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Research Article

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Determination of Quality in Surface Water and Open well Water around Industrial Park Special Economic Zone of Mambattu (SPSR Nellore District), A.P. India

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ABSTRACT

This study was conducted to analysis various water samples of SEZ of Mambattu, Tada mandal, SPSR Nellore district and assess the possible impacts of such effluents on quality of open well water and surface water. A total of 10 samples including 5 from surface water (surrounding industries leather ,power, steel, electronics, chemical, matrices, etc.), and 5 from open well water of all bore wells in the vicinity of the SEZ were collected in November 2011, the samples in the SEZ of mambattu, the industry like leather, Power, Steel, Electronics, Chemicals, Matrices are located were analyzed for various physico chemical parameters like temperature, pH, EC,DO, Total Hardness, BOD,COD,TDS, Sulphates, Nitrates, Chloridres and heavy metals like Fe, Pb, Zn, Mn, Cd .The results were compared with US EPA and WHO standards for both surface and open well water collected from above said area. All physicochemical parameters are within the permissible limit except Fe concentrations which were found above the permissible limit.

Key words: Surface water, Open well water, Physico - chemical Parameters, Water Quality Index, WHO.

INTRODUCTION

Open well water and surface water has been using for domestic and industrial water supply and irrigation purposes all over the world. There has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Industrial estates are established to fulfill the demand of the growing population in the country [1-2]. The introduction of industries on one hand manufactures useful products but at the same time generates waste products in the form of solid, liquid or gas that leads to the creation of hazards, pollution and losses of energy. Most of the solid wastes and waste waters are discharged into the soil and water bodies and thus ultimately pose a serious threat to human and routine functioning of ecosystem.

In India groundwater is used for domestic and agricultural purposes. Similarly most of the industries are using ground as well as surface water for their manufacturing and cleaning purposes, this used water come out as a waste water. Heavy metals are basically present in groundwater but these play an important role in determining the quality of water for drinking purposes. Metals are considered toxics and when they enter the body more than the prescribed limit they start causing harm. In the same way many physicochemical parameters play an important role in determining the quality of water. According to WHO organization, about 80% of all the diseases in human beings

are caused by using contaminated water. Once the ground water is contaminated, its quality cannot be restored by stopping the pollutants from the source. Therefore it becomes imperative to regularly monitor the quality of ground water and to device ways and means to protect it. Water quality index is one of the most effective tools [3-4] to communicate information on the quality of water to the concerned citizens and policy makers.

The excess concentration of these physico chemical parameter may cause various ill effects. The levels of heavy metals need to be studied in both surface and groundwater. Present work was carried for 6the determination of quality of water in the SEZ of Mambattu, SPSR Nellore District, AP, in collected November 2011. In the close vicinity of this industrial area there is dense population of residents who generally use open well water for most of their domestic purposes. Therefore In this paper physicochemical parameters and the presence of some important heavy metals like lead, cadmium, iron, zinc, Manganese, have been studied in surface water and subsequently in groundwater of this locality. Standard methods were adapted for the analysis of various water quality parameters[5].

EXPERIMENTAL SECTION

2. Quality Assurance procedure:

Special precautions are taken during sampling and analysis of water. All the Samples are collected in polythene containers and stored at 4°C by using ice packs for physicochemical analysis.Samples are separately collected in 100 ml polyethylene containers (containers are previously soaked in 2% nitric acid and washed with distilled water) and acidified with con.HNO_3 and stored at 4°C for trace metal analysis. All the containers are rinsed twice with the same samples before collecting the water samples. All Analytical Reagent grade chemicals are used in the analysis. Repetition of analysis was performed and taken mean results.

3. Chemical analysis

Surface and Open well water of the surrounding area were analyzed for various important Physico - chemical Parameters such as temperature, pH, electrical conductivity, Total solids, Total dissolved solids, biological oxygen demand and heavy metals concentration by using standard methods. Chloride was determined using Argentometric titration method. Titration methods were used for total hardness, calcium hardness and alkalinity measurements. Sulfate, Nitrate, were analyzed by using UV-VIS Spectrophotometer (Thermo Alpha series). Standard curves of nitrate, sulfate, cyanide and fluoride are prepared using different linear concentrations of standards. Good linear graph and Correlation coefficient of standard curve is is observed.

4. Heavy metals analysis:

For the analysis of heavy metals viz , Zinc (Zn), Iron (Fe), Manganese (Mn), Cadmium (Cd),and Lead (Pb), Samples were analyzed on ICPMS for concentration by using specific cathode lamp. ICP-MS was calibrated for each element using standard solution of known concentration before sample injection.

RESULTS AND DISCUSSION

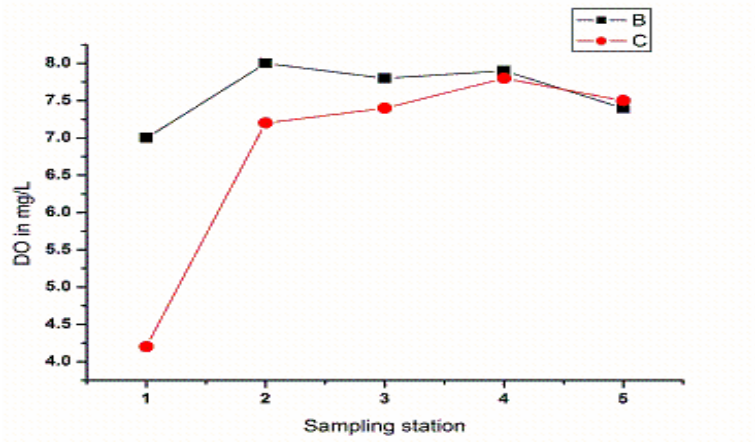
Industrial effluents are the main source of surface and ground water pollution. Ten samples from different places were analyzed for the determination of various physical and chemical parameters such as temperature, pH, electrical conductivity (EC), total solids (TS), total dissolved solids (TDS), biological oxygen demand (BOD) and for identification of in the collected samples. These values and compared heavy metals Surface water and ground water were compared with the values recommended by United States- Environmental Pollution Agency (US-EPA) and World Health Organization (WHO) for drinking water given in (Table – 1 & 2).

5.1. Temperature:

Temperature was noted using thermometric method at the site of sampling using portable calibrated mercury thermometer.

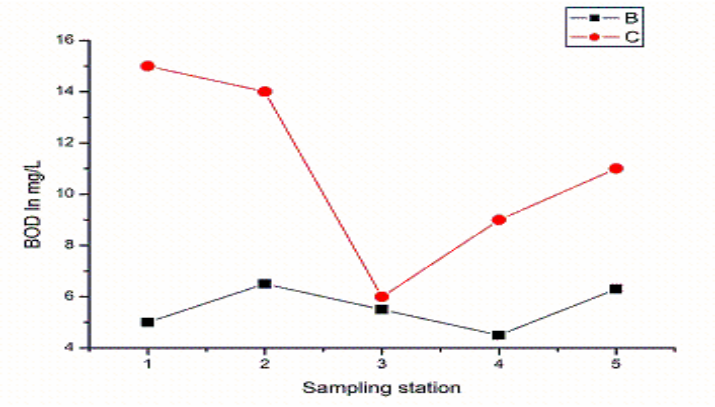
5.2. Dissolved oxygen (DO).

The DO values of open well sample are in the range between 7.4 to 8 mg/L and surface water sample are in the range between 4.2 to 7.8 mg/L. The variation of DO in open well water and surface water show in the **Graph – I.** These values are almost correlating with the standard values of WHO and US – EPA.



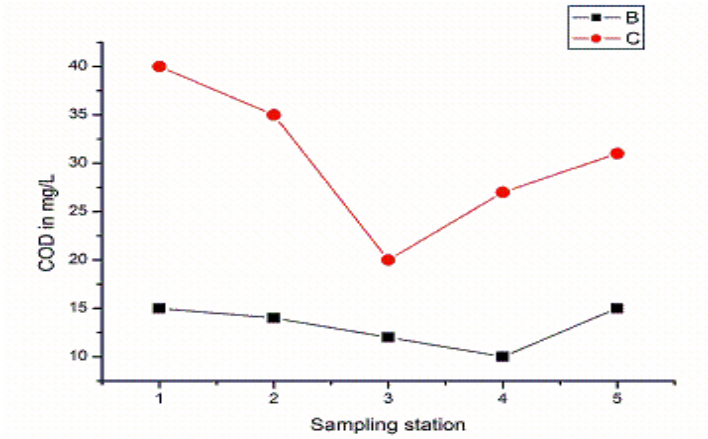
B = open well water (mg/L)
C = Surface water (mg/L)
Graph – I: Dissolved oxygen at different sampling station.

5.3. Biological oxygen demand (BOD):
Biological oxygen demand (BOD) is expressed as weight of oxygen consumed per unit volume of water during a defined period of time at a defined temperature was calculated following the procedure of Hamer. For this the sample was incubated for 5 days at 20^0 C in the dark. The reduction in dissolved oxygen concentration during the incubation period yields a measure of the biochemical oxygen demand. The BOD values in open well water ranges 4.5 to 6.5 mg/L and surface water sample value ranges from 6 to 15 mg/L**.** The variation of BOD in open well water and surface water show in the **Graph – II.**



B = open well water (mg/L)
C = Surface water (mg/L)
Graph – II: Biochemical oxygen demand at different sampling station.

5.4. Chemical Oxygen Demand (COD):
The COD is another important parameter for river water quality assessment. This measures the total quantity of oxygen required to oxidize all organic material (including the inert) into carbon dioxide and water. The COD mean values for both open well water and surface water were found higher than the WHO acceptable level (10mg/L). The variation of COD in open well water and surface water show in the **Graph – III.**

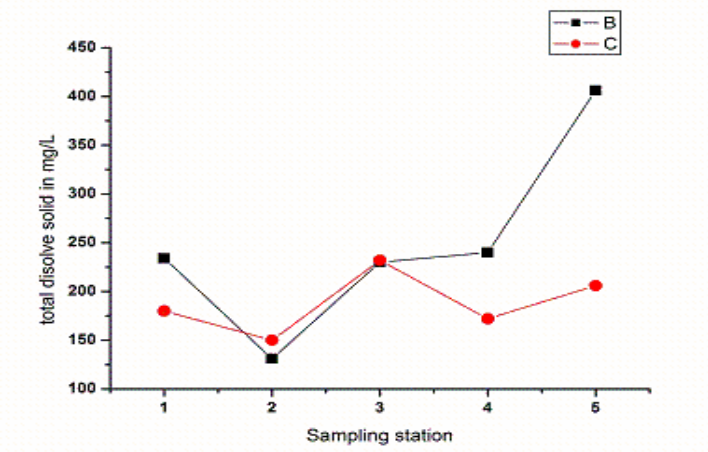


B = open well water (mg/L)
C = Surface water (mg/L)

Graph – III: Chemical oxygen demand at different sampling station.

5.5. Total dissolved solids (TDS):

Total dissolved solids (TDS) is the measure of total inorganic salts and other substances that are dissolved in water. TDS was determined following the procedure of Richard by using Electrical Conductivity (EC) meter. The TDS values of open well water ranges between 131 to 406 mg/L and surface water ranges between 150 to 232 mg/L. The variation of TDS in open well water and surface water show in the **Graph – IV.**

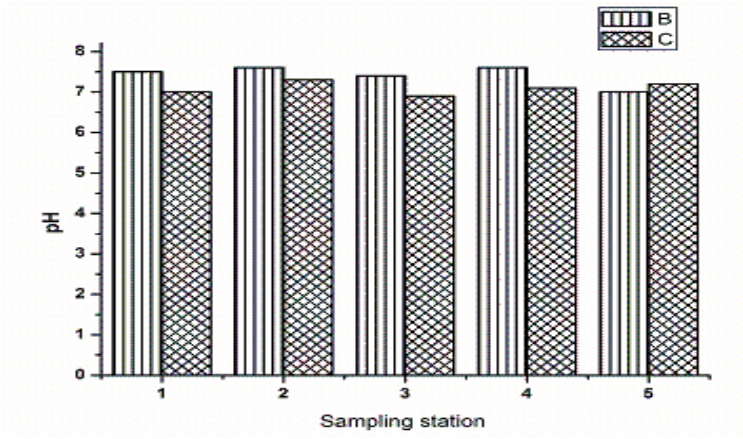


B = open well water (mg/L)
C = Surface water (mg/L)

Graph – IV: Concentration of Total Dissolved solids at different sampling station.

5.6. pH:

pH of the samples was noted using potentiometric method. The pH meter standardized by using buffer solutions of known value before analysis. The P^H values of all the ground water samples varied between 7 to 7.6 and also in the surface water samples varied between 6.3 to 7.3 which are all in alkaline range. The variation of P^H in open well water and surface water show in the **Graph – V.** Therefore the P^H values of both ground water and surface water are in the permissible limit.



B = open well water (mg/L)
C = Surface water (mg/L)
Graph – V: P^H Value at different sampling station.

5.7. Electrical conductivity (EC):
EC is the measure of the ability of an aqueous solution to convey an electric current. This ability depends upon the presence of ions, their total concentration, mobility, valence and temperature. EC was determined by conductivity meter following the procedure of Richard. The values are show in Table – I & II.

5.8. Total suspended solids (TSS):
Total suspended solids are the portion of solids that usually remains on the filter paper. Suspended solids consist of silt, clay, fine particles of organic and inorganic matter, which is regarded as a type of pollution because the high TSS in concentration of suspended solid may adversely affect growth and reproduction rates of aquatic fauna and flora. For TSS analysis, known amount of sample was filtered through the pre weighed filter paper and was determined by using following formula.

$$\text{Total suspended solids, mg/L} = \frac{(A - B)\ X\ 1{,}000}{(\text{Sample volume, mL})}$$

Where:
A = Sample and filter weight, mg
B = Filter weight, mg

Samples were collected:

S-1:- peda mambattu village**.**
S-2:- kandriga harijanawada
S-3:- china mambattu village
S-4:- opp bharat electronics
S-5:- peda mambattu harijinawada , mambattu, SPSR Nellore district, india

Table-I Analysis of selected samples of open well water

S.NO	Parameters	Uints	S-1	S-2	S-3	S-4	S-5	Standard U.S.EPAmg/L	Standard WHO mg/L
1	Temperature	^{0}c	25.4	26.0	25.3	24.8	25.4	---	12^{O}C
2	Turbidity	NTU	3	2	3	4	3	---	---
3	pH	-------	7.5	7.6	7.4	7.6	7	6.0-8.5	6.5-9.2
4	E.C	µs/cm	355	201	356	369	548	300	400
5	DO	mg/L	7	8	7.9	7.8	7.4	4-6	3PPM
6	T.H	mg/L	114	66	99	146	159	---	---
7	BOD	mg/L	5	6.5	5.5	4.5	6.3	---	---
8	COD	mg/L	15	14	12	10	15	4.0	10
9	TS	mg/L	240	136	276	248	412	---	---
10	TDS	mg/L	234	131	230	240	406	500ppm	500ppm
11	Alkalanity	mg/L	115	50	90	135	160	---	---
12	Sulphates	mg/L	10	3.3	3.6	3.8	7.7	---	---
13	Nitrates	mg/L	1.6	2.9	0.8	6.1	0.2	100	45
14	Chlorides	mg/L	34	32	43	30	72	---	---
15	Ca	mg/L	32.8	18.4	17.9	30.4	45.6	100	100
16	Mg	mg/L	7.8	4.9	14	17	10.2	30	150
17	Iron	mg/L	0.131	0.234	0.257	0.108	0.003	0.3	0.3
18	lead	mg/L	0.010	0.008	0.005	0.003	0.002	0.05	0.05
19	Zinc	mg/L	0.003	0.006	0.008	0.021	<0.001	5.0	5.0
20	Manganese	mg/L	0.006	0.005	0.003	0.004	0.051	0.05	0.1
21	Cadmium	mg/L	0.001	0.003	0.001	0.001	<0.001	0.01	0.05

Table - II : Analysis of selected samples of surface water

S.NO	Parameters	Uints	S-6	S-7	S-8	S-9	S-10	Standard U.S.EPAmg/L	Standard WHO mg/L
1	Temperature		25.8	24.6	25.2	25	24.9	---	12^{O}C
2	Turbidity	NTU	8	6	6	7	6	---	---
3	pH	-------	7	7.3	6.9	7.1	7	6.0-8.5	6.5-9.2
4	E.C	µs/cm	273	230	309	256	276	300	400
5	DO	mg/L	4.2	7.2	7.4	7.8	7.5	4-6	3PPM
6	T.H	mg/L	84	67.6	74	78	80	---	---
7	BOD	mg/L	15	14	6	9	11	---	---
8	COD	mg/L	40	35	20	27	31	4.0	10
9	TS	mg/L	186	154	239	198	165	---	---
10	TDS	mg/L	180	150	232	176	206	500ppm	500ppm
11	Alkalanity	mg/L	75	65	95	78	85	---	---
12	Sulphates	mg/L	3.5	4.1	3.3	3.1	3.6	---	---
13	Nitrates	mg/L	<0.1	0.3	0.5	<0.1	0.4	100	45
14	Chlorides	mg/L	40	31	38	43	34	---	---
15	Ca	mg/L	22.4	15.2	18.4	21.5	14.9	100	100
16	Mg	mg/L	6.8	7.2	6.8	6.6	6.9	30	150
17	Iron	mg/L	0.666	0.55	0.087	0.091	0.076	0.3	0.3
18	lead	mg/L	0.005	0.002	0.002	0.003	0.003	0.05	0.05
19	Zinc	mg/L	0.004	0.008	0.003	0.003	0.003	5.0	5.0
20	Manganese	mg/L	0.005	0.002	0.006	0.002	0.003	0.05	0.1
21	Cadmium	mg/L	0.002	0.002	0.002	0.002	0.001	0.01	0.05

Samples were collected:

S-6:- Tata plate processing compound wall**.**

S-7:- Opp vinkem lab.

S-8:- Apache foot ware pvt Ltd

S-9:- Regan power tech east

S-10:- Back side of power tech, mambattu, SPSR Nellore district, india

CONCLUSION

The major source of surface and ground water pollution is injudicious discharge of untreated industrial effluents directly into the surface water bodies resulting in serious surface and ground water pollution. This loss of water quality is causing serious health hazards and even death of human beings, also death of aquatic lives, crop failure and loss of aesthetics. This problem is aggravated by lack of awareness among public, lack of wastewater treatment

facilities, lack of financial resources and the inefficient environmental laws. From the present research study, it can be concluded that although the results are somewhat in line with the safe limits of USEPA as well as WHO but the toxic level of harmful elements can mix up with the ground water as well as surface waterif no precautionary measures were taken for filtering of the industrial effluents, which are mainly causing water pollution in the surrounding area.

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