ENVIRONMENTAL ASSESSMENT OF KARELI SUGAR MILL EFFLUENT ON LOCAL GROUND WATER

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ABSTRACT

The present investigation deals with a study of sugar mill effluent on ground water which used for domestic purposes. Water quality index and various physico-chemical parameters of the selected samples of nearby sugar mill were evaluated. The study indicates that water quality parameters in the sugar mill effluents is very high and exceed the permissible limits.

INTRODUCTION

All industrial establishments generate and dispose of wastes in one form or others, traditionally waste is viewed as an unnecessary element arising from industrial activities. The industrial areas dump lots of materials in their environment which causes pollution. The most often affected are natural resource including water resources. The ground water is one of the earth, renewable resources which occur as a part of hydrological cycle. The effluent discharged from sugar mills contains a number of chemical pollutants.

In this paper an indication of higher concentrations of chemicals in the effluents and their subsequent effect on the local ground water was critically examined.

MATERIALS AND METHODS

The supplied and treated water samples were analyzed for various parameters using standard procedure (APHA, 1995). The chemicals used were of analytical grade and the instruments were in the limit of precise accuracy.

The pH was measured by pH meter, temperature was measured with thermometer, DO, alkalinity, chloride, hardness, all are measured by titration methods, BOD of effluent was measured by dilution methods, COD was observed by close reflux method.

Water samples were collected in 1L polythene bottles previously soaked with 8N HNO_3 and washed with distilled water. The samples were acidified with 6N.HNO_3 (8m/L) soon after sampling. The samples for heavy metals analysis were collected separately and acidified immediately.

All the water samples included with effluent taken for analysis. The details of Sampling Information are as under;

Table 1. Water sampling information

Collection area of the sample	Sample No
1. Effluent of Sugar mill	Sample RK-I
2. Water sample of hand pump near Sugar mill	Sample RK-II
3. Water sample of hand pump before Sugar mill	Sample RK-III
4. Water sample of well behind Sugar mill	Sample RK-IV

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Table 2. Summarized results of some physico- chemical characteristics of Kareli Sugar Mill

Physico-Chiemical Characteristics	Limits	RK - I			RK - II			RK - III			RK - IV		
		Pre-Mon-soon	Mon-soon	Post-Mon-soon	Pre-Mon-soon	Mon-soon	Post-Mon-soon	Pre-Mon-soon	Mon-soon	Post-Mon-soon	Pre-Mon-soon	Mon-soon	Post-Mon-soon
pH	7.0-8.5	8.1	7.9	7.8	7.6	7.3	7.9	7.5	7.9	7.9	7.6	7.8	7.9
Temperature	30	30	31	30	28	27	28	28	27	28	29	28	28
Electrical Conductivity	300	1040	820	920	730	890	790	750	800	700	790	800	750
Total Alkalinity	200	368.2	719.04	759.04	227.8	413.9	635.04	330.34	445.4	655.2	293.8	358.2	719.04
Total Hardness	300	344	380	524	304	340	408	256	280	282	220	289	344
Chloride	250	789.6	646.2	650.4	218.4	315.6	213.47	347.8	308.4	330.1	389.2	390.1	440.2
Fluoride	1.5	1.8	1.5	1.9	1.2	1.2	1.4	0.5	0.6	0.8	0.5	1.2	1.4
Phosphate	0.1	0.4	0.2	0.8	0.1	0.1	0.4	0.1	0	0.2	0.1	0.0	0.3
Zinc	5.5	0.436	0.434	0.814	0.123	0.152	0.436	0.110	0.148	0.123	0.228	0.189	0.428
Copper	1.0	0.366	0.220	0.501	0.067	0.189	0.190	0.190	0.220	0.366	0.183	0.189	0.190
Iron	1.0	0.542	0.348	0.434	0.202	0.173	0.202	0.298	0.234	0.441	1.184	0.213	0.303
Manganese	<0.05	0.128	0.173	.20	0.082	0.128	0.151	0.040	0.152	0.616	0.168	0.173	0.182
Dissolved Oxygen	4.0-6.0	0	0	0	34.2	4.0	3.1	3.2	4.1	3.3	4.0	4.1	4.1
BOD	06	2.0	1.9	2.5	2.8	1.4	1.7	2.0	1.4	2.0	1.4	4.0	2.1
COD	10	2400	1600	1200	176	114.0	64	128	112.0	144	105	80	120
TDS	500	1.890	1.900	1.789	0.432	0.595	0.32	0.346	0.443	0.440	0.14	0.206	0.311

All values are expressed in mg/L except pH and Ec, pH in pH units, mhos cm⁻¹ .

RESULTS AND DISCUSSION

The values of various water quality parameters of waste water generated from sugar industry have been summarized in Table 2 along with permissible values. Prescribed by Bureau of Indian Standards (BIS, 1983).

The average temperature of sugar mill effluents is 30°C and is found to equal to that of room temperature observed on the day, so the sugar mill effluent is not thermally polluted.

The value of pH fluctuated from 7.3 -8.1 which is within the permissible limits. Electrical conductivity is an excellent indicator of ionic forms of TDS, which is a measure of salinity that affects the taste of potable water (WHO, 1994). The electrical conductivity values of water sample in the study area ranged from 700 -1040 micro mhos/cm.
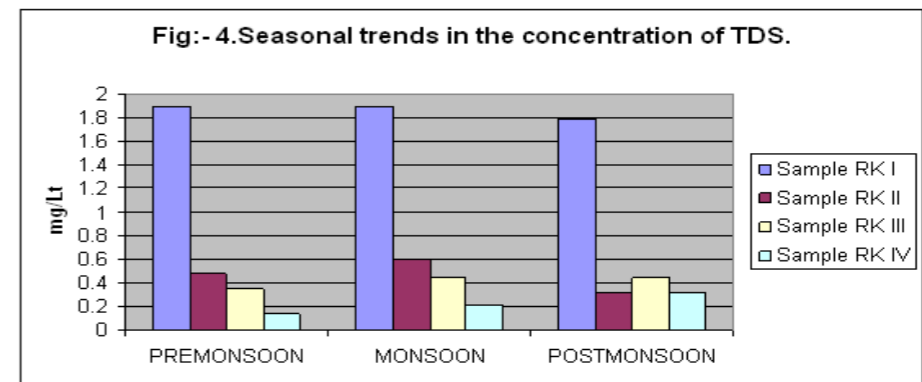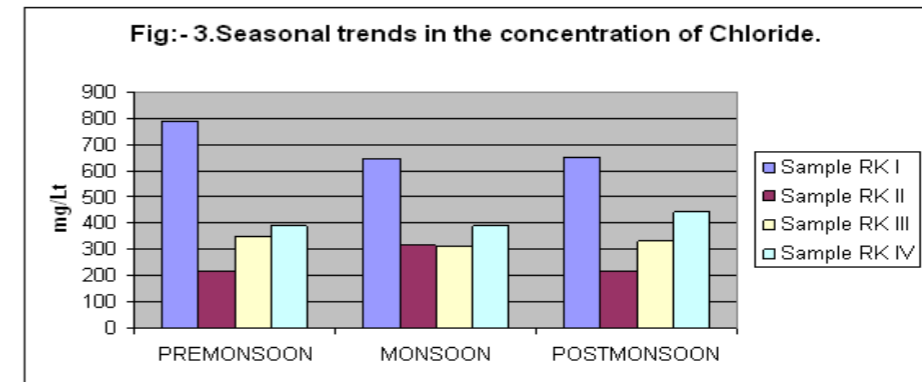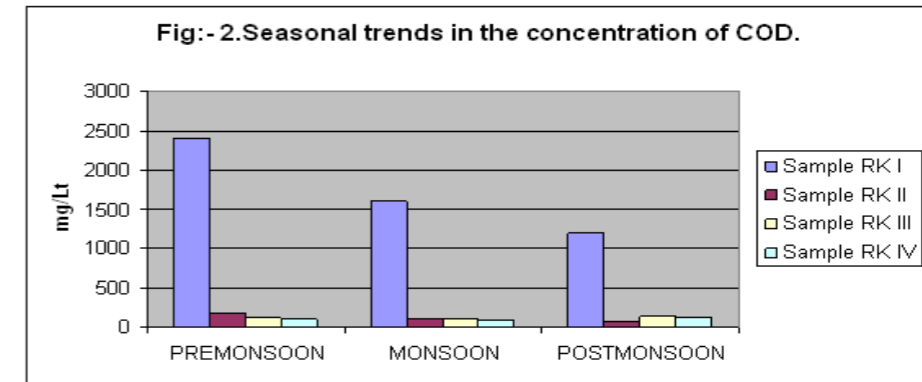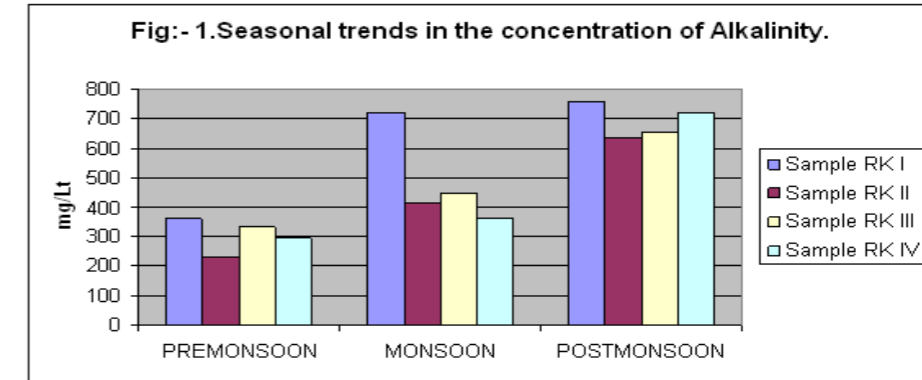
The alkalinity values were found increasing in the post monsoon period, compared to the premonsoon period in all samples in Fig 1. This may be due to the movements of pollutants into the ground water storage.

Hardness of water is due to the presence of dissolved chlorides,Sulphates, carbonates, and bicarbonates of calcium and magnesium ions.

The range of total hardness is 300- 520 mg/L. It is observed that the water was fairly hard for maximum part of the study and had crossed the maximum limit for portability purposes.

Biochemical Oxygen Demand (BOD) is a measure of biologically degradable organic matter. Chemical Oxygen Demand (COD) is a measure of chemically oxidisable organic matter. High load of organic compounds in the effluents may cause an increase in BOD & COD load and simultaneous depletion of DO concentration. The observed value of COD ranges from (1200 -2400mg/L) as shown in Fig 2.

The DO level of the effluents is zero and sample of nearby sugar mill is much below the desirable limits, it is due to

Fig:- 1.Seasonal trends in the concentration of Alkalinity.

Fig:- 2.Seasonal trends in the concentration of COD.

Fig:- 3.Seasonal trends in the concentration of Chloride.

Fig:- 4.Seasonal trends in the concentration of TDS.

the overload of effluent and increased density of microorganisms which lowers the DO level.

In Fig 3.The chloride concentrations ranges from 218.4-789.8 mg/L which exceeds the permissible limits (250 mg/L).

CONCLUSION

Several physico-chemical parameters and there variability have been studied in relation to the pollution in water. The different parameters measured during the study have higher value which affects the ecosystem. The chemical analysis showed that the polluted site of Kareli Sugar mill contains high values of chloride, total alkalinity and COD which indicate high pollution load. The present study indicates greater impact of sugar mill on ground water quality.

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