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Physico-Chemical Analysis of Sugar Factory Effluents of Deonandra Dist. Parbhani

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Abstract

Physico-Chemical parameters and toxic metal contents in the effluents discharged from sugar factory have been studies. The study reveals most of the physic-chemical parameters such as Color, Odor, Total Solids, COD, & BOD, have exceed the Indian Slandered 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 traces amount.

KEYWORDS: Sugar factory effluents, Physico-chemical parameters, Toxic metals, Water pollution.

INTRODUCTION:

Industrialization is a significant tool for the growth and development of any nation. The industrial activity has explored world-wide. This time it has become a matter of major concern in the degradation of the environment. Water resources are affected by industrial pollution extremely. Pollution caused by industrial effluents is a serious problem in throughout the world. The sugar facotry effluent is having a higher amount of organic and inorganic elements. They contain higher contents of total hardness, total dissolved solids, biological oxygen demand, chemical oxygen demand, calcium, magnesium, sodium, iron and sulphate. In addition to that, some traceable amount of heavy metals such as zinc, copper and lead were also exists in the effluent. Sugar industry effluents are commonly used for irrigation, so it is necessary to understand the response of industrial effluent to crops depends on it. Sugar mill effluent that has not been treated properly has an unpleasant odor when discharged into the environment. The effluents not only affect the plant growth but also degrade the soil properties when used for irrigation.

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 Parbhani districts. The sugar factory is playing an important role in the economic development of region, state and country.

Water is the most essential requirement not only for life sustenance but for the economic and industrial development. At the same, it is a known reality that water is an

important issue in the maintenance of our environmental balance with the rapid growth of population and acceleration in industrialization. In last few decades, the tremendous increase in the demand for freshwater has also been a matter of great concern. The release of treated and untreated industrial effluents in unplanned manner is one of the major causes of water pollution. The effluents released from sugar cane factory into land and into various surface water bodies not only affect the water quality and soil but also pollute the groundwater due to percolation of some water soluble pollutants. 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 dissolve solids, and some toxicants. This effluents are discharged in the environment they disturbed the ecosystem of living & non living organisms. The present study was undertaken to study the physic-chemical characteristics and toxic metals of sugar factory effluent discharged from the Godavari Dudhana Sahakari Sakhar Karkhana Ltd. Deonandra Pathari, Parbhani district. This study was conducted during the sugar factory is in full crushing capacity (March 2000)

MATERIALS AND METHOD

Four different water samples were collected from different locations Godavari Dudhana Sahakari Sakhar Karkhana Ltd. Deonandra Pathari, Parbhani 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 regent 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. HNO_3 and $HClO_4$ 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.	30.7	30.2	29.8	29.5
PH	6.7	7.1	7.5	7.9

Electrical conductivity	6290	4327	4038	3315
TSS	210	184	170	162
TDS	3460	3410	3380	3360
TS	2060	2005	1960	1935
Oil & Grease	10.7	10.4	10.2	10.0
Hardness	320	223	203	197
Chloride	448	421	407	398
Sulphate	207	200	185	148
DO	2.0	2.3	2.7	2.9
COD	832	800	756	746
BOD	279	250	215	210

Result and discussion:

All the effluent samples were collected in the month of March 2000. The results of the physicochemical analysis of the Godavari Dudhana Sahakari Sakhar Karkhana Ltd. Deonandra Pathari, Parbhani district effluent samples S1 to S4 are compared with standard values prescribed by WHO and are presented in Table 1.

1] Color:

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

2] Odor:

The odor 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 30.7 to 29.5 $O^{\circ}C$ 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 6.9 to 7.9 in their sampling sites studied during the operational seasons. Change in P^H 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 P^H may be attributed to the loss of heat of effluents in the environment with more in the P^H the concentration of other parameter are affected.

5] Electrical Conductivity:

The electrical conductivity of the effluent was recorded in the range 6290 to 3315 µmhos/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

Magnesium:

It has been observed that the concentration of Magnesium (Mg) various from 40.00 to 30.00 ppm. Which is higher the ISI limits.

Lead:

Concentration of Lead (Pb) with values varying from 0.50 to 0.24 ppm. The concentration of Pb is higher than the limit prescribed by ISI limits.

Zinc:

It has been observed that the concentration of Zinc (Zn) various from 0.40 to 0.12 ppm. Which is higher the ISI limits.

Manganese:

It has been observed that the concentration of Manganese (Mn) various from 1.52 to 0.47 ppm. Which is higher the ISI limits.

Nickel:

It has been observed that the concentration of Nickel (Ni) various from 0.02 to 0.020 ppm. Which is lower the ISI limits.

Copper:

The present study indicate that, the concentration of copper (Cu) was in between 0.45 to 0.19 ppm. This is higher than the ISI limits.

Cadmium:

It has been observed that the concentration of cadmium (Cd) various from 0.028 to 0.020 ppm. Which is higher the ISI limits.

Mercury:

It has been observed that the concentration of Magnesium (Mg) various from 1.4 to 0.6 ppm. Which is higher the ISI limits.

Conclusion:

The analytical results of sugar water effluents of Godavari Dudhana Sahakari Sakhar Karkhana Ltd. Deonandra Pathari, Parbhani district shows that the PH, total alkalinity, Chloride, calcium, COD are well within the permissible limit given by WHO. The effluent is disperse or diluted by water all parameters are permissible limit. Hence all the samples are fit for agriculture and other purpose.

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point of effluents discharged by sugar factory. The decrease in sulphate may be due to biodegradation and dispersion or dilution of effluents.

13] Dissolve Oxygen:

The range of Dissolve Oxygen of the effluent was recorded 2.0 to 2.9 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.

14] Chemical Oxygen Demand:

The range of Chemical Oxygen Demand of the recorded effluents was 832 to 746. Sampling site S1 was higher value 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 279 to 210 Sampling site S1 was higher value 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	6.50	6.43	6.05	5.87
Mg	40.00	36.30	32.25	30.00
Pb	0.50	0.42	0.34	0.24
Zn	0.40	0.28	0.15	0.12
Mn	1.52	1.04	0.61	0.47
Ni	0.02	0.02	0.020	0.020
Cu	0.45	0.36	0.27	0.19
Cd	0.028	0.026	0.023	0.020
Hg	1.4	1.0	0.8	0.6

The quantitative analysis of toxic metals has generally indicated that there was a gradual decrease 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 show variation of 6.50 to 5.87 ppm with distance which is higher than the ISI limits.

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