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Research Paper

IMPACT OF SUGARCANE (*Saccharum officinarum L*) INDUSTRY EFFLUENTS ON SURFACE WATER QUALITY OF SARADA RIVER, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH, INDIA

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Abstract

The impact of the sugarcane (*Saccharum officinarum L*) industry effluents on surface water quality of Sarada river was investigated with evaluation of the physico-chemical parameters of Sarada river waters to determine the pollution levels from the discharges of sugar cane industry effluents of Chodavaram mandal of Visakhapatnam district, Andhra Pradesh, India. The water samples were collected from inlet point of Sarada river to utilize the industry sugar processing and outlet point after treatment of the sugar industry effluent waters to compare with Sarada river waters quality. These study findings revealed that significant changes were observed in the Physico-chemical parameters of river waters before and after processing such as p^H, Electrical conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Alkalinity, Chlorides, Sulphates, Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). The details of findings were presented and discussed in detail.

Key words: Sugar Cane Industry, Sarada River, Total Dissolved Solids (TDS), Total Suspended Solids(TSS), Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD).

INTRODUCTION

Water is a marvellous source of nature and it is the vital for the survival of life, without which the basic needs of life come to stand still the fact that ¾ th of the earth surface is covered by water and it plays an important role in human life. But now days water is polluted, by the introduction into fresh or ocean waters of chemical, physical, or biochemical material that degrades the quality of water and affects the organisms living in it. surface water is usually rain water that collects in surface water bodies like oceans, lakes or streams but surface water can become contaminated in many ways, one

of which is direct recharge came from industry sources containing acids, alkalis, salts, poisons, oils and in some cases harmful bacteria. Release of untreated industrial effluents into nearby water bodies is considered to be one of the major issues related to global scenario [9] and waste water effluents are major contributors to a variety of water pollution problems. Effluents migrating from industries have its marked influence on the surface water bodies by altering the physical, chemical and Biochemical characteristics [11].

Thus an effort has been made to knowing the present status of water quality during sugar processing from sugarcane industry at Chodavaram mandal of Visakhapatnam district. This study is aimed to compare the water quality with the following objectives:

1. To analyse the physico- chemical parameters of water samples before and after processing in sugar industry.
2. To compare the variations physico-chemical parameters of river waters intake and sugar industry effluent discharges.

2.0 STUDY AREA:

The Chodavaram Co-op Sugras Ltd., is located in Govada village of on Sarada river banks of Chodavaram mandal, Visakhapatnam district, Andhra Pradesh, India geographically situated between 17° 49′ 59.88″ to 170 83′ 33″ N latitude and 82° 57′ 0″ to, 82^0 95′0″ E longitudes (Figure 1). It has an average elevation of 39 meters (131 feet). It is well connected to the nearest city and district headquarters- Visakhapatnam (46 km). Major occupation of the population is agriculture with cultivation rice (*Oryza sativa*) and sugarcane (*Saccharum officinarum*) are the major commercial crops under Sarada river irrigation.

The Chodavaram Co-operative Sugars Limited, Govada is the major agriculture based industry located on the banks of Sarada river. The surrounding farmers are the shareholders in the sugar factory and running successfully to the utmost satisfaction of the farmers and workers, by updating with latest technologies and gaining maximum sugar recovery from the qualitative cane supplied by the farmers.

2.1 Sarada river is a ephemeral river in Visakhapatnam district of Andhra Pradesh, India [2] geographically coordinates are north latitude 17^0 25′ to 18^0 17′ and east longitude of 82^0 32′ to 83^0 06′.The catchment area of the basin is 2,665 square kilometers. It rises at an elevation of 1,000 meters in the Eastern Ghats. It runs eastwards for a distance in 122 kilometers and joins the Bay of Bengal. The Sarada river basin is surrounded by river Nagavali in the north, River Gosthani, Gambhiram and, Megadrigedda in the east Bay of Bengal in the South and Machhkund sub-basin of the river Godavari in the west.

3.0 MATERIALS AND METHODS:

The water samples were collected from inlet point(at which point taking water from sarada river) and outlet point (at which point water relesed to sarada river after sugar processing) into two clean polythene bottles of 2.25 litre at the co-operative sugars Limited, Govada of Chodavaram mandal in Visakhapatnam district. These samples were transferred to Dept. of Environmental Sciences laboratory, Andhra University for analysis of Physico-chemical properties. The water samples were analyzed as per the following methods/instruments [1]

Parameter	**Units**	**Methods**
p^H	-	APHA-4500
Electrical Conductivity (EC)	µmhos/cm	APHA-3114
Total dissolved solids-TDS	mg/L	APHA-2540B
Total Suspended Solids-TSS	mg/L	APHA-2540D
Alkalinity as $CaCO_3$	mg/L	APHA-2320B
Chlorides as Cl^-	mg/L	APHA-4500B
Sulphates as SO_4^{2-}	mg/L	APHA-4500C
Chemical Oxygen Demand-(COD)	mg/L	APHA-5220B
Biochemical Oxygen Demand- (BOD)	mg/L	IS 3025-P 44

4.0 RESULTS AND DISCUSSION:

4.1 PHYSICAL PARAMETERS:

4.1.1 pH:

The pH is one of the important biotic factors that serve as an index for pollution and the factors like photosynthetic exposure to air, disposal of industrial water and domestic sewage affects on pH concentration.River water quality study is usually required for stabilizing base line conditionssetting certain water quality and standards, monitoring of temporal [6]. The **p**H of the aquatic system is an important indicator of the water quality and the extent pollution in the watershed areas. pH was recorded to be varying from 4.67 in (inlet) to 4.70 in (outlet), thus it indicates the water's acidic nature is slightly decrease in out let, may be due to industrial effluent from the nearby sugar industry.

4.1.2 ELECTRICAL CONDUCTIVITY (EC):

The Electrical Conductivity (EC) is a one of the methods to measure the total dissolved ions and is directly related to total solids. Higher the value of dissolved solids is the greater the amount of ions in water [3]. The range of electrical conductivity observed between 6084 µmhos/cm (inlet) and 5794 µmhos/cm (outlet) from this study EC decreased at outlet may be due to neutralization.

4.1.3 TOTAL DISSOLVED SOLIDS (TDS):

In water the Total Dissolved Solids (TDS) are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and manganese, organic matter, salt and other particles [8].TDS values are observed from 3952 mg/L(Inlet) and 3762 mg/L(outlet), may be due to influenced by industrial effluents .At high flows, the TDS values tend to be diluted by surface runoff and for most rivers there are inverse correlation between discharge rate and TDS [3].

4.1.4 TOTAL SUSPENDED SOLIDS (TSS):

The undissolved matter present in water or effluent is referred as total suspended solids (TSS). These particles reduce the photosynthetic activity of water plants by smothering benthic organism. The quantity of total suspended solids observed as 84 mg/L(Inlet) and 82 mg/L (outlet).similar results were reported from effluent of paper mill changes on total suspended solids [4].

4.2 CHEMICAL PARAMETERS:

4.2.1 ALKALINITY:

Alkalinity of water is a measure of weak acid present in it and of the cations balanced against them [13]. Total alkalinity of water is due to presence of mineral salts present in it. It is primarily caused by carbonate and bicarbonate ions [12]. Alkalinity was changed from 450 mg/L (Inlet) to 490 mg/L(outlet) during sugar making process. Maximum value of alkalinity was due to increase in bicarbonates present in water.

4.2.2 CHLORIDES:

Chlorides are generally occurs in water. More concentration of chloride is considered as the indicator of pollution due to organic waste of animal or industrial origin. In this chlorides are observed as 198 mg/L (Inlet) and 134 mg/L(outlet)this variation may be due to releasing of industry effluents. Chlorides are troublesome in irrigation water and also harmful to aquatic life [10].

4.2.3 SULPHATES:

Sulphates are present in water naturally occurs due to the process of weathering and leaching from soil and rock formations. Most of the industries use coal as raw material and emit sulphur compounds into atmosphere causing acid rains and deposited in the

soil affecting both soil and water quality. High concentrations of sulphates can lead to dehydration & gastrointestinal problem [5] if it exceeds a concentration of more than 400 mg/L it imparts a bitter taste to cause laxative effects. In the present investigation the sulphates content is 1476 mg/L(Inlet) and 1570 mg/L(Outlet).This variation may be due to releasing of sulphur contains waters from industry.

4.2.4 BIOCHEMICAL OXYGEN DEMAND (BOD):

Biochemical Oxygen Demand (BOD) is a measure of the oxygen in the water that is required by the aerobic organism. The biodegradation of organic materials exerts oxygen tension in the water and increases the BOD [2]. The present study is considered that sugar industry effluents have effect on the water quality. It was observed that BOD is 450 mg/L in (Inlet) and 540 mg/L in (Outlet).High BOD level may indicate decline in DO, because the oxygen is available in the water is being consumed by bacteria leading to inability of fish and other aquatic organisms to survive in the river.

4.2.4 CHEMICAL OXYGEN DEMAND (COD):

The Chemical Oxygen Demand (COD) is a test which is used to measure of pollution of industrial and domestic waste .It is also used for indirectly measure the amount of organic compounds in water. The measure of COD determines the quantities of organic matter found in water. This makes COD useful as indicator of organic pollution in surface water [7].

In this study COD was found to be ranging from 1000 mg/l(Inlet) to 1200 mg/l (outlet) and these values are more than permissible levels of water.

Table 1: Analysis of physico-chemical parameters of Sarada river water at inlet and outlet points of sugarcane industry.

S No	Water Parameter	Inlet	Outlet	Remarks
1	$_{p}^{H}$ (Hydrogen Ion Concentration)	4.67	4.70	Acidic
2	Electrical Conductivity(µmhos/cm)	6084	5794	Decreased
3	Total Dissolved Solids(mg/L)	3952	3762	Decreased
4	Total Suspended Solids(mg/L)	84	82	Normal
5	Alkalinity (mg/L)	450	490	Increased
6	Chlorides (mg/L)	198	134	Decreased
7	Sulphates (mg/L)	1476	1570	Increased
8	Chemical Oxygen Demand (mg/L)	1000	1200	Increased
9	Biochemical Oxygen Demand (mg/L)	450	540	Increased

Figure 1: Google earth imagery shown the Chodavarm Co-op Sugars Ltd., and Sarada River.

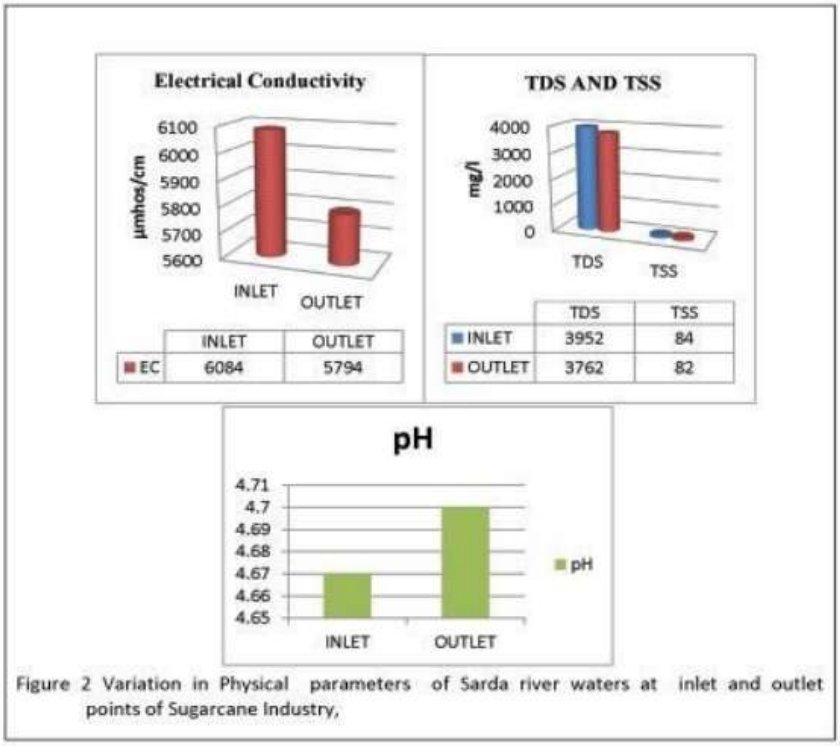

Figure 2 Variation in Physical parameters of Sarda river waters at inlet and outlet points of Sugarcane Industry,

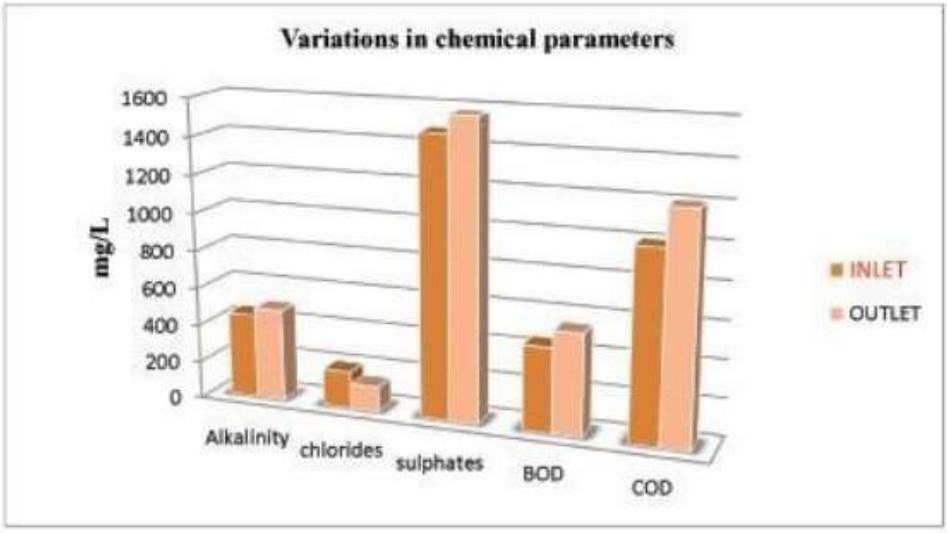

Figure 3 Chemical parameters of Sarada river waters at inlet and outlet points of Sugarcane Industry

Photo Plates

Plate 1: Sugar cane dumping yard and conveyer belt

Plate 2: Storage tanks of Sugar molasis for permentation

Plate 3: Sugar cane Industry treated water enter into Sarada River

Plate 4: Collection of untreated water sample for analysis

5.0 CONCLUSION:

The results of present study indicated that there was a significant variation in physical and chemical parameters of Sarada river water observed in inlet and outlet water samples from sugar industry. The pH is acidic in nature and slightly decreases at outlet point before entering into Sarada river waters. Electrical conductivity (EC) shows more variation from inlet to outlet. Total dissolved solids (TDS) were present more concentration than permissible limits but TDS in outlet is less than inlet. Total suspended solids (TSS) are observed similar to TDS in both inlet and outlet samples. The chloride content is also decreases from inlet to outlet. But both the water samples contains high amounts of sulphates with high COD and BOD demands is due to the presence of untreated effluents released at the outlet of Sewage Treatment Plant (STP) were above the normal limits of physic-chemical parameters of Alkalinity, Sulphates, COD and BOD were increased in out let waters.

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7.0 REFERENCES:

[1] APHA. 2012. Standard Methods for examination of water and waste water. 22nd edition, American Public Health Association, Washington, D.C.,p1360

[2]. A.P. State Portal 2017.Socio-Economic Survey 2016-2017- Planning Department, Govt. of Andhra Pradesh, India.

[3]. Abida,B.And Harikrishna (2008).Study On The Quality Of Water In Some Streams Of Cauvery River,E-Journal Of Chemistry,5,(2):377-384.

[4]. Bhatt,L.R.,Lacoul, P.,Lakhak, H.D., Jha,P.K. (1999). Physico Chemical Characterstics And Phytoplankton Of Taudha Lake Kathmandu,Poll.Res.18(14):353-358.

[5]. Charkhabhi, A.H And M.Sakizadeh "Assessment Of Spatial Variation Of Water Quality Parameters In Most Polluted Branch Of The Anzali Wetland , Northern Iran," Polish J.Of Environ.Study,15,395-403.

[6]. Dharmalingam And V. E.J.Sarvavana Sundaram.2014. Effluent Of Paper Mill-Physico--Chemical Properties Of Water. Int.J. Of Chem.Tech.Research, 6(7). 3541-354

[7]. Ellen Horn, M.J And D.G .Barceloux,1988. Poly Cyclic Aromatic Hydrocorbons In: Medical Technology.Diognosis And Treatment Of Poisoning. Elsevier Publishers, Ny, Usa.Pp952-954

[8]. Kamal, D.,Khan,A.N., Rahaman, M.A. and Ahamed,F.(2007). Study on The Physico-Chemical Properties of Water of Mouri River, Khulma, Bangladesh, Pakistan. Journal of Biochemical Sciences 10(5): 710-717.

[9] King, J.M., Scheepers, A.C.T.,Fisher, R.C.,Reinecke, M.K. and Smith, L.B. (2003). River Rehabilitation: Literature Review, Case Studies and Emerging Principles. WRC Report No.1161/1/03.

[10]. Mahananda Mohanty,B.P and Behava,N.R. Physico-Chemical Analysis of Surface and Ground Water of Baragarh District, Orissa, India, IJRRAS, 2(3) (2010).

[11]. Mathuthu, A.S. K. Mwagna and A. Simoro 1997.Impact Assessment of Industrial and Sewage Effluents on Water Quality of the Receiving Marimba River in Harare. In N.A.G. Moyo (Eds), Lake Shivero, A Polluted Lake. University of Zimbabwe Publications. Harare, Zimbabwe.

[12].Rajkumar,S.,Velmurugan,P., Shanti, K., Ayyasamy,P.M. and Lakshmana Swamy,P. (2004). Water Quality of Kodaikanal and Lake,Tamilnadu In Relation to Physico-Chemical and Bacteriological Characteristics, Capital Publishing Company, Lake 2004, Pp.339-346.

[13].Singh, M.R.,Gupta A and Beeteswa,K H.(2010). Physico-Chemical Properties of Water Samples From Manipur river System, India. J.Appl.Sci.Environ.Manage.Vol.14 (4):85-89.