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Physico chemical studies of Untreated Effluent of Sugar Mill at Sri Ganganagar(Rajasthan)

Rajender Kumar Bishnoi

Department of Zoology

Ch. Ballu Ram Godara Govt. Girls (P.G.) College

Sri Ganganagar(Rajasthan)

Abstract

The present study describes the water quality of untreated effluent of sugar mill at Sri Ganganagar city. The result of this study effort were made of evaluate the chemical characteristics of sugar mill waste of Sri Ganganagar city. Samples were collected monthly from five different stations in dark bottles and were analyzed for different physico-chemical parameters like colour, odour, pH, total hardness, chloride, alkalinity, TS, TDS, Dissolved oxygen, BOD and free CO_2. The sugar mill untreated effluent contains high, BOD, TDS, TS and low contents of DO which is toxic, to plants. So it is not permissible for irrigation. But the diluted distillery effluent could be used for irrigation purpose.

Introduction:

Rapid industrialization has created a lot of pollution problem in ecosystem as industrial effluents containing many pollutants including heavy metals. Almost 70% of the water in Indian has become polluted due to the discharge of domestic sewage and industrial effluent into natural water sourced, such as river, streams as well as lake (Radhakrishanan et.al., 2007)

Distillery is an ancillary unit of sugar industry and molasses is used as raw material in the production of ethanol. The distillery effluent is produced in huge volume having a very high pollution potential due to the presence of large quantity of organic matter. The annual production of alcohol is about 6500-7000 million litre. The total waste water produced per litre alcohol is around 40-50 litre. Use of molasses generated waste water containing highly bio-degradable dissolved solids, high temperature, and low pH. High concentration of potassium, calcium, chloride and sulphate ions and high BOD and COD (Kaulet.al, 1993). Due to the higher organic matter of distillery effluent toxic conditions are created in the receiving stream by immediate depletion of oxygen. The problem of its disposal is further accelerated by colour and other toxicants. Its disposal has resulted in massive

destruction of aquatic flora and fauna and decolourisation of streams. The offensive odour due to the anaerobic decomposition spreads over a few kilometre and is serious public health hazard (Vaidyanathan et al., 1995)

The Sri Ganganagar state sugar mills Ltd., is one of the few oldest sugar mills in Rajasthan established in 1945. It is a state Gove Project and has about 1000 mt/day crushing capacity. About 640 m3 day of waste water or spent wash and distillery effluent is produced. Discharge of raw spent wash into open land or nearby water bodies resulting in a number of environmental, water and soil Pollution including threat to plant and animal lives. Therefore, the present work was carried out to investigate the physicochemical characters of the distillery effluent.

Material and Method

Sampling:

The distillery effluent was collected from distillery unit and storage pond situated near the Sri Ganganagar state sugar mills Ltd. Sri Ganganagar. Samples were collected monthly from five different stations in dark bottles and were analyzed for different physico-chemical parameters like pH, total hardness, chloride, alkalinity, TS, TDS, Dissolved oxygen, BOD and free CO_2, in laboratory of Deptt. of Zoology Govt. Girls college, Sri Ganganagar following the methods described by APHA(1998), Trivedi and Goyal (1984).

Reagents & Standards

Analytical grade chemical were used throughout the study without any further purification. To prepare all the reagents and calibrations standards, double glass distilled water was used. The metal standard were prepared from stock solutions of 1000 mg by successive dilute with ultra pure water. Deionised water was used throughout the study. The glassware were washed with dilute Nitric acid (1:15) followed by several portions to distilled water. All the experiments were carried out in duplicate.

Result and Discussions: The results of different parameters are shown in table-1

Colour: In the present investigation the colour of the untreated effluent was dark brownish throughout the study period at all the sampling stations. Colour is very important factor for the aquatic life for making food from sun-rays. Photosynthesis activity gets reduced due to dark colouration and affects other parameters like temperature D.O. and B.O.D. etc.

Odour: Odour can be defined as the “perception of smell”. Whether pleasant or unpleasant, odour is induced by inhaling air-borne volatile organics or inorganic. Odour affects human beings in a number of ways. Strong, unpleasant or offensive smells can interfere with a person’s enjoyment of life especially if they are frequent and / or persistent. Very strong odour can result in nasal irritation; trigger symptoms in individuals with breathing

problems. In the present study the smell of untreated effluent was decaying molasses smell throughout the study period at all the sampling stations

Total alkalinity: Alkalinity is an important if it is less than 100 ppm is desirable for domestic use; however in large quantities it imparts bitter taste to water. In the present investigation the total alkalinity was between 50 to 488 mg/l. The maximum alkalinity was at S_1 in November. The minimum alkalinity was at S_3 in Sept. The total average value of alkalinity was 254.64 mg/l.

Free CO_2: Free CO_2 of untreated effluent sample range between 26.4 mg/l to 1096.4 mg/l. The maximum range was at S_1 in Oct. The minimum CO_2 at S_2 in August. The total average value of free CO_2 was 367.58 mg/l

Total hardness: Total Hardness is a measure of the ability of water to cause precipitation of insoluble calcium and magnesium salts of higher fatty acids from soap solution. The total hardness of untreated effluent sample range between 180 mg/1 to 1530 mg/l for individual sample. The maximum ranges of hardness from S_2 in August. The minimum hardness at S_2 in October. The total average value of hardness was 691.72 mg/l.

Chloride: The high concentration of chloride is considered to be an indication of population due to high organic waste of animal origin. Chloride ions concentration forms an important parameter in any water quality study since the chlorides are the indicators of domestic pollution. The chloride content of the water of sugar mill waste studies range from 119.2 mg/1 to 404 mg/l. The maximum range of chloride 404.7 mg/l from S_5 in August and the minimum range of chloride 119.2 from S_1 in November. The total average value of chloride was 222.44 mg/l. Similar results was observed by Matkar (2002), effluent from sugar industry having 450 mg/lit.

Total solids (TS): Total solids are the measure of the amount of all kinds of solids in waste water. Total solids can be determined as a residue left after evaporation of the unfiltered sample. The range of TS from 100 mg/1 to 2600 mg/l. The maximum range of TS from S_1 in November and minimum range of TS from S_2 in December. The total average value of TS was 1456 mg/l.

Total Dissolved Solid (TDS): Total dissolved solid is important parameter in water. This includes various kind of minerals present in the polluted water may also contributed to the TDS. However dissolved solids do not contain any gas and chloride. In present investigation the range of TDS was between 100 mg/l to 1700 mg/l. The maximum value of 1700 mg/l from S_4 in December and minimum value 100 mg/l from S_1 in August. The total average value of TDS was 792 mg/l.

Dissolve Oxygen (DO): Oxygen availability throughout the year is influenced by other chemicals present in the water, biological processes, and temperature (Balakrishna *et al.,* 2013b)

In present investigation Dissolve Oxygen of waste water sample range between 0 mg/l to 4.8 mg/l for individual sample. The maximum value 4.8 mg/l from S_5 in September and the minimum range of dissolve Oxygen was zero at all station in October, November and December. The total average value of dissolve Oxygen was 1.41 mg/1. Avasan et.al., (2001), observed the DO of sugar mill is ranging between 0 to 2. He observed that if DO is low then it cause anoxic conditions

pH: It is affected by environmental factors such as temperature, salinity and pressure.

The pH of all sampling stations from 4.2 to 5.6. The maximum pH range was at S_1 in October and the minimum pH range was at S_4 in August. The total average value of pH was 5. Similar

results were observed by (Surrender Reddy *et al.*, 2015). Since pH has no direct effect on human health but it show close relation with some other chemical constituents of water and consequently influence chemical kinetics of important constituents of water. The pH value of natural water changes due to biological activity and industrial contamination. Higher pH

includes the formation of trihalomethanes which are toxic.

Biochemical Oxygen Demand (B.O.D.): B.O.D. is characterized as measure of oxygen required by microorganism while settling natural decomposable natural matter in a water vigorous conditions. The natural oxidation is moderate procedure .During oxidation the natural toxins are oxidized by certain microorganism into carbon dioxide and water utilizing broke down oxygen. Beruch et. al. (1993), recommended that oxidation of the natural waste by common microorganisms make abnormal state of BOD (1920 mg/lit of 2100 mg/lit). In the present investigation BOD ranged between 380-1050 mg/l. The maximum value 1050 mg/l from S_5 in October and the min. range of BOD was380 mg/l in September. Senthil et.al., (2001), watched the BOD of sugar factory emanating in a scope of 635 mg/lit to 950 mg/lit .

Conclusion: The water quality parameters of the study area clearly indicate that the water (sugar mill waste) cannot be used for domestic purposes. The sugar mill untreated effluent contains high, BOD, TDS, TS and low contents of DO which is toxic, to plants. So it is not permissible for irrigation. But the diluted distillery effluent could be used for irrigation purpose. Major

criteria for suitability of water for irrigation purposes is as such, TDS < 1000mg/l

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Table-1: Water quality Parameters of Untreated Effluent of Sugar Mill at Selected Stations

S. No.	Stations	Month	Parameters								
			pH	CO_2	O_2	BOD	Alkalinity	Hardness	Cl	TS	TDS
1	S1	Aug.	4.9	39.6	3	860	200	375	215.6	200	100
2	S2		5.4	26.4	2.6	980	240	1530	291.1	2200	900
3	S3		5.1	57.2	3.4	630	250	1410	347	1700	1400
4	S4		4.2	83.6	3.1	820	340	785	369.2	700	600
5	S5		4.9	88	4.6	490	380	1205	404.7	900	800
6	S1	Sept.	5.2	748	3.4	560	130	600	218.6	1100	400
7	S2		5.3	360	2.8	610	154	362	157.6	1100	200
8	S3		5	316.8	3.4	390	50	588	139.1	2100	600
9	S4		4.9	442.4	4.2	570	152	484	144.8	1300	1100
10	S5		4.5	374	4.8	380	124	644	201.6	1500	700
11	S1	Oct.	5.6	1096.4	0	690	348	230	315.2	1100	700
12	S2		4.8	426.8	0	880	358	180	285.4	1300	1000
13	S3		5	365.2	0	910	380	314	262.7	1500	900
14	S4		5.5	356.4	0	650	390	280	269.8	900	500
15	S5		4.6	338	0	1050	130	196	244.2	1600	1000
16	S1	Nov.	5.3	726	0	1010	488	725	119.2	2600	500
17	S2		5.2	352	0	890	300	890	215.8	1300	800
18	S3		5.1	418	0	780	424	910	227.2	1100	300
19	S4		5.1	448.8	0	1090	350	515	207.2	2000	500
20	S5		5.2	222	0	470	390	765	132	2500	700
21	S1	Dec.	4.5	792	0	690	120	1215	184.6	1400	900
22	S2		4.7	316.8	0	550	132	1010	142	100	700
23	S3		4.9	264	0	760	158	845	129.2	1700	1300
24	S4		5	355	0	590	178	650	190.2	2100	1700
25	S5		5.1	176	0	660	200	585	147.2	2400	1500
Total Average			**5**	**367.6**	**1.41**	**718**	**254.6**	**643.72**	**222.4**	**1456**	**792**