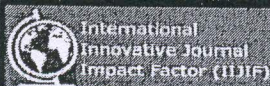


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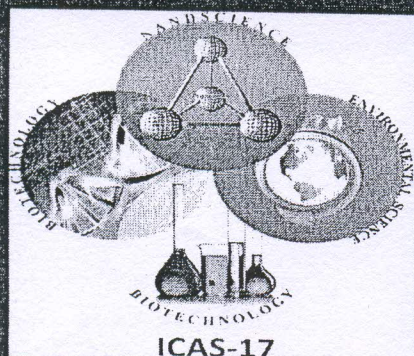
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## **"POLLUTION STUDIES ON SUGAR FACTORY EFFLUENT- PHYSICO-CHEMICAL CHARACTERISTICS AND TOXIC METALS"**

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### **ABSTRACT**

Physico-Chemical parameters and toxic metal contents in the effluents discharged from sugar factory have been studied. The study reveals most of the physico-chemical parameters such as Colour, Odour, Total Solids, COD, BOD, Fluoride & alkalinity have exceeded the Indian Standard Institution prescribed values while PH, Phosphate, Sulphate are found within the permissible limits. The concentration of toxic metals like Cd, Cu, Fe, Hg, Mn, Mg, Pb, Zn & Ni was determined by Inductively Coupled Plasma Atomic Emission Spectroscopy. The Fe, Hg, Mg, Pb & Mn contents exceed the permissible limits. Zn, Cu & Cd are within the permissible limits while Ni is found in trace amount.

**Key words:** sugar factory effluents, physico-chemical parameters, toxic metals, water pollution.

### **INTRODUCTION:**

India is an agricultural country and majority of its population lives in rural area and agriculture is the main occupation. According to an estimate the agriculture production and yield is increasing due to irrigation throughout India. Country to the belief, agricultural sector is a major source of water consumption for production of Banana, sugarcane etc. In Marathwada region Vishnupuri and Yeldari dam are the major sources of water for agriculture. Due to this farmer cultivate sugarcane as a major cash crop. Sugar factory are considerably increasing in Marathwada region particularly in Nanded districts. The sugar factory is playing an important role in the economic development of region, state and country.

The effluent discharged from sugar factory constitute number of organic & inorganic pollutants, such as carbonate, bicarbonate, phosphate, sulphate, and toxic metals in addition to the Total Solids, Total Suspended solids, Total dissolved solids, and some toxicants. This effluent is discharged in the environment they disturbed the ecosystem of living & non living organisms. The present study was undertaken to study the physico-chemical characteristics and toxic metals of sugar factory effluent discharged from the Shankar Sahakari Sakhar Karkhana Ltd. Waghawada Nanded district. This study was conducted during the sugar factory is in full crushing capacity (Jan. 2000)

### **MATERIALS AND METHOD**

Four different water samples were collected from different locations at Shankar Sahakari Sakhar Karkhana Ltd. Waghawada Nanded district. randomly and kept in glass bottles without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labeled in the field. Analysis of water samples was done as per standard process. All the chemicals used of AR grade. Double distilled water was used for the preparation of reagent and solutions. The water samples were



immediately brought in to Laboratory for the estimation of Physico-chemicals parameters, like water temperature were recorded at the time of sample collection by using Thermometer.

While other parameters such as pH, Electrical conductivity, Total Suspended Solids, Total Dissolved Solids, Total Solids, Oil & Grease, Hardness, Sulphate, Dissolve Oxygen COD, BOD contents. Temperature, pH and TDS measured as per the by silver nitrate titration method using potassium chromate as indicator. For metal analysis 500 ml of effluent sample was collected & transferred in one liter beaker. After adding 5ml (5:1) Con.  $\text{HNO}_3$  and  $\text{HClO}_4$  mixture, kept on hot plate, a light colored residue indicates the completion of digestion. This residue was diluted with double distilled water. This filtrate used for analysis of toxic metals using ICP-AES.

**Table 1: Physic-chemical parameters in Sugar Factory Effluents collected at various distances.**

Parameters	Site Notation			
	S1	S2	S3	S4
Colour	Dark brownish brown	Dark brownish brown	Dark brownish brown	Dark brownish brown
Odour	Decaying molasses smell	Decaying molasses smell	Decaying molasses smell	Decaying molasses smell
Temp.	28	27.7	27.5	27.3
PH	6.5	6.9	7.3	7.8
Electrical conductivity	5895	5705	5678	5605
TSS	79.5	76.0	73.5	70.0
TDS	1922	1905	1890	1870
TS	2005	1980	1960	1940
Oil & Grease	9.7	9.5	9.3	9.1
Hardness	300	200	175	170
Chloride	345	340	336	332
Sulphate	240	235	219	170
DO	2.0	2.2	2.4	2.5
COD	252	225	190	185
BOD	125	112	103	97

### Result and discussion:

All the effluent samples were collected in the month of January -2001. The results of the physicochemical analysis of the Bhaurao Chavan Sahakari Sakhar Karkhana Ltd. Lakshminagar effluent samples S1 to S4 are compared with standard values prescribed by WHO and are presented in Table 1.

#### 1] Colour:

The sugar factory effluent is dark brownish black in colour. This is observed visually.

#### 2] Odour:

The odour of the sugar factory effluents is disagreeable and almost equivalent to decaying molasses smell.

3] *Temperature:*

The range of temperature of the effluent samples was within 28 to 27.3 O°C in their sampling sites studied during the operational seasons. Temperature of S1 site was higher as compare to other site. The sampling of S1 site is very close to the point effluent discharged by sugar factory. As increasing distance the temperature decreases due to loss of heat of effluent in the environment.

4] *PH:*

The range of PH of the effluent samples was within 6.5 to 7.8 in their sampling sites studied during the operational seasons. Change in temp. was recorded in S1 site with higher values from other sites. The S1 site is very close to the point of effluent discharge by sugar factory. The decrease in temp. may be attributed to the loss of heat of effluents in the environment with more in the temp. the concentration of other parameter are affected.

5] *Electrical Conductivity:*

The electrical conductivity of the effluent was recorded in the range 5895 to 5605  $\mu$ nhos/cm in sampling site of sugar factory during the operational seasons. The electrical conductivity value of S1 sampling sites was higher than that of other sampling sites. The recorded values found to decreases with increase in distance, due to dilution of effluent with water.

6] *Total Suspended Solids:*

The Total Suspended Solids of the effluents was recorded in the range 79.5 to 70.0 mg/l in sampling site studied during the operational seasons. The Total suspended Solids were high value in sampling site S1 from other sampling sites. The suspended solids recorded on these sites decreased with increase in distances. Due to biodegradation and dilution or dispersion of the effluents.

7] *Total Dissolve Solids:*

The range of TDS of the effluent was recorded 1922 to 1870 mg/l in sampling sites studied during the operational seasons. The TDS recorded in the sampling sites S1 was high as compared with the other sampling sites. The TDS recorded on these sites were decrease with increase in distance due to dilution of the effluents.

8] *Total Solids:*

The range of Total solids of the effluent was recorded 2005 to 1940 mg/l in sampling sites studied during the operational seasons. The Total solid was recorded high value at S1 sampling sites than the other sites. The S1 site value of TS was high due to site is close to the point of effluent discharged by sugar factory. The discharge effluent comes from number of processing units which use of solid matters. The other sampling sites TS value are decreases with increase in distances.

9] *Oils & Grease:*

The range of oil & grease of the effluent was recorded 9.7 to 9.1 mg/l in sampling sites studied in operational seasons. The S1 sampling site with higher values of oil & grease then other sites, due to it is very close to the point of effluent discharged by sugar factory. The discharged effluent comes from number processing units which required oil & grease for smooth working process. The other sites value is decreases with increase in distances due to dilution of effluent.

10] *Dissolve Oxygen:*

The range of Dissolve Oxygen of the effluent was recorded 2.0 to 2.5 mg/l in sampling sites studied in operational seasons. The S1 sampling site with lower values of dissolve Oxygen then other sites, due to it is very close to the point of effluent



discharged by sugar factory. The comparing S1 sampling site with other sampling sites, the dissolve oxygen recorded on these sites were increased with increase in distances.

11] *Harness:*

The range hardness of the effluents was recorded 300 to 170 mg/l. The hardness was recorded in S1 site with higher value from other sites. The S1 site is very close to the point of effluents discharged by sugar factory. The hardness was decreases with increasing distances & dilution of effluents.

12] *Chloride:*

The range Chloride of the effluents was recorded 345 to 332 mg/l. The chloride was recorded in S1 site with higher value from other sites. The S1 site is very close to the point of effluents discharged by sugar factory. The decrease in chloride may be due to biodegradation and dispersion or dilution of effluents.

13] *Sulphate:*

The range sulphate of the effluents was recorded 240 to 170 mg/l. The sulphate was recorded in S1 site with higher value from other sites. The S1 site is very close to the point of effluents discharged by sugar factory. The decrease in sulphate may be due to biodegradation and dispersion or dilution of effluents.

14] *Chemical Oxygen Demand:*

The range of Chemical Oxygen Demand of the recorded effluents was 252 to 185. Sampling site S1 with higher values from other sites. The S1 site is very close to the point of effluent discharged by sugar factory. The COD recorded on S2, S3 & S4 sites are decreases with increasing distance due to biodegradation and dilution of the effluent with water.

15] *Bio-Chemical Oxygen Demand:*

The range of Bio-Chemical Oxygen Demand of the recorded effluents was 125 to 97. Sampling site S1 with higher values from other sites. The S1 site is very close to the point of effluent discharged by sugar factory. The COD recorded on S2, S3 & S4 sites are decreases with increasing distance due to biodegradation and dilution of the effluent with water.

Table 2: Concentration (ppm) of toxic metals in effluent samples collected at various site.

Heavy Metal	Site Notation			
	S1	S2	S3	S4
Fe	6.87	6.50	6.32	6.04
Mg	40.10	36.80	32.05	30.20
Pb	0.41	0.35	0.29	0.18
Zn	0.39	0.21	0.10	0.06
Mn	1.50	1.02	0.52	0.41
Ni	0.03	0.03	0.028	0.027
Cu	0.35	0.26	0.19	0.11
Cd	0.023	0.020	0.018	0.014
Hg	1.5	1.1	0.8	0.7

The quantitative analysis of toxic metals has generally indicated that there was a gradual decreases in their quantity due to the dilution or dispersion & distance is increases from discharge point.

**Iron :-**

The contents of iron (Fe) in sugar factory effluent shows variation of 6.87 to 6.04 ppm with distance which is higher than the ISI limits.

#### **Magnesium :**

It has been observed that the concentration of Magnesium (Mg) varies from 40.10 to 30.20 ppm. Which is higher than the ISI limits.

#### **Lead :**

Concentration of Lead (Pb) with values varying from 0.41 to 0.18 ppm. The concentration of Pb is higher than the limit prescribed by ISI limits.

#### **Zinc:**

#### **Conclusion:**

The analytical results of sugar water effluents of Yelegaon town, Nanded District shows that the PH, total alkalinity, Chloride, calcium, COD are well within the permissible limit given by WHO. The effluent is dispersed or diluted by water all parameters are permissible limit. Hence all the samples are fit for agriculture and other purpose.

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