PHYSICO-CHEMICAL CHARACTERIZATION OF THE EFFLUENTS AND NEARBY GROUND WATERS OF TULJA BHAVANI CO-OPERATIVE SUGAR FACTORY LTD., NALDURG, TQ. TULJAPUR, DIST. OSMANABAD

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ABSTRACT

The physico-chemical analysis of the effluents of Tulja Bhavani Cooperative Sugar Factory Ltd. Naldurg Dist. Osmanabad and Nearby dug well and bore well waters of pre- and post monsoon seasons of 2006 and 2007 has been carried out in present investigation. The methods employed for the analysis are as per the standard methods recommended by APHA[1], WHO[2], ICMR[3], IS, IS 3307-1977. The water samples during pre monsoon and post monsoon seasons from the various sites were collected and analytical estimations was done. The values are compared with the standard limits. The study reveals that the physico–chemical parameters are within the permissible limits with some slight variations in some parameter*s*.

Key words: Physico-chemical, Sugar factory, Dug well-bore well waters, Effluents

INTRODUCTION

The geographical limitations selected for physico–chemical analysis is the Sugar factory named Tulja Bhavani Co-operative Sugar Factory Ltd., Naldurg selecting samples of effluents and the dug well, bore well of the nearby locality. The sugar factory effluents percolate and enter into the drinking water sources, may be in minor amounts but disturbing the drinking water quality. It is done by analyzing these through different parameters. The pH, BOD, COD, alkalinity, hardness, TDS and inorganic salts (cations and anions) were found differing from the standard values and thus disturb the hygiene and health of the people. No attention has been paid towards this serious problem and hence, this paper presents the results of the study carried out during pre monsoon and post monsoon season 2006.

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EXPERIMENTAL

Material and methods

The effluent and ground water samples (dug well, bore well) were collected in clean polythene bottles. Suspended matters of the water samples are removed by the filtering through Whatman No. 42 before analysis. The nitrates were estimated by phenol-disulphonic acid method[4]. The standard methods were used for estimation of various physico–chemical parameters (Table 1). The analytical grade chemicals were used for all the analytical estimations.

Table 1. Methods employed for examination of physico - chemical parameters

Parameter	Method employed
pH	pH Metry
E.C.	Conductometry
Total dissolved solids	Conductometry
Chloride	Agrentometric titration
Alkalinity	Titrimetry
Hardness as calcium	EDTA titration
Mg	EDTA titration
Sulphate	Turbidimetry
D.O., B.O.D.	Wrinklers method
COD	Reflux method
Mg^{2+}	Flame photometry
SO_4^{2-}	Calorimetry
NO_3^-	Spectrophotometry

Table 2. Reported values of different parameters of the samples of pre / post monsoon seasons of 2006 related to TBSSK Ltd. Naldurg, Dist. Osmanabad.

S. No.	Parameter	Dug well	Bore well	Effluent
1.	Temp.	32.0 / 31.8	32.4 / 32.0	32.3 / 32.0

S. No.	Parameter	Dug well	Bore well	Effluent
2.	pH	7.2 / 7.5	7.8 / 7.7	3.41 / 3.4
3.	Econd (mmho.)	0.456 / 0.45	0.60 / 0.58	0.358 / 0.340
4.	TDS (mg/L)	39 / 37	59 / 57	36 / 34
5.	OH alkalinity (mg/L)	---	---	---
6.	CO_3^{2-} alkalinity (mg/L)	---	---	---
7.	HCO_3 alkalinity (mg/L)	500 / 400	500 / 400	300 / 200
8.	Arsenic (mg/L)	---	---	---
9.	F^- (mg/L)	---	---	---
10.	D.O. (mg/L)	2.1 / 2.0	2.4 / 2.36	3.3 / 3.1
11.	C.O.D. (mg/L)	7450 / 7280	6700 / 6600	133000 130000
12.	Cl (mg/L)	26.8 / 24.6	40.51 / 39.5	4250 / 4000
13.	Total hardness (mg/L) as $CaCO_3$	5.6 / 4.9	9.0 / 8.7	84 / 80
14.	Calcium hardness (mg/L) as $CaCO_3$	4.5 / 3.8	7.0 / 7.0	---
15.	Mg - hardness (mg/L) as $CaCO_3$	1.1 / 1.1	2.0 / 1.7	83 / 80
16.	--- PO_4^{3-} (mg/L)	0.0007 / 0.00069	0.00121 / 0.00111	0.00105 / 0.009
17.	--- SO_4^{2-} (mg/L)	1.2 / 1.0	20 / 19	45 / 42
18.	--- NO_3^- (mg/L)	---	---	[1]0.09
19.	BOD (mg/L)	208 / 200	100 / 100	1000 / 900

For the analysis of water samples, the common and essential parameters like pH, E.C., hardness, BOD, COD, DO, TDS, alkalinity, Ca^{2+}, Mg^{2+}, Na^+, K^+ were selected as per drinking water specifications of BIS (1993) including the desired parameters to asses the potability of drinking water. Conductivity measurements in all the samples were also done to asses the contribution of ions in deciding quality of water.

The parameters like pH, EC, BOD, COD, hardness and free chlorine were analysed at sampling sites. The other parameters were analysed in the laboratory as per the standard methods of water and waste water (APHA-1993) pH was measured using in pocket pH meter and conductivity by using portable conductivity bridge. The concentrations of Na^+, K^+ were analysed by flame photometer. The concentrations of SO_4^{2-} and NO_3^- were measured using spectrophotometer. The other parameters were measured by standard value metric methods as per APHA (1985).

Table 3. Reported values of different parameters of the samples of pre / post monsoon seasons of 2007 related to TBSSK Ltd. Naldurg, Dist. Osmanabad.

S. No.	Parameter	Dug well	Bore well	Effluent
1.	Temp.	32.1 / 32.0	32.3 / 32.1	32.2 / 31.9
2.	pH	7.2 / 7.4	7.75 / 7.7	3.40 / 3.39
3.	Econd (mmho)	0.450 / 0.415	0.61 / 0.59	0.359 / 0.339
4.	TDS mg/L	38.7 / 38.6	58 / 58	37 / 355
5.	OH alkalinity (mg/L)	Nil	Nil	Nil
6.	CO_3^{2-} alkalinity (mg/L)	Nil	Nil	Nil
7.	HCO_3^- alkalinity (mg/L)	500 / 400	500 / 400	303 / 210
8.	Arsenic (mg/L)	Nil	Nil	Nil
9.	F^- (mg/L)	Nil	Nil	Nil
10.	D.O. (mg/L)	2.0 / 2.0	2.4 / 2.30	3.29 / 3.2
11.	COD (mg/L)	7380 / 7370	6685 / 6680	132800 132750
12.	Cl^- (mg/L)	26.7 / 26.0	39.5 /39.0	4240 / 4100

13.	Total hardness (mg/L) as CaCO$_3$	5.5 / 5.0	8.9 / 8.7
14.	Calcium hardness (mg/L) as CaCO$_3$	4.2 / 4.0	8.1 / 8.0
15.	Mg - hardness (mg/L) as CaCO$_3$	1.3 / 1.0	0.8 / .07
16.	--- PO$_4{}^{3-}$ (mg/L)	0.0007 / 0.00069	0.0011 / 0.0011
17.	--- SO$_4{}^{2-}$ (mg/L)	1.1 / 1.0	20 / 18.9
18.	--- NO$_3{}^{-}$ (mg/L)	Nil	Nil
19.	BOD (mg/L)	215 / 206	103 / 99

RESULTS AND DISCUSSION

The results of the present study are summarized in Table 2 with respect to effluents, dug well and bore well waters after the assessment of contamination in these. All the parameters were found within the permissible limits, for dug well and bore well water but in the case of effluents, most of the parameters were found above the permissible limits. pH of the factory effluents was found to be acidic. Its higher conductivity in pre monsoon season was recorded. It indicated the presence of ionic species. It is supported by very high values of total dissolved solids. Effluent also has high level of BOD, COD and chlorides. Very less concentration of DO has been reported in the dug well, bore well and effluents. The values of similar parameters for the dug well and bore well were found in the permissible limits. The higher values of the sulphate may be due to use of sulphuric acid (sulphur) as an intermediate raw materials in the sugar factory, which may percolate to the soil in the dissolved form (mostly H$_2$SO$_4$), thereby coming in the drinking water as sulphate. The hardness of water is caused by presence of calcium and magnesium. The carbonates and bicarbonates are responsible for alkalinity.

Most of the constituent parameter values of the post monsoon samples of all the three kinds of samples under study are lower than that of the pre monsoon period. It may be due to the usage of inorganic fertilizers and biodegradable assists in the fields and rain water flowing through the soil of this area. Noticeably the COD, BOD and chloride content

of the effluent of the concerned factory are higher in pre and post monsoon seasons as compared to the dug well and bore well waters during the same period. The overall investigation is meant to know the water quality of region because most of the water resources are for drinking, cleaning and irrigation purposes. The alkaline water of dug well and bore well are within the permissible limits and the higher TDS and sulphate in bore well during pre and post monsoon seasons are of little concern.

The results obtained during this investigation have been communicated to the related and responsible community. The dug well and bore well waters are used for drinking purposes, which might have been contaminated (above and below the permissible limits). These results have been communicated to the residents of the Sugar factory quarters, nearby village Andur, Naldurg and the possible adverse effects of the same to the authorities of concerned gram panchayat. The effluent analysis of the Sugar factory has been brought to the notice of the authorities of the sugar factory.

Recommendations have been made to take care of effluents. These may be purified at the site using effluent treatment plants by recycling unit. It is to be taken care of that the hazardous byproducts of the factory should not get enter in the drinking water resources (natural resources of dug wells and bore wells.) The same results and recommendations have been sent to the Collectorate of Osmanabad district. The utmost care has been taken of bringing this information to the majority of the civilians that is farmers, students, and housewives.

CONCLUSION

The dug well and bore well waters of the near by locality of the sugar factory are not so much contaminated, except the presence of sulphate and hence, to make it more potable, some physico–chemical methods can be applied. High levels of estimated values of the most of the parameters of the sugar factory effluents may be minimised by setting the effluent treatment plant and recycled unit at the factory site.

ACKNOWLEDGEMENT

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