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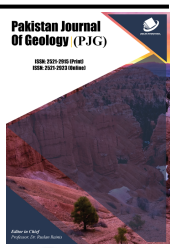

IMPACT OF INDUSTRIAL EFFLUENTS ON GROUND WATER QUALITY- A CASE STUDY OF GUJRANWALA, PAKISTAN

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ABSTRACT

Industrial effluents are polluting our natural resources, surface as well as ground water. No doubt industrial development is the need of the hours, but they are destroying the quality of life. By directly discharging wastewater in the drain poses a substantial impact on all factors of environment. The current study was conducted to investigate the groundwater condition and quality of nearby areas of different industries (textile and tannery) due to untreated disposal of waste water. Sampling points were selected within the range of 4km from particular industry. Important parameters for ground water quality were investigated. It included pH, hardness, Chlorides, Nitrates and TDS. Results have shown deviations from their respective permissible limits that is a big indicator of groundwater destruction due to disposal of industrial waste water that is composed of several dangerous pollutants. It is the need of the hour to work on the wastewater treatment programs so that waste water will be processed to remove pollutants and can be used again. This is 2 in 1 strategy. Treated water will be free of pollutants and can be used again. Fresh water demand will be lessened.

KEYWORDS

Ground water, Contaminant, Effluent, Industrial impacts.

1. INTRODUCTION

Water is crucial ingredient for all organism, structures and stages of life. Surface water and ground water are two important sources of water [1]. Ground water is one of the precious natural capital. In Pakistan, ground water is a major source of many important applications in agricultures and industries. In Punjab 79% of area is occupied by fresh water ground water, where it is mostly used for domestic and irrigation purposes. Out of 79% 3 million acres are facing salinity almost up to 3000 mg/l TDS and 3.26 million acres area has crossed salinity limit of more than 3000 mg/l [2]. On one side industrial revolution changed the world and shifted our life to comfort zone but on the other hand, they are ruining our environment in a number of ways [3]. Decline in ground water quality is a consequences of increase population, rapid growing urbanization, unsustainable rules and uncontrolled dumping of solid waste, liquid waste and lack of monitoring of enforcement of different laws [4].

Effluents discharge directly to water body is extremely an alarming situation [5]. Release of industrial waste water without any treatment in natural body is a cause of declining dissolved oxygen which is the basic need of aquatic organisms. It results in high level of BOD and TDS [6]. Heavy metals concentrations in ground water is a result of leaching of contaminant from natural body to ground water because water is universal solvent and it has ability to carry pollutants or any substance from one corner of region to another [7]. Water quality related issues are facing by major cities of Pakistan e.g. Sheikhupura, Karachi, Rawalpindi, Peshawar, Kasur, Lahore, Gujranwala, Sialkot and Faisalabad due to discharge of untreated wastewater (domestic and industrial) [8]. Effluents from different industrial sectors contain a variety of pollutants and chemicals like Cr, Cd, dyes, Pb, Zn, Dioxins and many others that are extremely dangerous to health of humans and aquatic organisms [9].

After entering in a natural body, they are deteriorating the water quality of streams and with the passage of time they enter the ground water because they are persistent and have a long life. The areas around the industries have to suffer with a very bad quality water. They are affecting human health, increases the cost of water treatment and consumes more soap during domestic usage. As a result, the domestic effluents contain more chemical compounds. The aim of this study is to investigate the ground water quality around the nearby areas of industries so that it will helpful for the respective authorities and agencies for making its remedial strategies and plans.

2. DESCRIPTION OF THE STUDY AREA

Current study was regulated in District Gujranwala where a number of factories are located in and around the city. It is located 32.16 latitude and 74.19 longitude and 231 m above sea level. It is known as third largest industrial sector after Karachi and Faisalabad. Sugarcanes, grains, melons and rice are important in this region for export [10]. It has famous name in industrial production of textiles, tannery, iron products, metal utensils, steel and sanitary etc. Waste water from different industries of ghee, tanneries, ceramic, flour and textile industries are disposed of in natural drain without any treatment and control.

3. METHODOLOGY

A survey was conducted for the investigation of water quality of Gujranwala area around the different industrial zones. Five points for collecting ground water samples were selected within 4km range around textile and tannery industry. Samples were collected using standard procedure of sampling. Before collecting samples, water was allowed to run for almost 15 minutes from hand pumps Samples were preserved and transported to laboratory for testing procedure. Then all samples were tested against following parameters TDS, hardness, pH, Chlorides, and nitrates. We used a Fenway Meter for finding the pH meter. For find the Total Dissolved Solids, the equipment used was Hanna Meter. Hardness was determined by formula of hardness that included calcium and magnesium that were firstly titrated. Chlorides were determined by titration method. Nitrates were determined by UV spectrophotometer.

Table 1: Groundwater samples collection format along with distance from specific source

Sr. No.	Sample Name	Estimated Distance from Industry	Remarks
1	X1	1 Km	Samples from different distances within range 4km from textile industry
2	X2	2 Km	
3	X3	2.5 Km	
4	X4	3 Km	
5	X5	4 Km	
6	Y1	4 Km	Samples from different distances within range 4km from tannery industry
7	Y2	3 Km	
8	Y3	2.5 Km	
9	Y4	2 Km	
10	Y5	1 Km	

4. RESULTS AND DISCUSSION

4.1 TDS in Groundwater

It measures the amount of total dissolved solids in water. It is one of the methods of salinity measurement. High TDS cause bitter taste and give rise to hardness. It constitutes inorganic salts as well some traces of organic. Ground water from nearby areas of tannery site shows high deviation from standard values of NEQS 1000mg/l while samples of ground water from nearby points or sites from textile industry show less variation but both are not acceptable. Different types of inorganic salts are used e.g. ammonium sulfate are used during the delimbing process in tannery that helps in removing of hairs from skins. These types of salts are get dissolved with water and leach towards ground water.

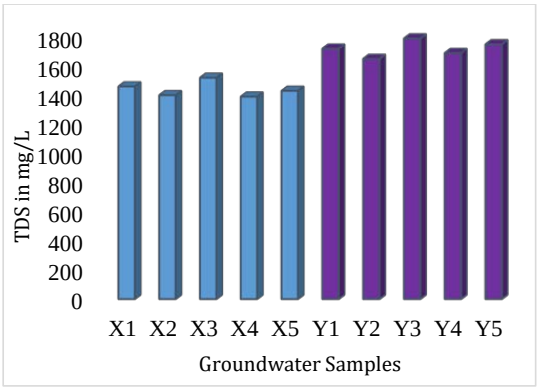

Figure 1: TDS of Groundwater Samples

4.2 Values of Chlorides in Ground Water

Different compounds of chlorides like ammonium chlorides are widely used in industry for controlling pH and exerts a mild diuretic effect. It is also used as bleaching agent. Trichloroethane is used widely in textile to clean fabric and to get dissolve many other substances during manufacturing processes. They are extremely toxic compounds. The samples show high values as compared to WHO standard 250mg/l.

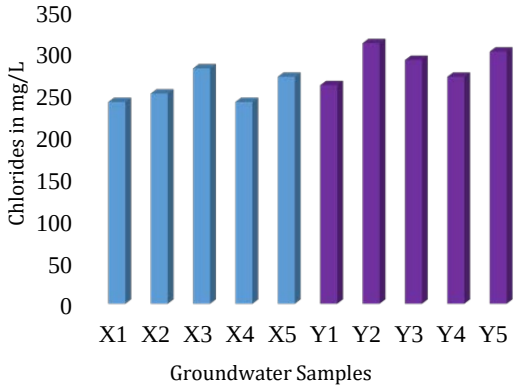

Figure 2: Chlorides of Groundwater Samples

4.3 pH of Ground Water

It is a measure of water nature whether it is acidic or basic. A water with pH values between 6.5 to 8.5 are generally considered satisfactory for drinking and other domestic use. More acidic water will difficult to treat and affect the aquatic organisms and infrastructures of water system. More alkaline water causes bitter taste to use which is undesirable by many people.

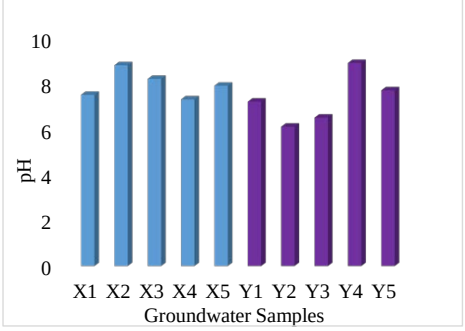

Figure 3: pH of Groundwater Samples

4.4 Values of Nitrates in Ground Water

Samples of ground water are showing high deviation from standard values of nitrate (EPA 10 mg/l). Nitrate with addition of some compounds like ammonium nitrate and cupric nitrate etc. is used in textile industry for dyeing of fabric and yarns. In tannery industry nitrate might be as a result of several components in tannery effluent containing nitrogen as part of the chemical structure and the nitrogen contained in proteinaceous material (from liming un hairy operation).

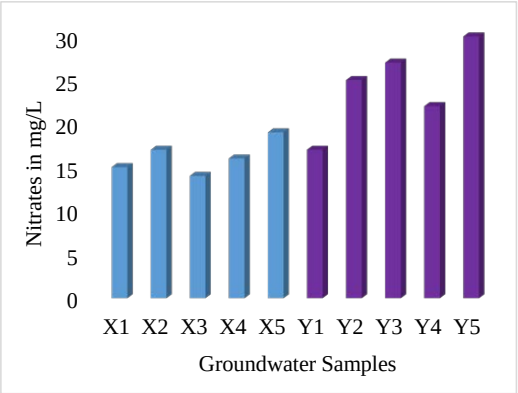

Figure 4: Nitrates of Groundwater Samples

4.5 Values of Hardness in Ground Water

Calcium and magnesium are two important ant minerals that make water hard. Samples of ground water from nearby points of both industries indicates slight hardness while some samples are under controlled limits. Water with hardness values between 120mg/l-180mg/l are considered as moderately hard while above 180mg/l is considered as very hard water with potential negative impacts. If ground water becomes hard it will affect our daily activities like more consumption of soap and detergents that will eventually pollute our domestic wastewater.

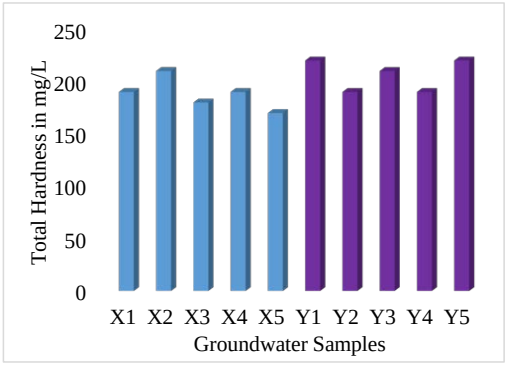

Figure 5: Total Hardness in Groundwater Samples

5. CONCLUSION

The water quality study of nearby regions of industrial sector in Gujranwala indicates the importance of wastewater treatment. No one can deny the importance of tannery and textile industries, but they are killing the people and environment. The chemical and substances used for making this economy are extremely dangerous, health affecting and most importantly depleting the quality of our natural resources. Water is the basic need of our survival. The number of patients admitted in hospitals of Pakistan with water borne diseases has increased about 200% in the last two decades is the evidence of the water quality is going to be decreasing day by day.

6. RECOMMENDATIONS

- The Government should make actions against all industries for the proper disposal of all types of wastes.
- Direct effluent disposal to any natural drain must be banned
- Water treatment should make necessary for all production companies particularly that are consuming the dangerous chemicals before it's too late.
- Penalties should be fixed in case of violations of rules.
- There should be a fair and strike audits of these industries as monitoring purposes.

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