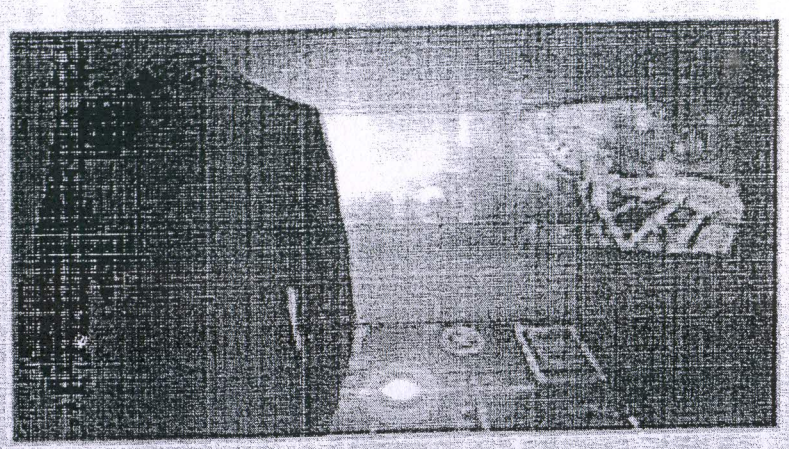
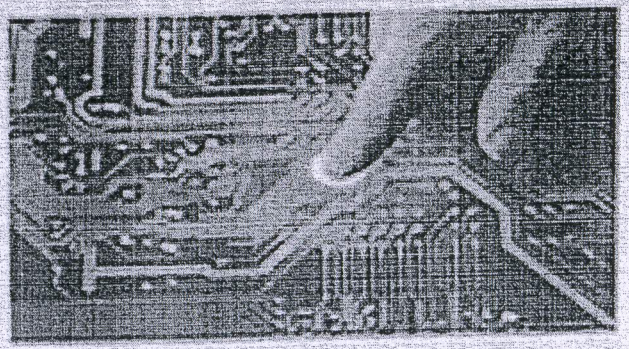




Universal Print, BMSD Society,
"MATHURA" Buildings, M. G. Road,
Ahmedpur, Dist. Latur, MH (INDIA). Pin 413515

International Journal of Universal Science & Technology

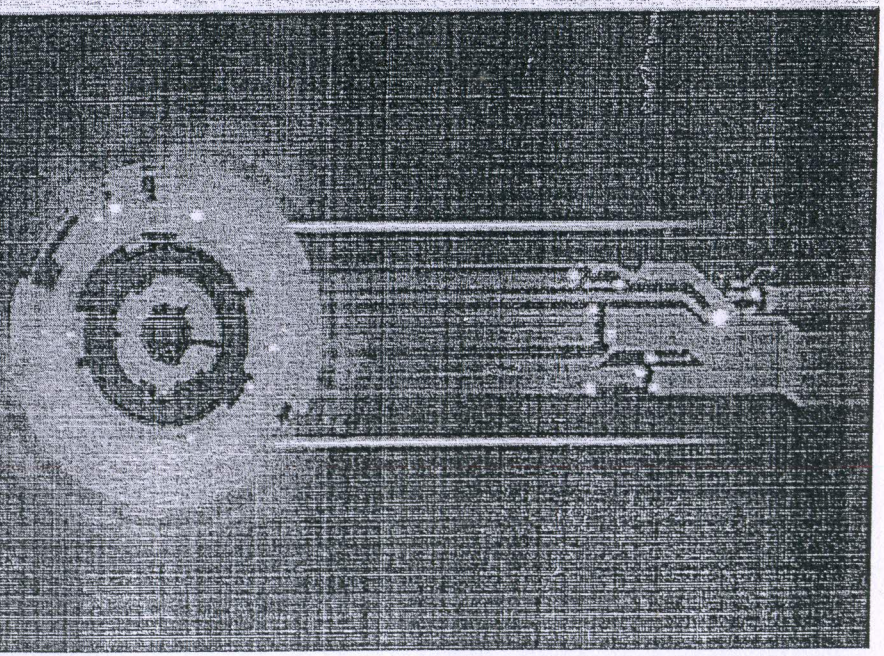
ISSN (Online) 2222-3222 ISSN (Print) 2222-3214

BALAGHAT MATHEMATICAL SCIENCES DEVELOPMENT SOCIETY'S

UNIVERSAL PRINT

Volume-xx No.xx Dec-2018

International Journal of Universal Science & Technology



ISSN: 2454-7263

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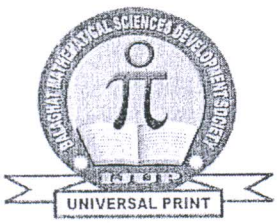

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International Journal of

Universal Science & Technology

Volume 03, No: 02 JAN. 2018

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CONTENTS

Sr. No.	Authors	Title	Page No.
1	Bhimrao C. Khade and Pragati M. Deore	Copper (II) Complexes with Some Essential Amino Acids: Formation Constant Studies In 80% Ethanol-Water Medium	61-68
2	S. A. Patil and S. S. Bodke	Effect of Post Harvest Treatments on Biochemical Changes of Mango (cv. Kesar) Fruit During Storage.	69-73
3	C. S. P. Rathore and Dr. L. P. Shinde	Development of environment Friendly Clean Agent for Replacement of Halons Used In Combat Tanks.	74-76
4	D. T. Biradar, D. B. Muley M. B. Swami Shinde A R	Synthesis of Schiffs Bases From 2-Amino-4 Aryl-3-Cyano-5 Oxo-*4H*-5, 6, 7, 8 Tetrahydrobenzopyran Derivatives And Substituted Aldehydes And Their Tranzition Metal Complexes	77-78
5	Sheetal V. Palande and Deelip K. Swamy	Study of Antifungal Activity of 2-Methoxy-6-{[2-(2-Methoxy-Phenoxy)-Ethylimino]-Methyl}-Phenol And Its Transition Metal Complexes on Asperligues Niger And Candida Albicuns	79-90
6	Dinkar P. Kotwal and W. N. Jadhav	Synthesis, Characterization and Antimicrobial Study Of Some Cu (Ii), Ni (Il), Co (II) And Zn (II) Bidentate SchiffBase Metal Complexes	91-94
7	Sambhaji N. Kabadi, Govind V. Panchal	Pollution Studies on Sugar Factory Effluent- Physico-Chemical Characteristics and Toxic Metals	95-99
8	Dr. Mahesh S .Bachewar	Analysis of Water Quality Using Physico-Chemical Parameters of Sugahav reservoir at Mukhed Dist.Nanded.	100-105
9	Manish Deshpande	Sustainable Approach Towards the Synthesis of Mesostructured Molecular Sieve from Agricultural Waste.	106-111
10	Ramesh F. Pagariya	Synthesis and *in Vitro* Antibacterial Evaluation of 4-Chlorophenol Incorporated Azo Dyes Molecules	112-117

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International Journal of Universal Science and Technology
ISSN: ISSN: 2454-7263 Copyright © Universal Print
Volume No. 03, Issue No. 02, Page No. 95-99 Published: Jan. 2018
Web: www.universalprint.org , Email: ijup@universalprint.org
Title Key: Pollution Studies on Sugar Factory ...

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 studies. The study reveals most of the physic-chemical parameters such as Colour, Odour, Total Solids, COD, BOD, Fluoride & alkalinity 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.

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

1. 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 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 Bhaurao Chavan Sahakari Sakhar Karkhana Ltd. Yelegaon Nanded district. This study was conducted during the sugar factory is in full crushing capacity (Jan. 2001)

2. Materials and method

Four different water samples were collected from different locations at Bhaurao Chavan Sahakari Sakhar Karkhana Ltd. Yelegaon 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

International Journal of Universal Science and Technology
ISSN: ISSN: 2454-7263 Copyright © Universal Print
Volume No. 03, Issue No. 02, Page No. 95-99 Published: Jan. 2018
Web: www.universalprint.org , Email: ijup@universalprint.org
Title Key: Pollution Studies on Sugar Factory ...

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.	29.5	29.2	28.9	28.6
PH	6.7	7.0	7.3	7.4
Electrical conductivity	6080	5220	5010	4705
TSS	83.0	80.0	78.0	75.0
TDS	2080	2060	2045	2030
TS	2215	2185	2165	2140
Oil & Grease	9.8	9.5	9.2	9.0
Hardness	310	215	200	185.
Chloride	280	270	255	240
Sulphate	470	460	450	400
DO	2.2	2.4	2.5	2.6
COD	270	260	250	235
BOD	200	178	160	150

3. 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. Yelegaon water 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 29.5 to 28.6 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

International Journal of Universal Science and Technology
ISSN: ISSN: 2454-7263 Copyright © Universal Print
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due to loss of heat of effluent in the environment.

4] *PH:*

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 6080 to 4705 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 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 83.0 to 75.0 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 wastes.

7] *Total Dissolve Solids:*

The range of TDS of the effluent was recorded 2080 to 2030 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 2215 to 2140 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 9.8 to 9.0 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 2.2 to 2.6 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 310 to 185 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 280 to 240 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 470 to 400 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

International Journal of Universal Science and Technology
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Volume No. 03, Issue No. 02, Page No. 95-99 Published: Jan. 2018
Web: www.universalprint.org , Email: ijup@universalprint.org
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biodegradation and dispersion or dilution of effluents.

14] *Chemical Oxygen Demand:*

The range of Chemical Oxygen Demand of the recorded effluents was 270 to 235. 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 200 to 150. Sampling S1 site has higher values than 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.

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 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 6.87 to 6.04 ppm with distance which is higher than the ISI limits.

Magnesium:

It has been observed that the concentration of Magnesium (Mg) various from 40.10 to 30.20 ppm. Which is higher 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:

It has been observed that the concentration of Zinc (Zn) various from 0.06 to 0.39 ppm. Which is higher the ISI limits.

Manganese:

It has been observed that the concentration of Manganese (Mn) various from 0.41 to 1.50 ppm. Which is higher the ISI limits.

Nickel:

It has been observed that the concentration of Nickel (Ni) various from 0.027 to 0.03 ppm. Which is lower the ISI limits.

Copper:

The present study indicate that, the concentration of copper (Cu) was in between 0.11 to 0.35 ppm. Which is higher than the ISI limits.

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ISSN: ISSN: 2454-7263 Copyright © Universal Print
Volume No. 03, Issue No. 02, Page No. 95-99 Published: Jan. 2018
Web: www.universalprint.org , Email: ijup@universalprint.org
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Cadmium:

It has been observed that the concentration of cadmium (Cd) various from 0.014 to 0.025 ppm. Which is higher the ISI limits.

Mercury:

It has been observed that the concentration of Magnesium (Mg) various from 0.7 to 1.5 ppm. Which is higher the ISI limits.

4. 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 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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