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Effluent Treatment Plant of Sugar Wastewater – A Review

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ABSTRACT

Sugar Industry is also called sugar cane mill. The production of sugar from which is carried out. As we known the cane is cash crop. So the sugar industry is the major industry which takes part in the growth of the country. Sugar industry is one of the major industries which have been included in the polluting industries. Sugar industry wastewater has a high degree of pollution parameters. Present report thus gives the different parameter studies such as pH, BOD, COD, etc. also the study of the sugar industry Bidri – Shri Dudhganga-Vedganga Sahakari Sakhar Karkhana Ltd. The parameters permissible limits which are prescribed by the board are also studied.
Keywords: Sugar Industry, cash crop, pollution parameters, BOD, COD.

I. INTRODUCTION

Water is an essential part of all living organisms. In this connection water plays a most valuable and important role in the natural cycle. Among the whole water availability, only 3% fresh water is available on the earth. In the available fresh water sources, entries of pollutants have been significantly increased from industries and domestic/anthropogenic activities. In this scenario the conservation strategies plays an important role in the conservation of fresh water bodies as well as water quality. Huge quantity of fresh water will be consumed for the production process which will be held in the industry. In the mean while the amount of consumption of fresh water is equal to the amount of discharge of wastewater as effluent [5]. Rapid urbanization and industrialization in the developing countries like India are facing severe problems in collection, treatment and disposal of effluents. Unmanaged organic waste fractions from industries, municipalities and agricultural sector decompose in the environment resulting in large scale contamination of land, water and air. This is leading to serious public health problems and environmental degradation. Unfortunately, due to the lack of knowledge, financial support and sometimes unwillingness to spend on treatment of wastewater, most of sugar industries in developing countries discharge their wastewater without adequate treatment. This not only creates problem but also wastes the water resource [2]. In this aspect the present study pointed out the pollutants concentration in the sugar industry effluent. Once determine the concentration of pollutants in the effluents, the wastewater treatment system can also be modified as per the modern technology to remove the maximum concentration of pollutants in the wastewater [5].

In countries like Cuba, Jamaica and India the sugar is produced from sugar cane, while in other many places beetroots are used as the raw material for sugar production. A large volume of waste of organic nature is produced during the period of production and normally they are discharged onto land or into the nearby water course, usually small streams, practically without pretreatment. Condition becomes worse as the stream flow reaches a very low level and eventually when enough dilution water is not available during the period of operation. Putrefaction of polluted stream water caused by heave discharge of organic waste, resulting in the odors nuisance near the sugar industry is a very common phenomenon. In fact, all the concerned bodies, both sugar industry and pollution control agencies are aware of these problems and are trying to find an economical means to stop the nuisance created by the sugar industry effluent [1].

II. METHODS AND MATERIAL

A. Sugar Industry

2.1 Manufacturing of sugar

Sugar cane is normally harvested manually in India. The sugar canes are cut into pieces and crushed in a series of rollers to extract the juice in the mill house. The milk of lime is then added to juice and heated, when all the colloidal and suspended impurities are coagulated; much of the color is also removed during this lime treatment. The coagulated juice is then clarified to remove the sludge. The sludge is further filtered through filter presses and then disposed of as solid waste. The clarified juice is then preheated and concentrated in evaporators and vacuum pans. The partially crystalized syrup from the vacuum pan known as "massecuite" is then transferred to the crystallizers, where complete crystallization of sugar occurs. The messecuite is then centrifuged to separate the sugar crystals from the mother liquor. The spent liquor is discarded as "Black Strap Molasses". The sugar is then dried and bagged for transport. The fibrous residue of the mill house is known as "bagasse", which may be burned in the boilers or may be used as raw-materials for the production of paper products, or may be used for generation of electricity. A flow diagram of the process of manufacturing in a typical sugar industry is given in Figure 1 [1].

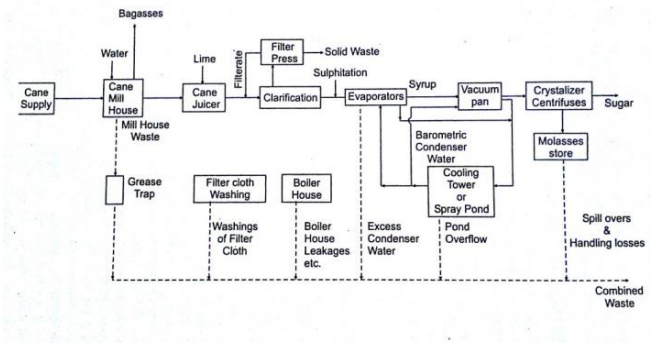


Figure 1: Flow Diagram for Sugar Manufacturing Process

2.2 Sources of wastewater

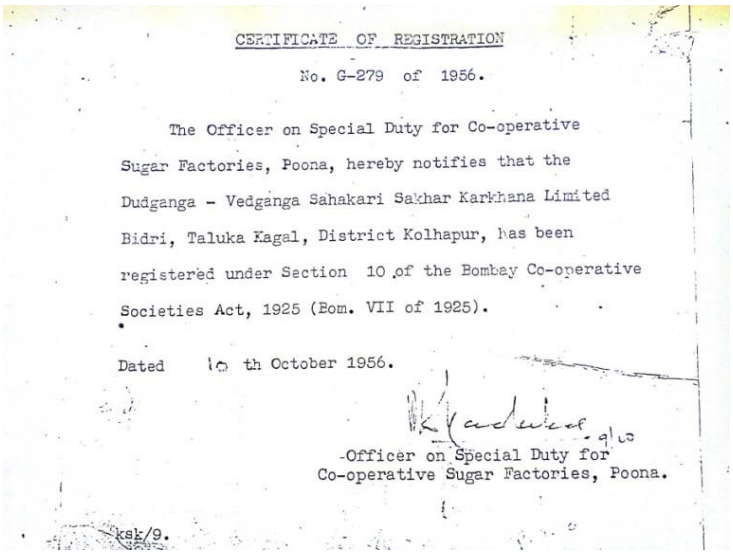
Waste from mill house includes the water used as splashes to extract maximum amount of juice, and those used to cool the roller bearings. As such the mill house waste contains high BOD due to the presence of sugar and the machineries. The filter cloth used to filter the juice need cleaning. The wash water thus used produced though small in volume, contains high BOD and suspended solids. Additional waste originates due to the leakages and spillages of juices, syrups and molasses in different sections, and also due to the handling of molasses. The periodical washing of the floor also contributes a great lot of the pollution load. Though these wastes are small in volume and are discharged intermittently, they have got a very high BOD [1].

2.3 Effect of waste on receiving water

The fresh effluent from the sugar industry decomposes rapidly after few hours of stagnation. It has been found that it causes considerable difficulties when their effluent gets an access to the water courses, particularly the small and non-perennial streams in rural areas. The rapid depletion of oxygen due to biological oxidation followed by anaerobic stabilization of the waste causes a secondary pollution of offensive odors, black color, and fish mortality. No question of the discharge of this waste into sewers is arises, as most of the sugar industries are situated in the un-sewered rural areas [1].

3. Company Profile

Shri Dudganga-Vedganga Sahakari Sakhar Karkhana Ltd., Bidri, Dist. Kolhapur was established on 10th October 1956 under the Bombay CO-operative Societies Act, 1925. The details are show below in Figure 2.



CERTIFICATE OF REGISTRATION

No. G-279 of 1956.

The Officer on Special Duty for Co-operative Sugar Factories, Poona, hereby notifies that the Dudganga - Vedganga Sahakari Sakhar Karkhana Limited Bidri, Taluka Kagal, District Kolhapur, has been registered under Section 10 of the Bombay Co-operative Societies Act, 1925 (Bom. VII of 1925).

Dated 10 th October 1956.

Officer on Special Duty for
Co-operative Sugar Factories, Poona.

ksk/9.

Figure 2 : Certificate of Registration.

Table 1: General Information of Industry

1.	**Name and location of industry**	Shri. Dudhganga Vedganga SSK Ltd. Bidri (Mouninagar) Tal. Kagal, Dist. Kolhapur-416208.
2.	**Site location**	The river Dudhganga is at 2.2 km from site.
3.	**Total plot area**	177 acres
4.	**Built-up area**	15 acres
5.	**Area available for the use of treated sewage / trade effluent for gardening irrigation**	36 hectors
6.	**List of products / byproducts manufactured**	Sugar – 600-650 M.T./day Molasses – 5400-6000 M.T./M Bagasse – 36000 M.T./M Pressmud – 5400 M.T./M Electricity – 20 M.W./hr.
7.	**List of raw materials and process chemicals with annual consumption**	Sugar cane – 5000 M.T./day Bagasse – 45 TPH Coal – 13.48 TPH

3.1 Process

Figure 3 shows the process flow for manufacturing of sugar in Dudhganga Vedganga SSK Ltd.

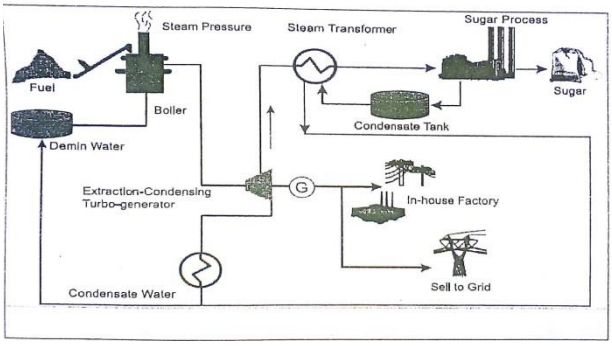


Figure 3: Process Flow Diagram for the Sugar Manufacturing Process of Industry.

Figure 4 shows the flow chart of manufacturing of sugar in Dudhganga Vedganga SSK Ltd.

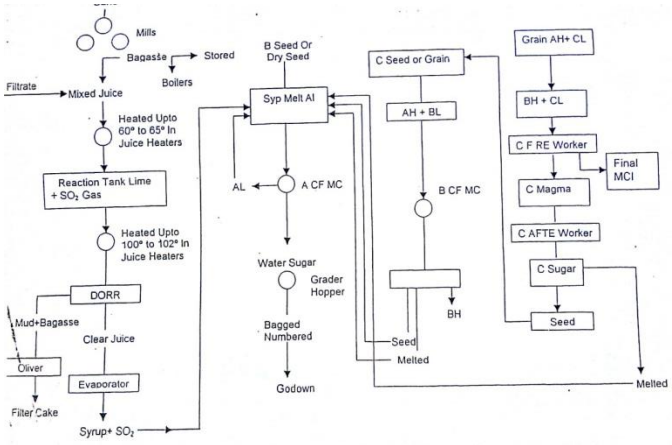


Figure 4: Process Flow Chart for the Sugar Manufacturing Process of Industry.

3.2 Water budget

Daily requirement of water is given in the table below.

Table 2: Water Budget

For Sugar & Co-generation					
Cooling Mill bearing, hot liquid, pumps glands, Spray pond	Process Imbibition water, In Oliver & Emico pans	Washing & Cleaning	Boiler	Laboratory	Domestic
Effluent	Effluent	Effluent	Effluent	Effluent	Effluent
Total effluent is treated in the State-of-the art ETP & treated effluent is used for irrigation purpose.					Effluent is treated in well-designed septic tanks followed by soak pits.

3.3 Co-generation Project

In year 2014-15, a total of 76519808 units of electricity are produced from the co-generation unit of the industry. Among the produced electricity 15495423 units of electricity and for co-generation unit 6578560 units of electricity is utilized by the industry itself. The remaining 54445825 units of electricity is being exported to electricity board, from which a total of Rs. 330427000/- is the profit to the industry from the co-generation project which is situated within the industry premises.

III. RESULT AND DISCUSSION

Effluent Treatment Plant

The consumption of large volumes of water and the generation of organic compounds as liquid effluents are major environmental problems in sugarcane processing industry. The inadequate and indiscriminate disposal of this effluent in soils and water bodies has received much attention since decades ago, due to environmental problems associated to this practice. The sugar cane industry is among those industries with the largest water demands and, in addition, is an important source of non-toxic organic pollution combined with the fact that India it is second largest producer and largest consumer makes it all the more important [7].

Like any other industries, the pollution load in sugar mills can also be reduced with a better water and material economy practiced in the plant. Judicious use of water in various plant practices, and its recycle, wherever practicable, will reduce the volume of waste to a great extent [1].

The operation of the ETP is such that it will give an effluent of such standard, prescribed by the Maharashtra Pollution Control Board (MPCB). The following prescribed standard by the board or under EP Act, 1986.

Dudhganga Vedganga SSK has provided an ETP. The units of the ETP are:

1) Screen Chamber cum Oil & Grease tank
2) Equalization Tank
3) Mixing Tank
4) Aeration Tank with aerator
5) Clarifier
6) Sludge Drying Bed.

Table 3: Norms for Sugar Industry

Sr. No.	Parameters	Standards Prescribed by Board
		Limiting concentration in mg/l, except for pH
1.	**pH**	5.5-9.0
2.	**Oil & Grease**	10
3.	**BOD (3 days 27^0C)**	100
4.	**Sulphate**	1000
5.	**Suspended Solids**	100
6.	**COD**	250
7.	**Chloride**	600
8.	**Total Dissolved Solids**	2100

The flow diagram of the ETP is shown in the diagram below (Figure 5).

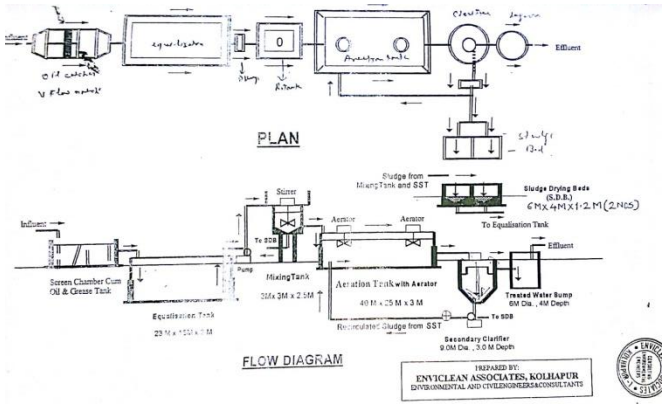


Figure 5: Process Flow Diagram of ETP of Industry.

A. Screen chamber cum oil & grease tank

The screen chamber (Bar Screen) is used to remove the large floating objects. The untreated effluent may contain large floating solids, paper etc. The screening chamber prevents these materials from choking pipe system and clogging the pumps, impellers and aberration to equipments.in this chamber, all these materials are removes by bar screen which are 10 mm wide and 50 mm deep, arranged with spacing of 20 mm between 2 adjacent bars. For removal of trapped matter frequent cleaning activities is carried out. Oil & grease chamber works for the removal of oil & grease from the influent which may cause damage to pumping unit, hazard to biological treatments. The combination of the bar screen and oil and grease chamber is provided in the ETP as shown in the Figure.

B. Equalization Tank

Equalization basins may be used for temporary storage of diurnal or wet-weather flow peaks. Basins provide a place to temporarily hold incoming sewage during plant maintenance and a means of diluting and distributing batch discharges of toxic or high-strength waste which might otherwise inhibit biological secondary treatment

(including portable toilet waste, vehicle holding tanks, and septic tank pumpers). Flow equalization basins require variable discharge control, typically include provisions for bypass and cleaning, and may also include aerators. Cleaning may be easier if the basin is downstream of screening and grit removal.

C. Mixing Tank

Mixing tanks are generally provided for through mixing of the influent which if held in the equalization tank. The mixing is carried out with the help of mechanical stirrers.

D. Aeration Tank with aerators

Aeration is the process by which air is circulated through, mixed with or dissolved in a liquid or substance. Hence aeration tank are provided to aerate the wastewater by the biological treatment of the waste can be carried with greater efficiency.

E. Clarifier

Clarifiers are settling tanks built with mechanical means for continuous removal of solids being deposited by sedimentation. A clarifier is generally used to remove solid particulates or suspended solids from liquid for clarification and (or) thickening. Concentrated impurities, discharged from the bottom of the tank are known as sludge, while the particles that float to the surface of the liquid are called scum.

F. Sludge Drying Bed

The sludge drying beds are used for dewater the settled sludge. The excess sludge from the clarifier is discharged to sludge drying beds at intervals so that the concentration of MLSS is maintained in aeration tank. These are the sand beds of 250 mm of sand over about equally thick well-graded gravel layer, underlain by perforated drainage lines spaced 2.5 to 6 m apart. The bed should slope towards the discharge end at rate of 1 in 200.

IV. CONCLUSION

The study concerned with the ETP for sugar industry. It can be concluded that, the overall performance of the effluent treatment plant was satisfactory. The individual units are also performing well and their removal efficiencies are satisfactory. The treated effluent meets the MPCB standard for discharge in inland surface water hence it can be said that the plant is working efficiently. This treatment plant is high potential for, reduction for pH, Temperature, TDS, and COD. The treated wastewater at outlet of ETP is given to the garden area of the industry. The details of the same are given in the table below.

Table 8: List of Trees Planted in the Industrial Premises

Sr. No.	Type of Tree Planted	No. of Trees
1.	Rain tree	289
2.	Gulmohar	185
3.	Nilgiri	500
4.	Saagvan	600
5.	Pleta forum	35
6.	Glyricidia	349
7.	Ulta ashok	200
8.	Spathodia	4
9.	Umber	5
10.	Jambhul	83
11.	Bhendi	5
12.	Silver oak	80
13.	Jacaranda	46
14.	Coconut	900
15.	Chikku	80
16.	Mango	112
17.	Supari	12
18.	Fanas	20
19.	Limbu	35
20.	Kadhipatta	25
21.	Peru	79
22.	Aawala	9
23.	Bottle brush	12
24.	Bottle palm	53
25.	Chinch	9
26.	Kavati chapha	1
27.	Pivala chapha	4
28.	Badam	1
29.	Hirava chapha	2

30.	**Papaya**	15
31.	**Aavada**	5
32.	**Bakuli**	2
33.	**Cassia**	215
34.	**Vad**	12
35.	**Christmas tree**	7
36.	**Morpankhi**	26
	Total	4017

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