IMPACT ASSESSMENT ON WATER QUALITY OF SHAKKAR RIVER DUE TO GADARWARA SUGAR INDUSTRY

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Abstract : This study aims to assess the effect on surface water and ground water due to sugar industry liquid waste Gadarwara Narsinghpur district (M.P.) and benchmark it with the Indian Standards as well as W.H.O. water quality standards. The results show that surface water and ground water are affected by industrial effluents However, the study shows that the surface water pollution in Gadarwara has significantly reduced, due to fact that the emission of effluents is treated regularly for the last few years. This makes the groundwater quality in the catchments area of study is found to be severely polluted and moderately polluted. The level of pollution is unfit for human consumption. The work was aimed to know the physical and chemical water qualities of sugar industry liquid waste on Shakkar river and ground water in Gadarwara, Narsinghpur district of Madhya Pradesh, India.

KEY WORDS: Water quality, sugar industry liquid effluent, W.H.O, Pollution, Gadarwara, Madhya Pradesh, India.

1.. Introduction

Narsinghpur district was established in 1956 in the central part of Madhya Pradesh. It is one of the leading agro based district in the central part of Madhya Pradesh. About 84% of the population resides in the rural area and is engaged in agriculture and other allied activities. Gadarwara (Narsinghpur) is situated in the central part of Madhya Pradesh. It attracts special attention because of its natural situation and historical importance as well. On the Northern ends Vindhyachal & on the southern ends throughout the lengths are Satpura ranges of Mountains. In the Northern part river Narmada flows from East to West. Narsinghpur district has received many natural gifts as Narmada Kachhar. Which is very fertile and appropriate for production of various kind of crops, sugar cane is one of them.

1.1. Study Area:

The district is located2240 North latitude to 2315 North latitude and 7838 East longitude to 7938 East longitude. The district is situated about 380 Metre above the mean sea level. Gadarwara is situated at 22.92° North latitude, 78.78° East longitude and 344 meters' elevation above the sea level.

Gadarwara is a small city in India, having about 41,420 inhabitants.

Gadarwara (Narsinghpur) being an agricultural land huge industries are rare, also most of the industrial institutions are agricultural oriented. In many places Gur has been prepared from sugarcane all over the district. Kareli is very famous for Gur Mandi. In Narsinghpur and Gadarwara there are sugar mills.

Sampling Stations:

Table 1: Code name of Sampling Stations

S.No.	Code Name	Site Name
1.	A	Effluent from Shakti sugar mill Gadarwara
2.	B	U/S Before mixing Shakkar river
3.	C	D/S After mixing Shakkar river
4.	D	Ground water (shallow well), Kodiya

5.	E	Ground water (deep well), Kodiya
6.	F	Effluent from Narmada sugar mill Gadarwara
7.	G	Ground water taken from shallow well, Salichouka
8.	H	Ground water taken from deep well, Salichouka

2. METHODS & MATERIALS

Methods: The physical & chemical analysis of water sample was carried out using standard analytical methods according to procedure outlined in the standard methods for the examination of water and wastewater (APHA).

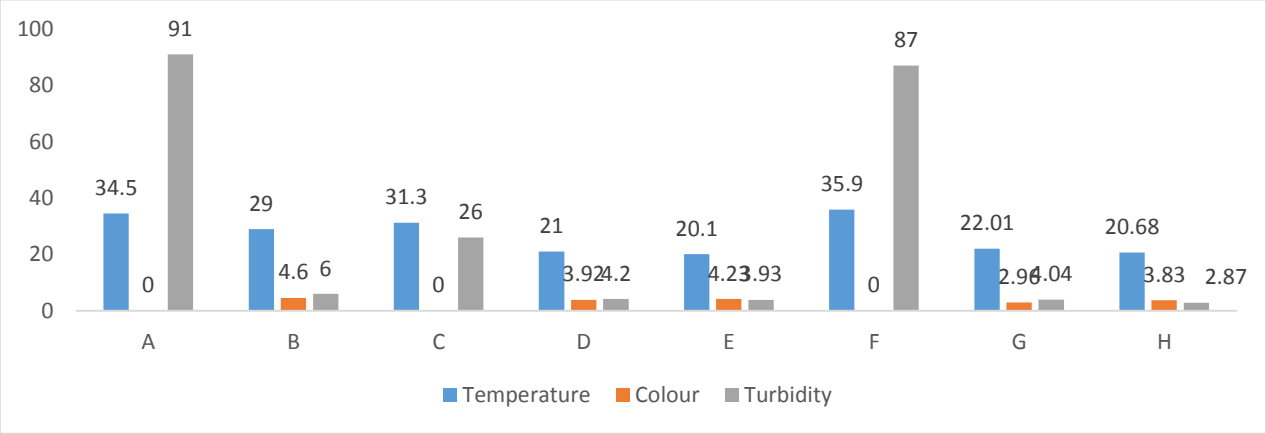
Table 2: Standard Physical Water Quality Parameters Determination Methods & Instruments Used

S.N.	Parameter	Method of determination
1	Temperature	Dipping of thermometer
2	Colour	Colour matching technique
3	Turbidity	Nephelometer method
4	Odour	Dilution method
5	Electrical Conductivity	Conductivity meter method
6	Suspended Solids	Filtration method
7	Oil and Grease	5520 B. Partition-Gravimetric Method
8	Alkalinity	2320 B. Titration Method
9	Total Hardness	2340 C. EDTA Titrimetric Method
10	Calcium Hardness	EDTA titration
11	pH	pH meter
12	Total Solids	Evaporation Method
13	COD	5220 B. Open reflux method
14	BOD	By DO Consumption Calculation
15	DO	4500-0 C. Azide Modification method
16	Fluorides	4500-F D. Spadns Method
17	Sulphates	4500-SO_4^{2-} E. Turbidimetri Method
18	Phosphate	4500-P D. Stannous Chloride Method
19	Chlorides	4500-Cl B. Argentometric Method
20	Nitrate	4500-NO_3^- B. Ultraviolet Spectrophotometric Screening Method

3. RESULTS & DISCUSSION

A. Physical Water Quality Parameters

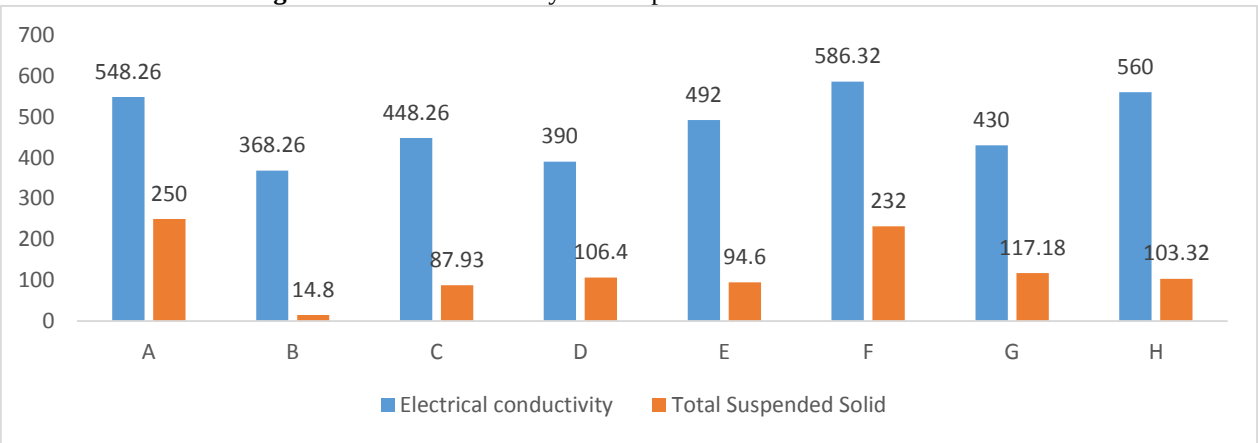
Fig.1 Temperature, Colour, Turbidity different stations



Odour: The effluent from sugar mills was highly odorous. It has very bad smell and intensity was high. The odour of effluent was very unpleasant near Shakti sugar mill and Narmada sugar mill. The odour of Shakkar river was normal before mixing of sugar industry and it becomes fishery after mixing of sugar industry effluent. The odour of ground water taken from shallow as well as deep well near by the Shakti sugar mill, Narmada sugar mill was normal.

Electrical Conductivity, Total Suspended Solids:

Fig.2 Electrical Conductivity and Suspended Solid of different stations



Oil and Grease: Oil and Grease of sugar mill effluent was high and it was 4.0 ppm for effluent from Shakti sugar mill and 5.0 ppm for effluent from Narmada sugar mill. The Oil and Grease of Shakkar river water was .29 ppm before mixing of sugar industry effluent and it becomes 1.86 ppm after mixing of sugar industry effluent.

B Chemical Parameters

pH: pH was tested by potentiometer and the respected values for various station are -

Station	A	B	C	D	E	F	G	H
pH	6.56	7.4	7.08	7.8	8.04	6.82	7.83	7.94

DO: Dissolved Oxygen demand (through Azide Modification method) in various point -

Station	A	B	C	D	E	F	G	H
DO	0.3	7.9	2.64	5.68	6.8	0.47	6.32	6.83

Fig.3 Alkalinity, Total Hardness , Total Solids different stations

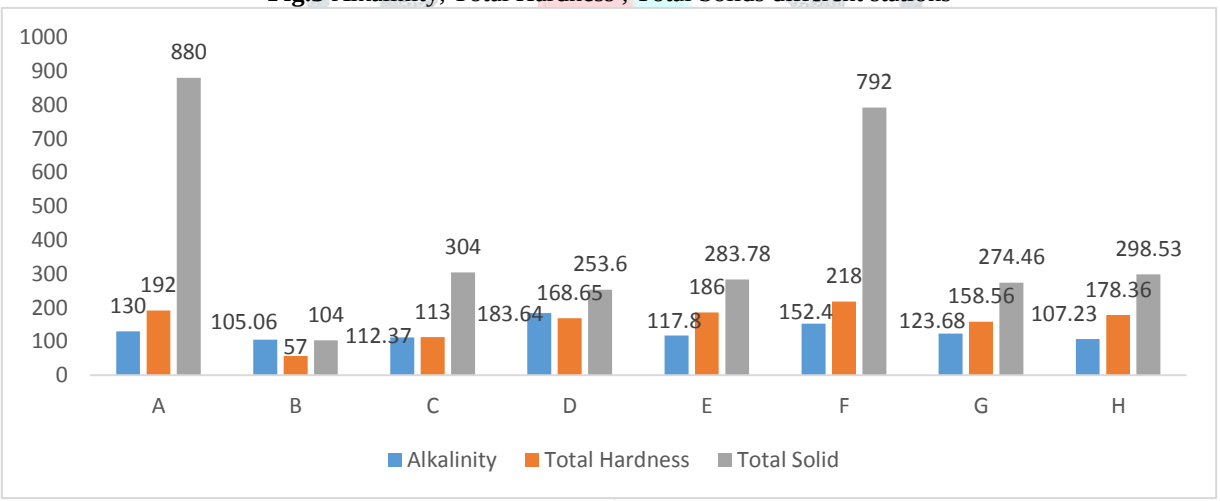


Fig 3.BOD and COD of different stations

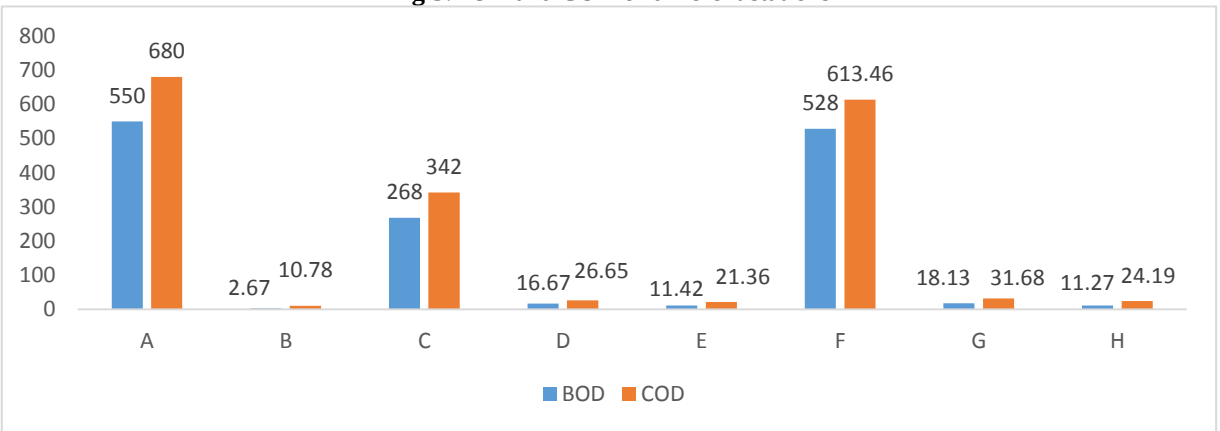
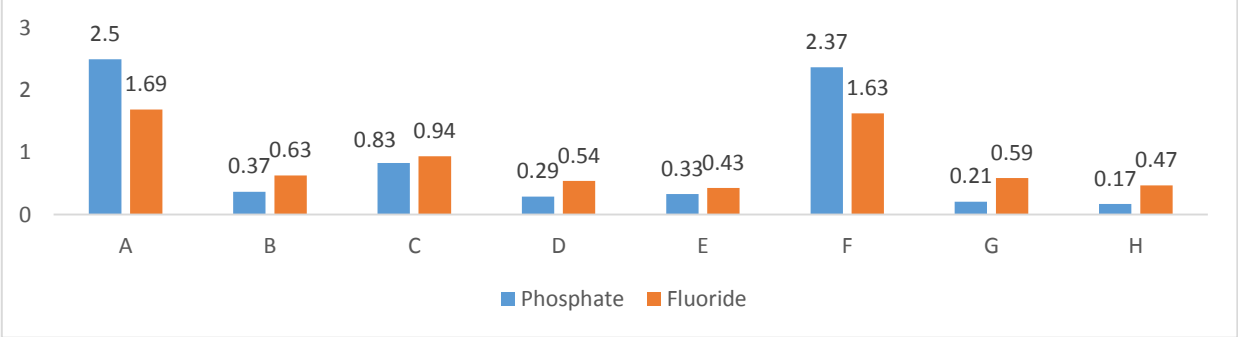


Fig 4. Phosphate and fluoride of different stations



DISCUSSION

By products of sugar industry are Bagasse, Molasses, Filter mud, Boiler ashes, Protein from cane juice and Cane top and leaves**.** These are generated when the cane is washed (cane washing is done only on mechanically harvested cane). The suspended solid content of cane wash water is high. It may also contain considerable amounts of sugar. also, Large amounts of water are used for cooling the bearings of milling machines which pick up lubricants. It also includes spill overs and floor washes. The clothes of filter press are washed periodically to remove the mud clogging in the pores. This effluent contains large amount of suspended solids and possesses a high BOD. Cooling and condenser waters are the wastes from this section which contain sugar particles that gain access during concentration of juice at multiple effect evaporators. Mostly generated by leakage from centrifuges and periodical floor washings. This waste has an extremely high BOD though small in volume and discharged intermittently. The cooking waters are recycled from the pond. However excess water is let out as waste which possess low BOD and suspended solids. Like other industries boils blow down also contribute to effluent, but the volume is much less. Leakage and overflow from molasses storage tanks contribute to the high BOD of sugar factory effluents. Juice heaters and other heating surfaces are cleaned to remove accumulation of scales with hot caustic soda solution then with dilute hydrochloric acid followed by rising with water. These operations produce a large volume of effluents BOD value of this effluent is high.

The immediate oxygen demand of sugar factory effluents caused rapid depletion of the dissolved oxygen of Shakkar river resulting in anaerobic conditions. This resulted in the release of foul odours and in the production of sulphate and various other constituents, which precipitated and leading to yellow appearance. All these effects make the water totally unfit for fish and other aquatic life. Also, the dissolved and suspended solids deteriorate slowly resulting in totally unfit, coloured and odorous aquatic atmosphere. Further, suspended impurities block the drainage and ditches and retards water conveyance system. The excess oil and grease content is also a nuisance which prevents aeration and leads to slower decomposition of organic matter.

CONCLUSION

Being the most polluting industry, effluents discharged by sugar factories, if not treated, would inflict a serious damage to the environment. Even though, sugar industrial pollution is not toxic and detrimental to environment as such effluents from tanneries, paper mill and refineries, but large quantities of wastewater discharged have high pollution effects on the surrounding. The high concentration of suspended solids in the raw effluents cause blockage in drains and ditches and also delayed pollution effects due to slow decomposition of the selected matter. Effluents containing high salt concentration and toxic due to acidic and alkaline damage aquatic life. In case, if the effluents are directly discharged into a stream or river, the loss of aquatic life is be high.

The other worst effect is the development of obnoxious odour in the contaminated stream. The bad odour, if inhaled by humans and animals, is inflicting to serious health effect. The septic condition of contaminated water, seen in yellow turbid colour, produces hydrogen sulphide gas which is bad for the surroundings. The high level of BOD in the untreated effluents results in depletion of oxygen content, making water unfit for fish and other aquatic life. There is also loss of fertility of the soil and productivity of lands due to the direct outlet of effluents and hence strict laws should be implemented so as to control this pollution.

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