

Technology for Waste management in Distillery

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Abstract: *Word is facing the problem of waste management. Industrial process are responsible for the waste pollutant production. Which needs high cost and very difficult to treat. Wastewater characteristics and levels of pollutants vary significantly from industry to industry. Now days peoples are focusing toward the byproduct recovery ,waste minimization. Waste minimization leads to the reduction in hazardous waste. By recycling and reuse of water and other product or by the change in process also lead to the waste minimization. In distillery toxic waste generated is in huge quantity about 12-15 times that of the alcohol. as the waste is more it needs to treat the effluent for the reduction of toxic waste. In this thesis explained the various combination and methods for treatment and reuse of distillery effluent. This various combination provides a leaf towards a zero discharge of molasses based distilleries. In this work the various combination and methods of pretreatment are studied.*

Keywords: *Biomethanation, Composting, Incineration, RO system*

I. Introduction

In India distilleries are responsible for high pollution. The effluent from the distilleries contain the high BOD,SS,COD,TDS. If it is treated with most efficient technology there remains the amount of it. So the leaving stream of water having black colour and odors. it is most difficult to treat the waste but it is necessary to protect environment.

Molasses form the sugar factory is the major constituent in the sugar industry. Molasses is the byproduct of the sugar industry. The effluent of the ethanol distillery is known as spent wash. Spent wash is the approximately 13-16 times more by volume to that of the alcohol. It is highly organic brown in colour. spent wash is having is having very high BOD and COD values as it is very strong organic and complex.it is very troublesome to treat spent wash. ^[1]

In India 2.8 billion liters of alcohol is produces in 298 distilleries which generates 45 billions liters of wastewater yearly. That much waste has the potential to generate 1200 million meters cube of biogas. Waste generated in distillery is spent wash and it is 15 times more than that of the product. The waste for distillery is seven times more to that of the population of India. If the waste from the distillery is leaved it will lead to the large damage to aquatic life. This problem is due to the energy bearing organic materials allowed drain. These bacteria have bod so need to treat it. By treating the effluent we may get the water with the specific BOD and COD levels.

In India molasses is the most common raw material for the production of the ethanol. In the ethanol production the methods involve are the fermentation and the distillation. Molasses is nothing but just the byproduct of the sugar industry with acidic in nature, rich in salts, dark brown in colour and it also contains sugar which could not be crystallized. In production of ethanol molasses is diluted and fermented. This fermented liquid is passed thought the series of the distillation columns for the separation of the ethanol. This ethanol is used for the different uses.

II. Objective

Worldwide environment regulatory authorities are focusing on zero discharge of wastewaters from distillery industries. While in n India, distilleries had been instructed to achieve zero discharge of spent wash by December 2005 according to the Central Pollution Control board. After summarizing all the points following are the objectives of treating the distillery effluent

- To ensure safe treatment of the organic part of the effluent
- To ensure safe and proper disposal of the treated effluent
- To convert effluent into useful byproduct.
- Create Value for byproducts and recover energy.

III. Methods

The various combinations for treating the distillery effluent is as mentioned below. For the molasses based distillery there are three major routes available.

Concentrate up to 23-25% and composting

Concentrate up to 55- 60 % and incinerate and get the electricity

Biomethanation of spent wash and generate the methane gas, which will be burned in boiler and generate the steam /electricity.

Molasses Based Distillery –

A) Spent wash

Biomethanation + Composting.

Biomethanation+Evaporation + Composting.

Concentration + Composting.

Concentration + Incineration.

B) Lees / Condensate Polishing –

RO system

IV. Comparison chart for results of different software, calculations and actual site data

Sr NO	Equipment	SOFTWARE			Actual Areas at site
		TRI	ES	SAG Calculation	
1	Falling Film Heat Transfer Coefficient Area	000	1000	1000	2 375M
		70	361	362.5	
2	Flubex Heat Transfer Coefficient Area	25	925	925	2 237M
			237	237	
3	Finisher Heat Transfer Coefficient Area	50	250	250	80M2
		0	78	79.56	
4	Surface Condenser Heat Transfer Coefficient Area	100	1100	1100	2 370M
		62	355	354	

V. Suggestions for zero liquid discharge

Main effluent steam which is generated from distillery is spent wash and is treated in the boiler. But still we are left with some more streams which are to be treated or reused in the distillery process to make the distillery true zero effluent discharge. The streams and their properties are mentioned below along with required treatment:

Rectifier Spent lees:

Details	Unit	Quantity	Suggested Treatment or Recycle
Quantity	M/day	125	Rectifier lees should be recycled back to fermentation as process water dilution
Total Dissolved solids	M	800	
BOD	M	500	
COD	M	1000	
	M		

Pre rectifier & Recovery Spent lees:

Details	Unit	Quantity	Suggested Treatment or Recycle
Quantity	M	165	To be treated in Reverse Osmosis process and the generated permeate to be recycled to cooling tower as makeup water
Total Dissolved solids	PP	2000	
BOD	PP	1000	
COD	PP	2000	
VA	PP	3000	
	M		

Process Condensate from Evaporation:

Details	Unit	Quantity	Suggested Treatment or Recycle
Quantity	M	516	To be treated in Reverse Osmosis process and the generated permeate to be recycled to cooling tower as makeup water
Total Dissolved solids	PP	2000	
BOD	PP	1000	
COD	PP	2000	
VA	PP	3000	
	M		

VI. Self Sufficient Distillery Complex

Main utilities required for distillery are steam, power and water. Out of which water balance and making the water use optimum is detailed in earlier chapter. Here we will cover the other two utilities i.e power and steam

Power Balance:

Below table provide the details of the power requirement in complex:

Sr no	Sections	Operating Power in (Kw)
	Molasses handling section	25
	Fermentation	325
	Distillation	100
	Evaporation	225
	Utility	560
	Product Storage	25
	Boiler	700
	Water treatment plant	120
	Waste water treatment plant	80
	Plant & Yard Lighting	50
	Admin Office	25
	Colony	50
	Total	2285

Consumed power will around 90% of the operating power:2050 KW

Steam Balance:

Sr no	Sections	Steam TPD
	Distillation	206
	Evaporation	200
	Deareator+ CBD Losses @20%	120
	Total Steam Requirement	526

Steam Generated from boiler incinerating the spent wash:

Boiler /Incineration Section :-

55% concentrated spent wash quantity = 193.63TPD

Incineration boiler efficiency = 60%

Gross Calorific Value of 55% spent wash =1705Kcal /Kg

Steam pressure generated at 44kg/cm²

Steam Latent heat at 44 Kg/cm² (g) = 660 Kcal /Kag

Steam Generated by using a spent wash

$$= \frac{(\text{concentrated spent wash qty(kg/hr)} \times \text{Boiler Effi} \times \text{conc. Spent wash GCV})}{\text{Steam latent heat}}$$

$$= \frac{193.63 \times 0.6 \times 1705}{660}$$

$$= 300 \text{ TPD}$$

Coal Quantity used is 25% of total Fuel = $193.63 / 0.7 = 193.6$
 = 82.97 TPD

Boiler Efficiency = 60%

Calorific Value of coal = 3800Kcal /kg

Steam Generated

$$= \frac{(\text{coal qty(kg/hr)} \times \text{Boiler Effi} \times \text{Coal GCV})}{\text{Steam latent heat}}$$

$$= 286.62 \text{ TPD}$$

$$\text{Total Steam generated} = 300 + 286.62$$

$$= 587 \text{ TPD}$$

As per turbine recommendation 10.7 TPH will produce 1MW power

$$587 \text{ TPD will produce} = 2.3 \text{ MW}$$

This power is consuming in distillery ,evaporation and other accessory equipments

Hence from above calculation it is clear that steam generated from boiler by incinerating the spent wash is sufficient to fulfill the steam requirement of entire complex. Similarly high pressure steam generated from the boiler can be sent to turbine to produce power required for distillery complex. Hence the distillery becomes self sufficient will only small quantity of coal.

VII. Conclusion

Managing the waste is most important problem faced by word. Now-a- days revenue generation from waste by the means of byproduct recovery and minimization of waste is the main emphasis. Pollution prevention focuses on preventing the generation of wastes, while waste minimization refers to reducing the volume or toxicity of hazardous wastes by water recycling and reuse, and process modifications and the byproduct recovery as a fall out of manufacturing process creates ample scope for revenue generation thereby offsetting the costs substantially. The distillery industries generating a huge quantity of highly toxic effluent, is approximately 12-15 times by volume of the production of alcohol. To characterize the distillery effluent in detailed is necessary to treat a waste and reduce the pollution hazards. In this project explained the various combination and methods for treatment of distillery effluent.

The generated effluent can be incinerated in the boiler to make a distillery complex self-sufficient in terms of utilities like steam ,Power .The Waste water like process condensate and spent lees can be treated and recycle back in the process as explained in the project .This has reduced the fresh water requirement drastically. This various combination providing a leaf towards a zero discharge of molasses based distilleries. In this way the treatment of hazardous distillery waste can be done.

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