



Research Article

STUDY ON DISTILLERY EFFLUENT: CHEMICAL ANALYSIS AND IMPACT ON ENVIRONMENT¹Dr. Rakhi Chaudhary, ²Ms. Mahima Arora**Address for Correspondence**¹Chairperson, Dept. of Applied Sciences & Humanities, Haryana Engineering College, Jagadhri²Department of Chemistry, Guru Nanak Int. of Engg. & Tech., Mullana, Ambala

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ABSTRACT

Growing industrial establishments can result in hazards on the local environment in the city if proper attention is not paid. One of the major pollution sources is Distillery effluent. The Distillery industries are rapidly expanding in sub metropolitan cities. They discharge their untreated wastes directly into the natural environments which cause various adverse effects on soil, water, air and health. It also affects the farm animals. They drink it and resulted in increased livestock mortality, poor health, and reduced milk yield. Even the human beings lived in Distillery Effluent Polluted Area are affected by skin allergies, headache, vomiting sensation, irritating eyes, fever and stomach pain. This kind of water has dissolved impurities like carbonate, bicarbonate, sulphate, chloride of Calcium, Magnesium, Iron, Sodium & Potassium and colloidal impurities like coloring matter, organic waste, finely divided, silica & clay. In the present paper, chemical analysis of Distillery effluent and its impact on environment are discussed. It is analyzed that distillery industry produces a huge amount of wastewater which is highly polluted and having very high Chemical & Biological Oxygen Demand (COD and BOD), dark brown reddish color and has a high load of organic matter, when discharged into natural water bodies, causes severe environmental pollution. Some of the contaminants, such as certain level of minerals or compounds are not only harmful to health, but also create long term effects.

KEY WORDS: Distillery industry, BOD, COD, pH, Total solids, Suspended solids.**INTRODUCTION**

Two major resources are water and air, which get polluted in one way or other. Water amongst these is of prime importance. Due to the fact that an estimated almost all diseases in developing countries are directly due to unsafe drinking water. Distillery industries are the agro-based industries with high organic and inorganic contents which are high strength wastes and difficult to dispose. Ethanol produces as a byproduct in the distilleries, create a great destruction of natural and human resources. Cane molasses also contains trace amount of dark brown pigment called melanoidins that impart color to the spent wash. Alcohol manufacture in distilleries consists of four main steps viz. feed preparation, fermentation, and distillation and packaging. Distillation step is the main source of wastewater generation, where the large volumes of dark brown effluent (termed as spent wash, stillage, slop or vinasse) is generated at the temperature range of 71–81°C. The spent wash is acidic and loaded with organic and inorganic salts, resulting in high electrical conductivity (EC). Distillery industry produces a huge amount of wastewater as calculated even after some ordinary treatment method. The effluented water is highly polluted and having very

high Chemical & Biological oxygen demand (COD and BOD), heavy load of organic matter, color and odour of the effluent is dark brown reddish color with unpleasant odour of Indole, Skatol and other sulphur compounds. The temperature of distillery effluent is about 25°C. The pH value of the distillery effluent is alkaline and when discharged into natural water bodies, causes severe environmental pollution. This causes the declination in plant growth and crop growth. Besides the above pollutant, the distillery wastewater also has high amount of Potassium, Phosphorus & Sulphate content. In addition, spent wash contains low molecular weight compounds such as lactic acid, glycerol, ethanol and acetic acid & also contain small amount of heavy metals in water bodies causes several health problems. Heavy metals e.g. Hg, Cd, Cr can accumulate and they enter in food chain and biomagnify to toxic level. Due to the increased pollution that arises from distillery effluent, there is the loss of soil fertility, loss of interaction within livestock and agriculture and biodiversity loss. Use of such water for irrigation purpose produces both beneficial and damaging effects on various crops and including vegetables. High BOD, COD and other organic compounds like phenols, lignin and oil and greases in spent wash

are likely to deteriorate soil and environmental health. It also affects seed germination, speed of germination, peak value & germination value of wheat, pea plant & ladyfinger. Germination percentage decreases with the concentration of effluent. They have a bad effect on livestock's health, Farmer's health and soil fertility. Due to the effluent groundwater quality also depleted day by day. Distillery Effluent Polluted Area that can lead to eutrophication of water bodies. Further, its dark color hinders photosynthesis by blocking sunlight and is therefore deleterious to aquatic life. Wastewater can cause soil sodicity, salinity, contamination with a wide range of chemicals, water logging and an aerobiosis, loss of soil structure and increased susceptibility to erosion.

Material and Method

Sample of wastewater was collected in a clean glass or plastic container (the lid, seal and bottle was rinsed with boiling water before use) and stored below 4°C at the point where it is discharged into the holding dam as agreed with the managers and proprietors, the name/addresses of the studied distillery plant is not disclosed in this paper. Sampling was done at the interval of 2 hours start at 9:00 am to 5:00 pm. Standard procedure for chemical analysis of sample were used.

Result and Discussion

The effluent taken from various sites of distillery at different times are analyzed. The value of DO, COD & BOD was determined by volumetric analysis and a graph was plotted between times of sample collection and concentration in ppm. The plot is a zig-zag line which means that effluent varies with the time

period. Effluent water is found to be highly polluted and having very high Chemical & Biological Oxygen Demand (COD and BOD), dark brown reddish color and have high load of organic. When discharge into natural water bodies, causes severe environmental pollution and produce adverse effect. Some of the contaminants, such as certain level of minerals or compounds are not harmful to health, even create a long term effects. Color and odour of the effluent of distillery was red brown in color with unpleasant odor of Indol, Sketol and other sulphur compounds. Temperature of distillery effluent was about 25°C. The average pH value of the distillery effluent was 8.3. It means all samples are alkaline in nature and high pH causes declination in growth plant and crop growth. So, treatment must be needed, before discharge the effluent in water bodies. pH must be balanced otherwise highly alkaline water create large pollution. Treated effluent could be used for agricultural purpose. The range of Dissolved Oxygen in the distillery effluent was around 0.2; meanwhile the recommended BIS range is 4 - 6. The absence of D.O. is possibly due to high organic load. The value of BOD in distillery effluent was around 545 ppm and the recommended value of BIS is about 30. This indicates high organic load. Similar effect was seen on COD level, the COD value of the Distillery effluent was around 2402 mg/l while the recommended level by BIS is 250 only; this high amount is due to high organic load. BIS recommended total solid in distillery effluent in the range of 100 ppm the average value came out ~257.

Table-1 Chemical analysis of Effluent Sample

S. No.	Parameter	Sample 1	Sample 2	Sample3	Sample4	Sample5
1.	T ° C	25.51	25.62	24.59	24.63	24.55
2.	Color	Reddish	Reddish	Reddish	Reddish	Reddish
3.	pH	8.01	7.70	7.42	8.41	8.43
4.	D.O.(ppm)	0.1032	0.2064	0.4128	0.1032	0.2064
5.	B.O.D.(ppm)	546	534	552	540	564
6.	C.O.D.(ppm)	2396	2400	2408	2400	2404
7.	T.S.(ppm)	5000	5040	4720	4992	5088
8.	T.S.S.(ppm)	300	310	250	260	310

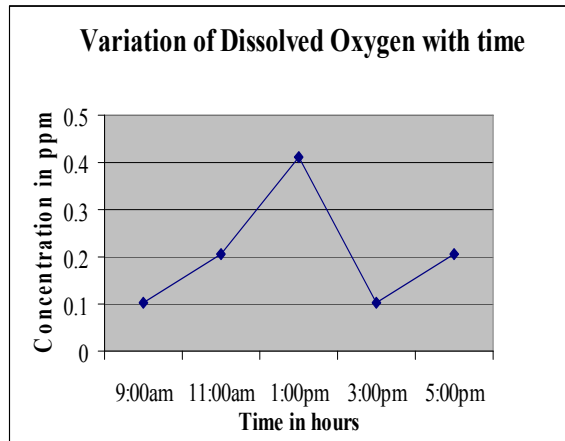


Fig .1 Variation of Dissolved Oxygen with Time.

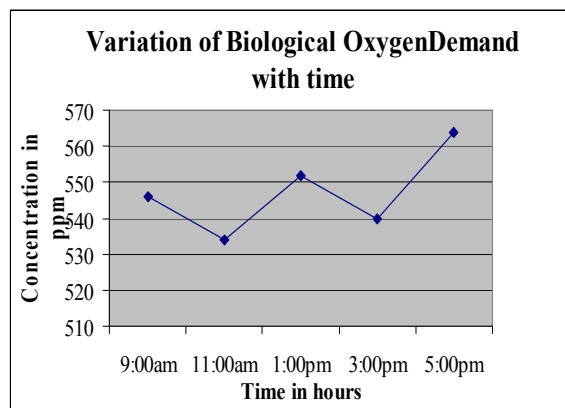


Fig 2 Variation of Biological Oxygen Demand with Time

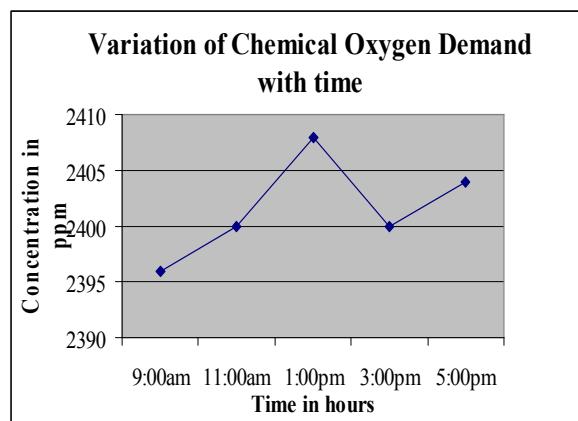


Fig3.Variation of Chemical Oxygen with time

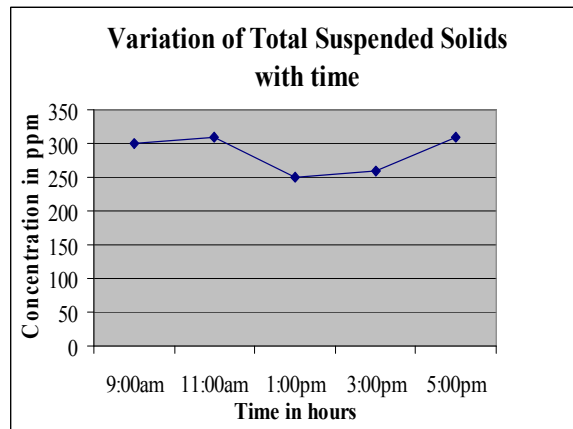


Fig 4 Variation of Total Suspended Solids Demand with time

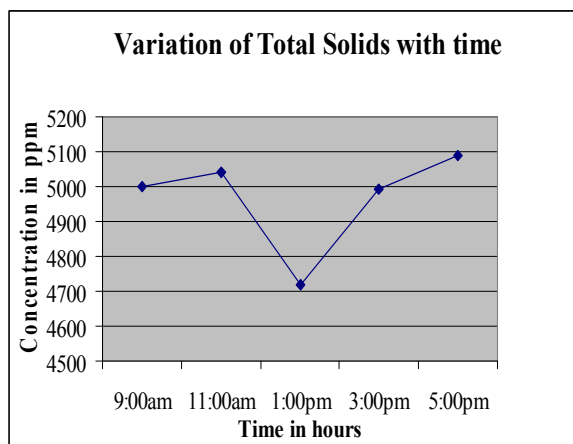


Fig.5 Variation of Total Solids with time.

Impact of Distillery Effluent on Environment

- Discharge of wastewater with high TDS would have adverse impact on aquatic life and to make unsuitable water for drinking purpose, if used for irrigation reduce the crop yield, corrosion in water system and pipe line.
- Suspended solids in wastewater reduce the light penetration and plant production as a result in receiving water by increasing turbidity it can also clog the fish gills.
- High amount of BOD in the wastewater leads to the decomposition of organic matter under the anaerobic condition that produce highly objectionable products including Methane (CH_4), Ammonia (NH_3), Hydrogen Sulphide (H_2S) gas.
- Low Dissolved Oxygen (DO) in water bodies affect the aquatic life as DO drops fish and other species are threatened and may get killed.
- Fall in DO levels causes undesirable odours, tastes and reduce the acceptability of water for domestic purpose.
- In steam generation, DO is one of the most important factors causing corrosion of the boiler material.
- Generally, industrial wastewater changes pH level of the receiving water body. Such changes can affect ecological aquatic system; excessive acidity particularly can result in release of hydrogen sulphide (H_2S) to air.
- Alkaline nature of wastewater causes declination in plant growth and crop growth.

- Color and odor of the effluent of distillery was red brown in color with unpleasant odor of Indol, Sketol and other sulphur compounds.
- Spent wash is a complex, multicomponent stream that is known to cause considerable fouling.

CONCLUSION

The characteristic of spent wash do not allow its discharge into a water body, hence it requires treatment. Biological treatment, especially with pure cultures, appears promising and possibly cost-effective for color removal; however, the initiatives are mainly confined to laboratory trials. Adsorbents like activated carbon that result in almost complete decolorization are not cost effective for treating the enormous volumes of spent wash typically generated in a distillery. Thus, there is scope for examining low cost adsorbents, including wastes generated in other industrial processes / operations. The production of distillery must be incorporated in the design to accommodate the increased amount of effluent. Extensive research has been conceded out on healing of distillery wastes in many parts of the world. Effluent in an organic nutrient solution, it has a wide spectrum of utility. There have been some attempts to use spent wash as substrate for yeast growth or for biochemical production.

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