

# Environmental Problems Related to Sugar Industries: A Case Study of Govind Sugar Mill Ltd, Aira, Lakhimpur Kheri

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**Abstract:-** Sugar industries are the largest agro-based industries after textile industries in India and have its big share in economic development. It not only generates huge employment opportunity to the rural and urban population but also contributes in various ways to the economy. In nature, sugar industries may also be considered as multi product industry, the byproducts are bagasse, molasses, press mud etc. having their multiple usages. In a way the variety of byproducts that sugar industries have their direct or indirect impact on our day-to-day life.

Despite of the benefits sugar industries have some social cost that is environmental problems. Basically, the byproducts of sugar industries are the solid waste and without filtration if they are dumped into the water bodies or to the open atmosphere, they are hazardous and impact the environment adversely.

In wake of environmental degradation, the corporate or the owners of the industries have some legal, ethical and social obligations and they need to adhere upon to the said norms. The whole idea of this paper revolves around the environmental problems related to the sugar industries with special reference to Govind Sugar mill, Aira, Lakhimpur Kheri. To know about the byproducts of sugar industries and their social cost is also an objective of this paper. The magnitude of this paper is to study the certain production and filtration processes of the said industry.

**Keywords-** Sugar Industry, Social Cost, Environmental Impact, Production and Filtration Processes.

## I. INTRODUCTION

India is the second largest sugar producer after Brazil and the largest sugarcane producer in the world and has its big share in Indian economy. It has very strong impact on the socio-economic development of farmers and rural India. In our country nearly 50 million farmers and equivalent labors are engaged in sugarcane cultivation. Currently in India about 532 sugar mills are operational, and approximately producing 251 lakh tons of sugar, besides this, about 2.7 billion liters of alcohol and 2,300 MW power

are also being produced.<sup>1</sup> Total export of the industry is around 1,300 MW of power to the grid. Indian sugar industry is fully capable of meeting the demand of potable alcohol as well as 10% blending in gasoline.

Uttar Pradesh is the primary sugarcane producing state of the country and occupies the first place in both sugarcane and sugar production. Due to the conducive climate and favorable soil conditions, the cost of sugarcane production in Uttar Pradesh is quite low, thereby the state's productivity and production of producer state in India. Approximately 48% of total cultivated area of sugarcane lies in Uttar Pradesh, and it contributes around 50% of the total sugarcane production. The important fact is that Lakhimpur Kheri district occupies first place in sugarcane production in Uttar Pradesh. It contributes around 28% of the total sugarcane production in the state.

Despite of all these facts regarding the contributions of the sugar industries towards various aspects of the economy, there are some environmental issues that often occur while the production procedure of the sugar industries takes place. The byproducts of sugar industries may be hazardous to environment, if they are not treated properly. The liquid and solid waste produced from sugar industries has adverse impact on the ecosystem and environment due to their high BOD load and toxic constituents. The main byproducts of sugar industries are bagasse, molasses and press mud, if sugar industries are not using bagasse and molasses to make the electricity, ethanol, and alcohol then they has to burn and dump these effluents which causes air pollution and soil degradation.

The environmental impacts get worse if the industries don't use proper filtration process and waste disposal management. Sugar industries undertake some environmental and ecological transformation process with the purpose of reducing the negative externalities. The Govind Sugar Mill Ltd (GSML) is one of the oldest industries in Uttar Pradesh. GSML has 10,000 tons per day (TPD) milling capacity and industry is producing 1000 TPD

<sup>1</sup> Asha D. M., M. Ramanjaneyulu. (2020). Economic analysis of production of alcohol, power and biocompost in sugar industry of Karnataka. International journal of advance research ( IJAR).ISSN: 2320-5407

sugar out of which 500 TPD is double sulphitated refined white sugar.<sup>2</sup> The main discharges of sugar industries are molasses, baggase, Wastewater, press mud etc. GSML uses all the possible filtration process for utilizing these effluents to check the social cost and to meet the society's demand.

## II. REVIEW OF LITERATURE

**S. Ahmad and A. Nomani (2014)**-The study is done with a purpose to conduct a triple bottom line assessment of sugarcane value chain and present alternatives that can improve the current sustainable practices across all the stakeholders. Also, for this study a value chain approach was adopted to identify the issues related to social, economic and environment across stakeholders linking the sugarcane producers and the processors. The main objectives of the study were to identify the critical productive agents across sugarcane value chain, and in their role in social development; to assess the sustainability issues faced by these productive agents using the 'triple bottom line approach' and to evaluate importance of sugar factories in social, economic and environmental advancement of the society. Using this triple bottom line approach author of the paper discussed social, economic and environmental sustainability of the sugar industry.

**D. Venkatesh and M. Venkateswarlu**- This study analyzed sugar industries also recognized how Indian sugar industries played an important role in economics development and provided employment in rural areas. This study explains state wise production trends size and structure of sugar industry and development of these industries. It covers a decade from 2005-06 to 2014-15 and categorizes sugarcane areas, production of sugar, production of byproducts and shows that the production of sugarcane is highest in Uttar Pradesh and lowest in Bihar and Punjab.

**AFS Ltd (India) Research Repot- Indian sugar industry (2013)** this report examines the growth and development potential of sugar industries in India this report shows the data from 2008 to 2013 and includes sugarcane productivity, sugar production, domestic consumption surplus scenario and shows state wise area under sugar cultivation, total sugar production as per Indian sugar mill association (ISMA) Report also shows that sugar industries utilize their waste to make byproduct which increase their profit and save environment also.

### AREA OF THE STUDY

The Govind Sugar Mill Ltd. was selected for the case study. The study is comprehensive in its nature; some of the data has been collected primarily, though the secondary data has been taken from the various annual reports of GSML. In this industry, the sugar is refined by double sulphitation process to negate the social costs of effluents. As per Central Pollution Control Board (CPCB) this industry is classified as a large unit with capacity of

10000 TPD. The period of operation of sugar mill is from early November to the end of April or May. The main reason to conduct a case study on GSML is its socio-economic impact on the society and their sustainable production procedure. Basically the environmental issues related to the sugar industries are common but the initiative taken by GSML to devoid them is outstanding. In this case study the researcher shall explore the different environmental challenges and issues related to sugar industries. Further it will discuss the procedures, done by the GSML to negate the said social costs.

## III. ENVIRONMENTAL ISSUES RELATED TO SUGAR INDUSTRIES AND THEIR IMPACTS

After Brazil Indian sugar industries have secured second place in world in producing sugar, though they are also infamous as highest polluting industries. The main by-products of sugar industries are bagasse, wastewater, molasses, press mud, air and noise pollution, which causes the degradation of the environment around us, affect the water we use, the air we breathe and also the soil we cultivate upon. As per the environmental policies, to treat the wastewater and use byproducts of sugar industry to make bio-fuel is mandatory to lower environmental degradation.

The major by-products released by sugar industries and their effect on environment are as follows:

**Waste Water-** Sugar mill on an average consumes around 1500 to 2000 liters of water and generates approximately 1000 liters of wastewater per ton of sugarcane crushed, the effluent is mainly floor washing wastewater and condensate water, Leakage in valves and glands of the pipeline add sugarcane juice, syrup and molasses in the effluent, The sugar mill effluent has a BOD of 1000 to 1500 mg/liter, but appears relatively clean initially, However after stagnating for some time, it turns black and start emitting foul odor, If untreated effluent is discharged in water bodies. It depletes dissolved oxygen in water and makes the environment unfit for aquatic life. If untreated effluent is discharged on land then it will harm soil health.

**Bagasse-** The fiber remaining after extraction of the sugarcane juice is called bagasse. Bagasse is a large volume agriculture residue that is generated around 540 million tons per year globally.<sup>3</sup> A sugar industry produces around 3 tons of wet bagasse after crushing 10 tons of sugarcane. Bagasse produces nitrogen, carbon, sulfur oxides. The particulate matter, usually referred to as fly ash, consists of ash, unburnt bagasse and carbon particles. Fly ash is very light therefore, if pollution control equipments are not installed, it escapes in the atmosphere through chimney and travels long distances. In such conditions, nearby population suffer from dizziness and irritation in eyes, nose, throat and lungs.

<sup>3</sup> Mishra. M., Khare. N., Agrawal. A. (2014). Bagasse Cogeneration in India: Status, Barriers. Journal of Mechanical and Civil Engineering (JMCE) ISSN: 2278-1684

<sup>2</sup> Govind Sugar Mill Ltd (GSML)

**Molasses-** Molasses is produced in the last step of sugar manufacturing process where sugar is separated from the mother liquor in centrifuges. Around 50 million metric tons molasses is generated by sugar industries on yearly basis globally. India has a first place in molasses production in the world. Molasses has very high pollution characteristics. If molasses discharged in water than it will pollute water bodies and if it is dumped on land than it will cause soil degradation.

**Air Pollution-** Air pollution in sugar industries is primarily generated from bagasse fired. The burning of bagasse produces particulate matters like- unburnt fiber, carbon particles, ash, and gaseous pollutants. Steam boilers, dust from unpaved access roads and sugar drying or packaging activities also causes air pollution in surrounding areas of sugar industries. Apart from particulate matters emission of odor is also a major problem of sugar industry.

The heavier particles slowly settle down in the surrounding areas which lead the problem of cleaning, reduction in property value, effect on vegetation and also cause serious breathing issues& health concerns.

**Noise pollution-** Noise is a major problem of sugar industry which is created due to machine running. Most of the sugar industries have old machinery which is very heavy. In the crushing period these machines are running continuously which affects workers hearing ability and also affects neighboring areas.

#### THE SOCIO-ECONOMIC PROFILE OF GOVIND SUGAR MILL LTD

The Govind Sugar mill Ltd (GSML) is one of the oldest industries in Uttar Pradesh. GSML has access to three sugarcane producing districts, which acquire around 40,000 hectares of sugarcane cultivated area. There are 70,000 farmers involved in sugarcane farming. GSML has 10,000 tons per day (TPD) milling capacity and industry is producing 1000 TPD sugar out of which 500 TPD is double sulphitated refined white sugar.

GSML is a leading manufacturer of brown sugar and coconut sugar in Lakhimpur Kheri district. They are also offering a complete choice of products include raw sugar. The plant produces 500 tons of molasses every day which is used for distillery unit to make ethanol and alcohol. GSML produces 3,000 tons of bagasse every day and it is being used as a biofuel to generate green electricity by burning dry bagasse to produce steam which is used to rotate turbines to produce power. The ashes produced from burnt bagasse are also used as organic manure. GSML also intends to set up a facility to use the waste products of sugar manufacturing during the purification of sugar, to produce bio-fertilizers.

#### GSML: A GREEN ENERGY PRODUCER INDUSTRY

GSML is successfully producing green energy via the Co-generation power plant situated within the establishment. The power plant promotes significant usage of renewable energy sources by using bagasse as its primary source of power production. The steam extracted from turbo generators is diverted towards sugar processing. The co-generation plant is also selling 22 mega watts of power every day to the state of Uttar Pradesh with minimal carbon footprint as compared to conventional sources of power generation.

GSML has installed a distillery Plant which is producing multiple products like Ethanol, Rectified Spirit and Extra Neutral Alcohol. The capacity of distillery is 100kl per day. The Plant also utilizes distillery waste (spent wash) as a fuel, thereby effectively making the plant a Zero Liquid Discharge facility. In its new avatar, GSML is raring to touch new horizons as it gears up to begin the era of intelligent innovation with creating a sustainable environment for the farmers and contributing to the growth of local rural economy.

TABLE-1

S. No	POLLUTANTS	U.P.P.C.B Standards	GSML Results
1	Water	1 to 14 PH	6.8 PH
2	Suspended Particulate Matter	150 Mg/Nm <sup>3</sup>	83.8 Mg/Nm <sup>3</sup>
3	Particulate Matter-10	100 µg/Nm <sup>3</sup>	78.6 µg/Nm <sup>3</sup>
4	SO <sup>2</sup>	80 µg/Nm <sup>3</sup>	12.2 µg/Nm <sup>3</sup>
5	NO	80 µg/Nm <sup>3</sup>	17.6 µg/Nm <sup>3</sup>
6	Noise	75db	57.6db
7	Solid Waste	Ash from slop fired boiler, 100 used as fertilizer	

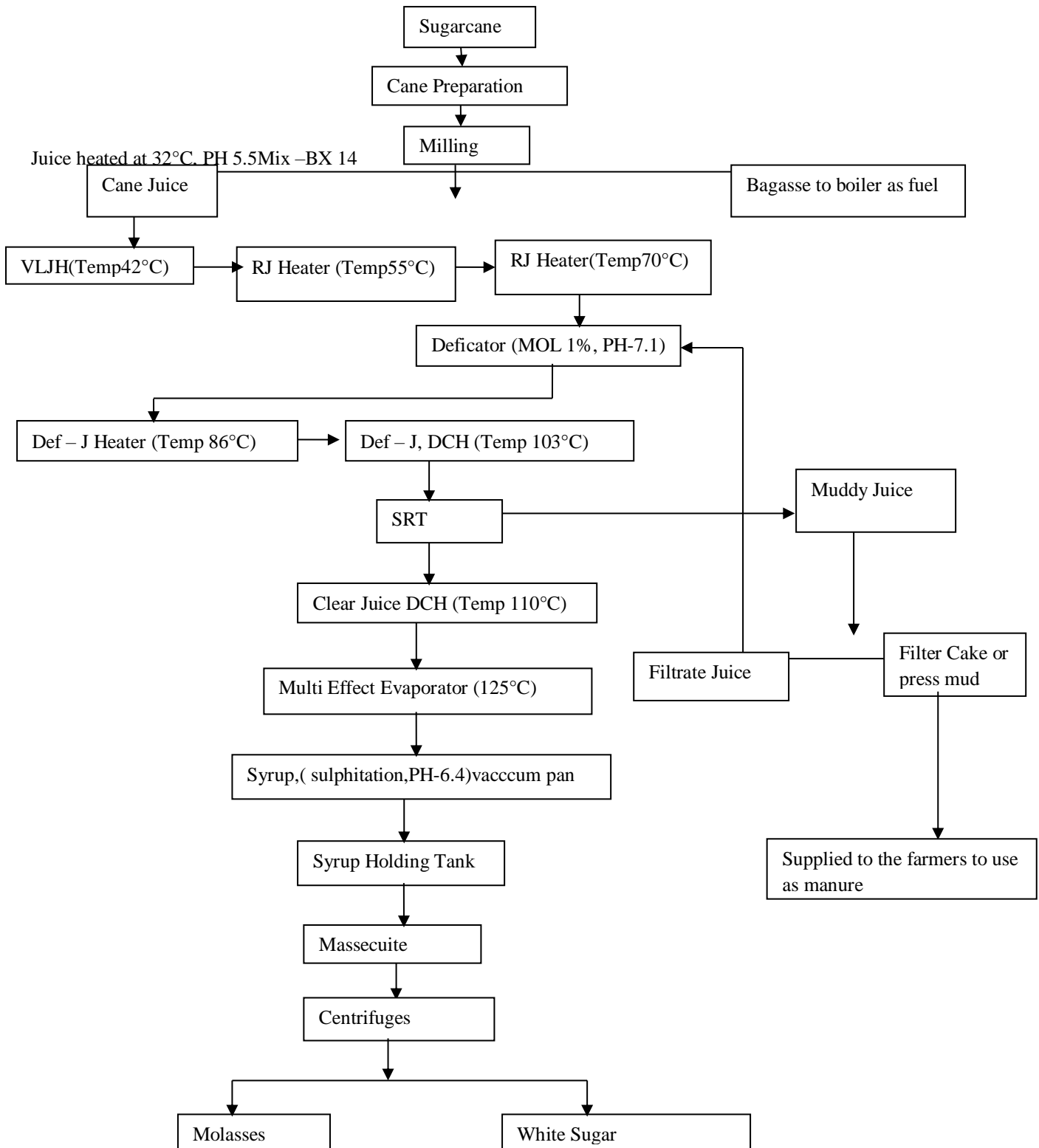
Source: GSML Environmental Report by U.P.P.C.B

The above table is reflecting the standards set by the GSML in relation to environmental checks. GSML not only follows all the rules of environmental protection it is also a front liner initiator in field of environment friendly practices. The parameters of the GSML were found within the standards stipulated by U.P.P.C.B. The PH level of water is 6.8 which are 48.57% below the limit. Suspended particulate matters are 83.8 Mg/Nm<sup>3</sup> which is also 55.86% below the limit. The particulate matters-10 is 78.6µg/Nm<sup>3</sup> which is 21.4% less than the limit. Sulfur dioxide (SO<sup>2</sup>) is 12.2µg/Nm<sup>3</sup> which is 84.7% less than the limit. The level of nitrogen oxides (NOx) is 17.6µg/Nm<sup>3</sup> which is 78.0% below the max limit set by U.P.P.C.B. Apart from the air pollution; noise pollution is also a big problem for sugar industries. But in GSML the value of noise is 57.6db (decibel) which is 23.2% less than the standards set by U.P.P.C.B. It shows that all the treatment system is working properly. The filtration process given below will shed light on how GSML is treating their byproducts to make environment friendly products.

**SUGAR MANUFACTURING PROCESS OF GSML**

The Govind Sugar mill Ltd. (GSML) is a large sugar industry and has 10,000 tons per day sugarcane, crushing

capacity. Sugarcane is brought to the sugar factory, weighed and sent the milling plant. The step-by-step manufacturing process of GSML is given below in the figure.



Juice is extracted in the milling plant and heated many times at different degrees of Celsius and also treated by double sulphitation process in this sugar industry. In this double sulphitation process, raw juice which has 5.5PH level is heated at 32°C and passed it to vapour line juice heater to raise its temperature from 32°C to 70°C in different tanks.

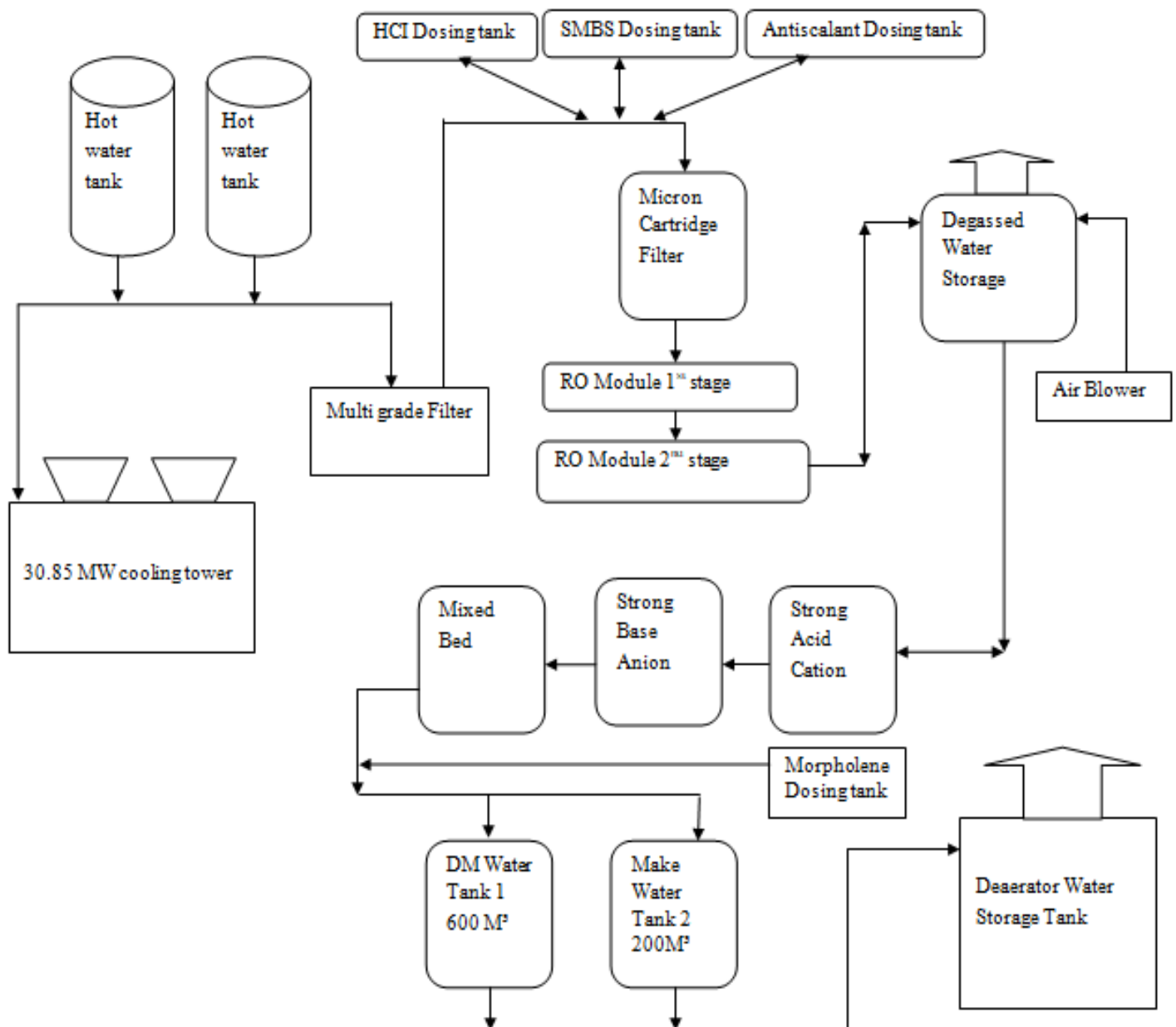
It is then treated with milk of lime and sulfur dioxide (SO<sub>2</sub>) and adjusted its PH level 7.1. Cane juice is heated again at 86°C to 103°C then sent it to SRT (short retention tray less clarifier) tank where juice is clarified and sent to multi effect evaporator. The concentrated syrup from the evaporator is again bleached by passing SO<sub>2</sub> and lime through and the PH of syrup drops down about to 6.4. It is then sent to massecuite where thickened syrup is boiled at 3-4 times at 125°C as per purity in order to extract the sucrose content on the crystals. After this the commercial sugar and molasses are separated in centrifuges.

#### IV. FILTRATION PROCESS OF GOVIND SUGAR MILL LTD

##### EFFLUENT WATER TREATMENT OF GSML

The sugar industry consumes large quantity of water in manufacturing process and resulting in huge wastewater generation. Sugar processing wastewater has high content of organic material and subsequently high biochemical oxygen demand (BOD) particularly because the presence of sugars and organic material arriving with cane. The given flow chart discusses the process of effluent treatment.

In GSML Effluent treatment plant is handle a quantity of 800cu.m/day with an inlet of BOD of 600mg/lit. The treated effluent will be around 200mg/lit. There are two tanks for hot effluent in GSML. The temperature is decreased down with the help of 30.85MW cooling tower.



The raw effluent is retained for 1 hour in tanks during this time oil and other floating matter float on surface and removed frequently than sent it to multi grade filter where PH level stays at 7.6.

After that the effluents go through hydrochloric acid (HCl) dosing tank, sodium metabisulfite (SMPS) dosing tank antiscalant dosing tank to micron cartridge filter than the water sent to degassed water storage where degasser air blower removed all gasses from the water. The degassed water passed through the process of strong acid cation, strong base anion and mixed bed than the morpholene dosing correct the PH level of the water and demineralised water sent to DM tank and make water tank where PH level decreases at 5.5 to 6.8. By this process the water is 100% fit for reuse.

### **BAGASSE UTILIZATION OF GSML**

The fiber remaining after extraction of the juice is called bagasse. In GSML, the quantity of bagasse is around 30% to 35% of the daily production. The wet bagasse with 50% moisture content is carried to the boiler house by bagasse carrier which is used as a fuel in boilers for steam and power generation. GSML has self generated power plant which make 40MW electricity per day from bagasse used as fuel. The co-generation plant is also selling 22 Mega Watts of power every day to the state of Uttar Pradesh with minimal carbon footprint as compared to conventional sources of power generation. 100% of bagasse used in GSML and also GSML purchase around 60 to 70 thousand quintal every year for their power generation plant.

### **MOLASSES UTILIZATION OF GSML**

Molasses is produced in the last step of sugar manufacturing process where sugar is separated from the mother liquor in centrifuges. Molasses serves as raw material for the distillery industry. In GSML the average production of molasses is around 4% to 5% of the cane crushed yearly. GSML has 19800 KL per year capacity of alcohol production and also has 100 KL per day capacity of ethanol production. Apart from using their molasses GSML also buy molasses from other sugar industries to make ethanol.

### **AIR POLLUTION REDUCTION OF GSML**

Air pollution is one of the major problems in all industries. In GSML, they installed 2 fly ash aerators in their boiler chimneys which control all kind of particulate matters. The analytical report received from the Uttar Pradesh pollution control board (U.P.P.C.B) reveals that in GSML all the parameters were found within the standards stipulated by U.P.P.C.B. and also these parameters are 44.13% below the limit which shows that aerators are working perfect.

### **NOISE POLLUTION REDUCTION OF GSML**

In GSML noise created due to machine is 57.6db out of 75db which is 23.2% below the limit of U.P.P.C.B standards. This noise does not impact as much but still the workers wear high quality earplugs or ear muffs to protect

their ears and their hearing in GSML. The sound is not reaching outside the factory.

## **V. CONCLUSION**

To, build resilient infrastructure, promote inclusive and sustainable industrialization by 2030 is the target-9 of the Sustainable Development Goals. In order to achieve the said goals Indian industries will have to work harder. So far as the sugar industries are concerned they are the most pollution generating industries in such scenario the initiatives done by GSML are worth praising. Indian sugar industries have overcome various challenges in order to achieve the second largest producer in the world. However in process of being second largest producer, significant negative impacts were inflicted onto the environment. The major effluents of sugar industries are waste water, bagasse, molasses and press mud which causes environment degradation.

To overcome the social costs and to save the mother earth, sugar industries have initiated filtration process which eventually save the environment and also create resilient society. With the help of filtration process GSML reuse leftover from sugar manufacturing. In GSML waste water after treatment is used for factory campus and irrigation purpose, the bagasse is used to generate electricity and paper production, molasses is used for distillery to make alcohol and ethanol, and press mud is used as manure. The usage of above said effluents earn revenue for the sugar industry. None of the process streams involved in sugar manufacturing generates toxic effluents. So the outcome of these initiatives was proved to be very effective in minimizing the pollution load from sugar industries.

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