Comparative Study of Physico- chemical Parameters of Ground water of Residential and Industrial area of Sirgitti in Bilaspur District

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Abstract: Water is available in abundance on the earth. It is one of the main reasons which make life possible on our planet. The quality strength and type of sewage depends upon the human population, industrialization, deforestation and life style of people. Analytical explorations of some selected physico- chemical parameter have been made on the ground water bodies of Sirgitti industrial area. In the present comparative study for physico-chemical analysis water samples were collected from to different locations the residential and industrial area of Sirgitti in Bilaspur district. The laboratory test of the collected water samples were performed for analysis of some selected physico-chemical parameters such as pH, EC, TDS, DO, COD, Total hardness, Fluoride, chloride etc. The methods employed for the analysis as per standard methods recommended by APHA and WHO standard of drinking water. The obtained values are compared with the standard limit. The results of this study reveals that in the industrial area of the physico-chemical parameters higher in the maximum permissible limit of WHO with variations in some parameters. Both the sampling stations groundwater unsuitable for domestic, irrigation and drinking purposes but the industrial area of BEC fertilizers groundwater is more polluted than the Adarsh nagar residential area of Sirgitti. So it is essential that the quality of ground water should be regular checked and also needs treatment before direct use.

Keywords: Physico-chemical parameters, Residential and Industrial area, TDS, DO, and Total hardness.

Introduction

Water is the basis of life for not only all human being but all living things on the earth. It is one of the most abundant compound of all kind of life[1]. Water is a non renewable natural resource so the human beings need to learn to use water responsibly. About 71% surface of the earth is covered with water which is mostly part of the oceans and other large water bodies. Water is the main source of life hence it is our prime responsibility to save it from water pollution so that pure and portable water is available to our future new generation. There is growing shortage of usable water resources day by day and it is also one of the major issue of the twenty first century[2]. Some studies have found that today most important environmental issue is the ground water to be contaminated. The Potable or fresh water, although renewable, is very limited and vulnerable resource because of mining, unplanned urbanization and the existence of different types of industries respectively.

Ground water is most suitable and ultimate portable water resources for human consumption in both urban as well as rural areas[3]. Fresh water is getting scanty mainly due to some reasons one of there is the increasing level of water pollution caused due to industrial waste and various human negligence and human activities like unplanned urbanization, deforestation and the other is the continuous wastage of water by people around the world. The use of chemical substances like pesticides, herbicides and uncontrolled disposal of industrial waste[4].So the primary cause of the ground water contamination one.

In Bilaspur the source of disposal of municipal as well as industrial waste is ground water of Sirgitti industrial area. Sirgitti and its surrounding area uninterruptedly polluted due to huge industrialization for domestic, agriculture and

irrigation purposes. Many of the people depends on ground water source of this area. So it is essential to removal of toxic substances and to explore the quantity of pollutant present with in the ground water of Sirgitti and its surrounding area[5-6].

Our planet filled generously with water thus all the mentioned needs are being taken care of since centuries. Fresh or potable water sources are getting depleted as the water bodies are being polluted due to domestic wastage in rural areas as well as industrial wastage in urban areas[7].

The purpose of the present study is to find out any impurities exertive in ground water of Sirgitti industrial area. Sirgitti is one of the industrial area of Bilaspur district. This study with help us in determining the degree of pollution in groundwater and also type of treatment required. hence it is absolutely necessary to study the characteristics and behaviour of groundwater, to discuss the levels of groundwater quality parameters in and around the sirgitti industrial area of bilaspur district and to compare the determined level with WHO drinking water standards and also calculate the data from ground water sampling stations of Sirgitti industrial area of bilaspur district.

Study Area

Bilaspur is the district headquarters and it ii the second one largest city of chhattisgarh state. It is located on the north western part of the chhattisgarh state and also on the banks of Arpa river which is called lifeline of Bilaspur. There are many industries established in Bilaspur city in which Sirgitti is one of the industrial area. Sirgitti industrial area has some residential area and some industrial plants. This industrial plants made the authors curious to analyze the quality of the ground water of industrial area of Bilaspur.

Water is being used injudiciously. The most important reasons for the deterioration of water excellent in water bodies are industrial effluents and untreated water of industries get mixed into streams and rivers. Sewerage water is also get mixed into these water bodies. So it is essential to examine the quality of water. In this present paper we have assessed comparative study of evaluation of water quality of winter season in reference of physico-chemical parameters to the industrial and residential area of Sirgitti in the Bilaspur district. Water samples collected from the two selected sites in which one Adarsh nagar residential area (S-1) and second BEC fertilizer industrial area (S-2) during November to August 2021-22.

Methods and Materials

In present investigation two Sampling stations S-1 and S-2 of the sirgitti industrial area were selected. water samples were collected in the pre-cleaned polythene bottles of one liters during November to August 2021-22. Water samples were analyzed by some physico-chemical parameters like pH, EC, TDS, DO, COD, TH, Fluoride and Chloride etc. Parameters such as pH, EC, DO were determined at the sample collection site using a potable Elico make PE-136 water analysis kit. Determination of other parameters such as Total hardness, COD, Fluoride and Chloride were carried out references the standard methods as prescribed by APHA[8] (1989), Manivaskam[9] (2000), Trivedi and Goel[10] (1986) and NEERI[11] manual on water and waste water analysis. Total dissolved solids measured by Gravimetric method. Total hardness calculated by EDTA Titrimetric method. Silver nitrate method used for chloride ions and SPANDS method used for fluoride ions in water Samples.

Result and Disscussion

The physico-chemical data of water sample collected from two sampling stations Adarsh Nagar (S-1) and BEC fertilizers (S-2) during the month from November to August 2021-22 are recorded in tables 1 & 2

Table-1: Physico-chemical parameters of water sample collected from sampling station

Adarsh Nagar (S-1) during year 2021-22

| Parameters	Units	Nov.2021	Feb.2022	May 2022	Aug2022
pH		6.51	6.82	6.71	6.85
EC	µmhos	420.00	434.20	530.00	525.00
TDS	mg/l	272.00	283.00	280.00	285.00
DO	mg/l	5.20	5.85	6.62	6.75
COD	mg/l	16.20	14.00	13.10	12.30
TH	mg/l	220.00	240.00	242.00	245.00
F⁻	mg/l	0.52	0.32	0.71	0.82
Cl⁻	mg/l	170.00	98.30	134.20	155.10

Figure-1:
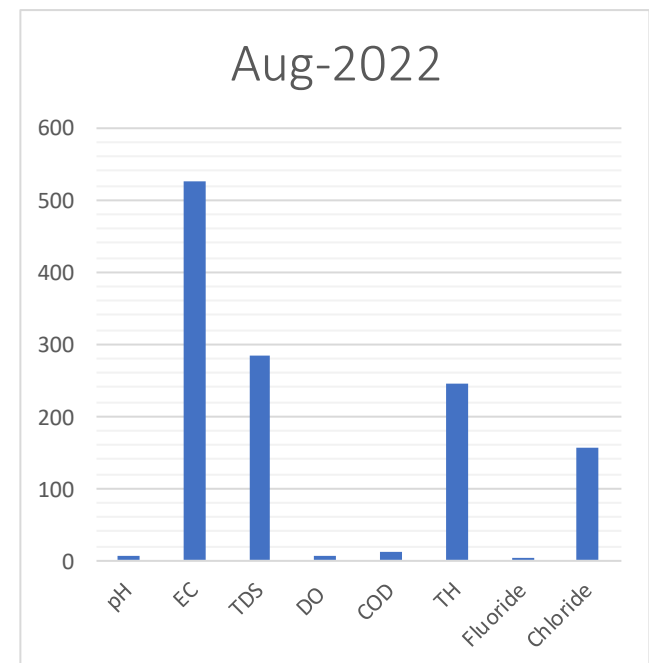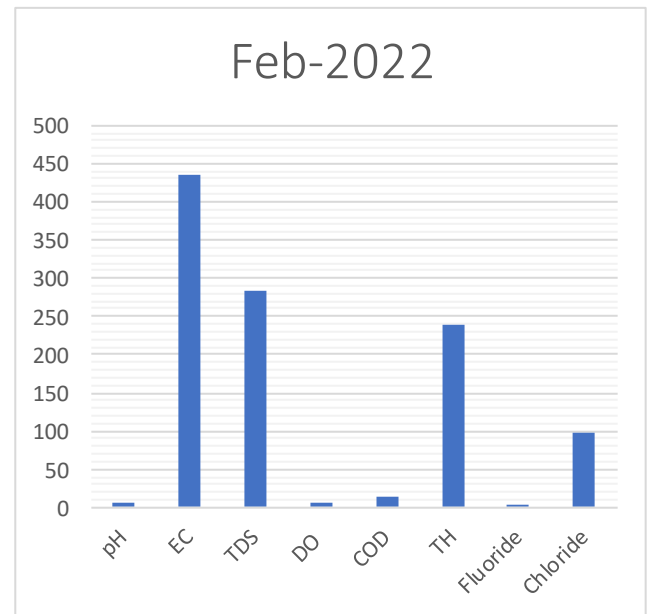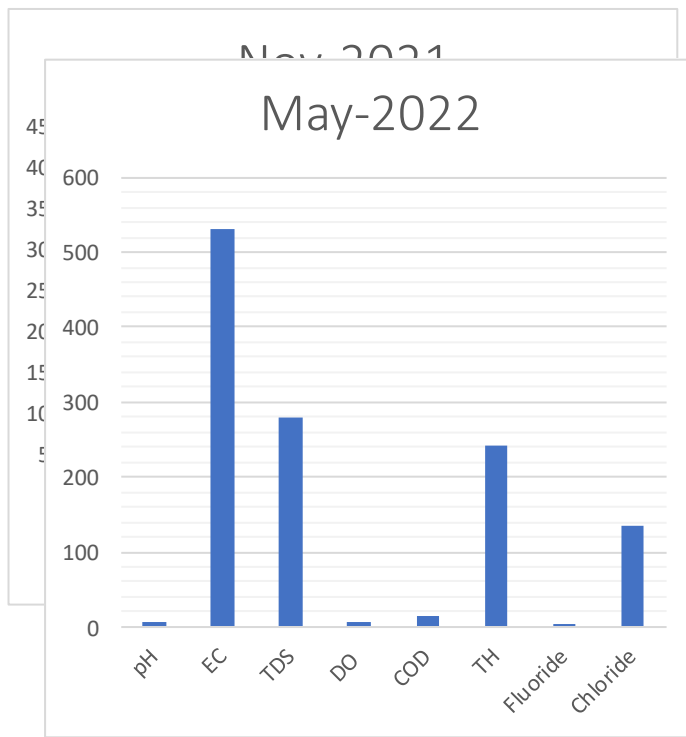
Table-2: Physico-chemical parameters of water sample collected from sampling station

BEC Fertilizer (S-2) during year 2021-22

Parameters	Units	Nov.2021	Feb.2022	May 2022	Aug.2022
pH		7.12	6.84	7.85	8.20
EC	µmhos	472.60	535.40	542.10	560.30
TDS	mg/l	560.00	572.00	581.00	590.00
DO	mg/l	7.40	6.90	8.10	7.25
COD	mg/l	17.10	20.00	18.00	19.00
TH	mg/l	340.00	332.00	362.00	383.00
F⁻	mg/l	1.02	1.18	1.21	1.25
Cl⁻	mg/l	150.00	180.30	225.00	245.00

Figure-2:
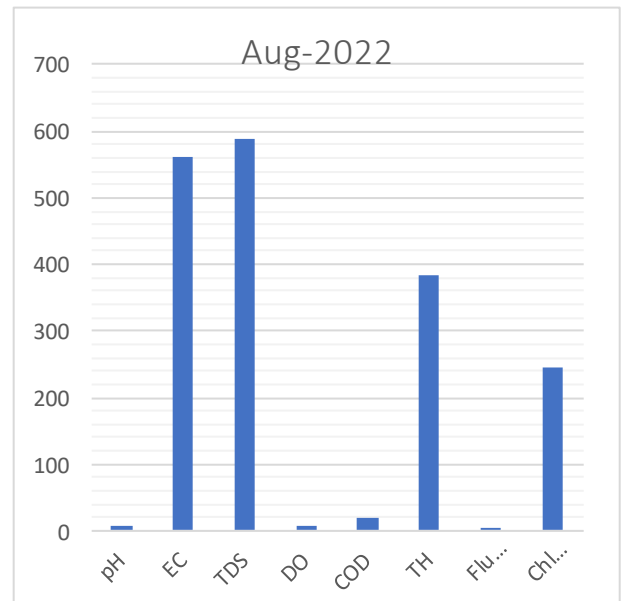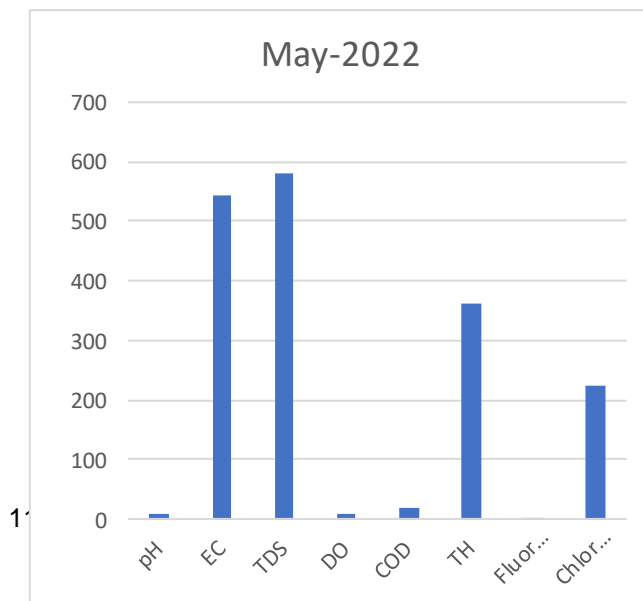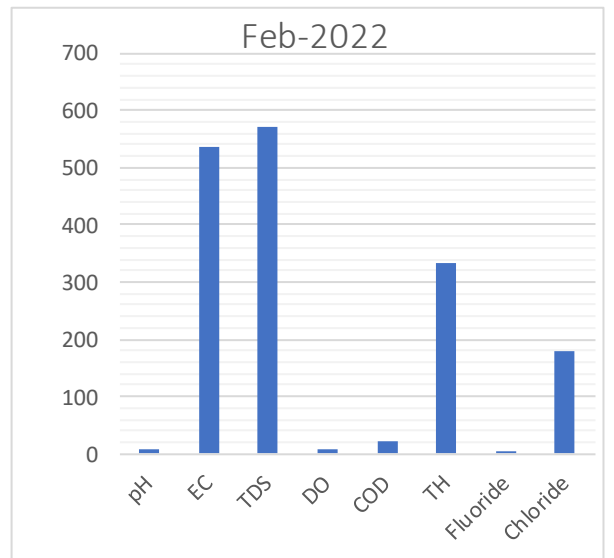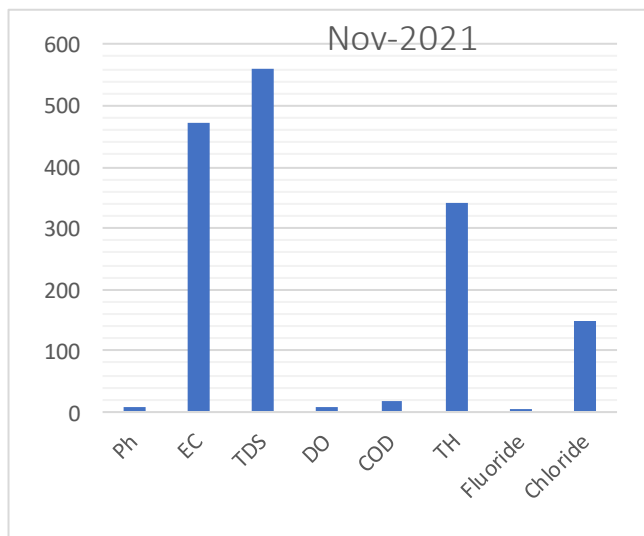
pH

The pH value is a measure of the acidity and alkalinity of the water. In water sample due to change in the amount of CO_2, carbonate and bicarbonate the variation occurs in the pH value[12-13]. The pH has no adverse effect on health but it alter taste of water as well as, all the biochemical reactions are sensitive to variation of pH. The lower values of pH may causes deactivation of digestion enzymes, tuberculation and problems in assimilation of vitamins and minerals while the higher values may produce eye irritation and exacerbation of skin disorder etc. in the present study the pH values in both the collected water samples ranged from 6.5 to 8.5 which are all within the limit.

Electrical conductivity

Electrical conductivity is a fundamental property of a materials that measures how strongly resists electric current. It is a numerical expression of the ability of an aqueous solution and also serve as tool as to assess the purity of water[14]. Maximum values of Electrical conductivity observed was 560.30 µmhos/cm in the month of August 2022 from BEC fertilizer and minimum value of EC observed was 420.20 µmhos/cm in the month of November 2021 in the ground water at Adarsh Nagar residential area. High value of EC is due to high concentration of ionic constituents present in the water body.

TDS

Solids in both form suspended and dissolved if present in large amounts may affect water quality as it may induce unfavourable physiological reaction in the water. The excess quantity of TDS was proportional to the degree of pollution[15]. The Total dissolved solids were in the range of 272-590mg/l. Minimum TDS 272mg/l was observed from ground water (S-1) Adarsh Nagar in the month of November 2021 and maximum TDS 590mg/l was observed from S-2 BEC fertilizer in the month of August 2022. The TDS value of S-2 were beyond permissible limit of 500 mg/l. Thus type of water may cause gastrointestinal irritation.

Dissolved oxygen

In water Samples DO is an important parameters and this is indicative of desirable condition for favourable growth and reproduction of aquatic organisms and also its correlation with water body gives direct and indirect information like photosynthesis, presence of nutrients, bacterial activity etc[16]. DO was recorded in the maximum range 8.10 mg/l from ground water BEC Fertilizer in the month of may 2022 and minimum range 5.20mg/l in Adarsh nagar residential area in the month of November 2021. Maximum permissible limit for DO as per WHO as United State Public Health service is 4.6-6.0mg/l[17].

Chemical Oxygen Demand

COD measurements give us an indication of accumulation of oxidizable organic matter in water body. This test is highly useful to find out the pollutional strength of industrial effluents and sewage. Higher COD in ground water indicates the presence of non-biodegradable dissolved organic carbon. The high incidence of dissolved organic carbon causes undesirable color, taste and odor in drinking water. During the study period COD values observed under the permissible limit. Maximum value was observed as 20mg/l at S-2 BEC Fertilizer during the month of February 2022 and minimum value was 12.30 mg/l at S-1 Adarsh nagar residential area in the month of August 2022.

Total hardness

The Total hardness was observed to be maximum value 362mg/l in the month of March 2022 in BEC Fertilizer and minimum value recorded was 220mg/l in the month of November 2021 at Adarsh nagar. The hardness value of both sampling stations ground water were higher than the permissible limit (200-600mg/l) as calcium carbonate from the value of table1&2. It can be concluded that ground water is hard in both ground water sources, which essentially the softening of water prior to its use.

Chloride

Chloride is indicator of the major inorganic anions in water and waste water. High chloride ion concentration indicates organic pollution in the water bodies. In water Samples when combine with calcium and magnesium may increase the corrosiveness of water[18]. Chlorides are generally found present in municipal sewage, human feces, urinary discharges etc. The permissible limit of chloride ion concentration in water is 250mg/l. During to present investigation maximum chloride ion concentration was observed 245.00mg/l in the month of August 2022 in BEC Fertilizer and minimum chloride ion concentration was observed 98.30mg/l at Adarsh Nagar residential area.

Fluoride

Fluoride is beneficial for humans, however an excess of this ion can produce numerous adverse effects on human health. Excessive fluoride intake can lead to dental fluorosis. The major supply of systemic fluoride in kids is from tap and bottled water, carbonated drinks and juices. The World health organization published in its report that around 70 million people in the world may be affected with dental fluorosis. According to WHO (1984) the maximum permissible limit of fluoride in drinking water is 1.5ppm and highest desirable limit is 1.0ppm. 20 million people are severely affected by fluorosis and 40 million people are exposed to risk of endemic fluorosis[19]. In present investigation Fluoride ion concentration recorded was under the maximum permissible limit from both the water samples. Fluoride values of the water were ranged 0.32-1.25mg/l.

Conclusion

In the present investigation has been made to evaluate the quality of ground water of residential and industrial area of Sirgitti in the Bilaspur district. The sampling was done for a period of one year which started from the month of November 2021 to August 2022. These samples were analyzed for 8 physico-chemical parameters to evaluate their suitability for domestic applications. From this comparative study in the industrial area we find that the physico-chemical parameters like EC, TDS, DO, TH and were affected to be more than permissible limit recommend by WHO. The experimental value of DO, was found 8.10mg/l and TDS in the month of may 2022 and the Electrical conductivity was found 560.30µmhos/cm, TDS was found 590.00mg/l in the month of August 2022. The main reason of high conductivity levels in water is highly mineralized ground water inflows; agricultural runoff is the main source since it flushes high nutrients into water bodies that frequently carry a higher concentration of dissolved solids, which affect the conductivity of water. High TDS value indicates that leaching of salts and home sewage and soil percolating into ground water in the industrial area of Sirgitti. In current study the Hardness value was found 383.000 mg/l in the month of August 2022 in the BEC Fertilizer. The ground water becomes hard due to the natural buildup of calcium and magnesium ions and salts. Based on these obeservations we find that the ground water in BEC Fertilizer industrial area (S-2) is more polluted to more extent than the ground water at Adarsh Nagar residential area (S-1).

It can be concluded that in those bore well which situated in the industrial area were larger affected because the ground water of this area are quite heavily polluted and the water is not more suitable for domestic purposes.So it is suggested that regular monitoring of the physico-chemical parameters is required at strategically selected sites otherwise both areas will become more and more power to water related hazards and the ultimate suffer will be the people residing in the nearby areas.

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