excess of organic content in the waste water.

CONCLUSION

Maximum level of EC, TDS and Chloride of the treated spent wash concludes the saline nature of the spent wash and confirmed its unsuitability for drinking and irrigation needs. A maximum level of hardness indicates its unsuitability of its application for domestic needs even after the treatment. DO at below detectable concludes that the spent wash are suitable for aquaculture purposes. Excess of BOD and COD also indicates higher organic load and unsuitability for agriculture purposes. Further, intensive thermal treatment of the spent wash is necessary for considering them even for irrigation purposes.

ACKNOWLEDGEMENT

The author sincerely thanks the concerned faculties of Environmental Engineering laboratory, Bapuji Institute of Engineering and Technology, Davangere, Karnataka for their cooperation in completion of the current research work.

REFERENCES

Shojaosadati SA, Khalilzadeh R, Jalilzadeh A, Sanaei HR (1999). Bioconversion of molasses stillage to protein as an economic treatment of this effluent. *Resources, Conservation and Recycling,* **27**, 125-138

Jimenez, A.M., Borja, R., Martin, A. (2003). Aerobic/anaerobic biodegradation of beet molasses alcoholic fermentation wastewater. *Processes in Biochemistry*, 38, 1275-1284.

Mane, JD, Modi S, Nagawade S, Phadnis SP, Bhandari VM (2006). Treatment of spent wash using modified bagasse and colour removal studies. *Bioresource Technology*, **97**, 1752-1755.

Thakur C, Srivastava VC, Mall ID (2009). Electrochemical treatment of a distillery wastewater: Parametric and residue disposal study", *Chemical Engineering Journal,* 148, 496-505

Kalaiselvi P, S Mahimairaja, P Srimathi and GS Kumar, (2010). Impact of industrial effluents in Seed invigouration: A review. *Asian Journal of Plant Science,* **9** 249-255.

Rameshwari KS and S Karthikeyan, (2005). Distillery Yeast Sludge (DYS) as an alternative feed reqoiurce in Poultry. *International Journal of Poultry Sciences,* **4** 787-789.

Selvamurugan M, P Doraiswamy and M Maheswari (2011). Effect of biomethnated distillery spent wash and press mud biocompost on microbial and Enzyme dynamics in Sugar cane grown soil. *Journal of Biological Science,* **11** 417-422.

Saliha BB, S Krishnakumar and S K Natarajan (2005). Response of rice crop to organic manuring in high pH soil *Asian Journal of Plant Science,* **4** 524-526.