GROUND WATER QUALITY PROFILE OF KALA SHAH KAKU

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ABSTRACT. A study on the contamination of ground water by industrial effluent in different areas of Kala Shah Kaku has been conducted. Kala Shah Kaku is one of the industrial areas in Punjab. The industrial effluent is one of the major causes of drinking water contamination in such areas. Grounwater samples have been analyzed for their different characteristics. Standard laboratory techniques have been employed to determine various parameters from the samples. The mean values of pH, Na^+, and SO_4^{2-} are within the permissible limits of WHO standards. Whereas conductivity, turbidity, hardness, TDS, Cl^-, Alkalinity, and potassium levels were above the permissible limit of WHO standard. On the basis of that we can say that the ground water of Kala Shah Kaku is hard and not suitable for drinking and it should be monitored.

Key words: water, Kala Shah Kaku, hardness.

INTRODUCTION

The two major sources of drinking water in Pakistan are surface water and ground water. Ground water quality varies from place to place depending upon geological conditions and anthropogenic activates. Mostly ground waters are supplied to communities without treatment (Butt et al., 2006). Large cities and industries are situated near banks of rivers, lakes and seashores. Their all waste material comprising various salts and other chemicals are disposed into water bodies. In fact ground water due to seepage of pollutants turns to be unfit for human and agricultural use

The industry today is considered as backbone of country's economy. It plays an important role in revolutionizing socio economic structure of a nation. The major types of industries established in Pakistan are leather, textile and sugar industries. Most of the industries developed in the country have unfortunately given little attention to the control and management of their industrial wastes. Industrial liquid waste is either discharged into natural water bodies without proper treatment. This causes water pollution problem. Due to varied nature of manufacturing processes, the industrial effluent may vary widely in nature and composition. These may be organic or inorganic chemicals such as inorganic acids, alkalis, oils, detergents, leather tanning wastes and electroplating wastes (World Bank, 1999). The effluents discharged by different industries contain a high range of physico-chemical parameters like temperature, pH, conductivity, hardness, alkalinity, Chemical Oxygen Demand (COD), Total Suspended Sediments (TSS), nitrates, nitrites, cations (Na^+, K^+, Ca^{2+} and Mg^{2+}) and anions (Cl^-, CO_3^{2-}, HCO_3^-, SO_4^{2-}). These effluents from different industries also contain heavy metals and trace metals including chromium, cadmium, copper, lead, nickel, zinc, cobalt, magnesium, iron and arsenic (Alim et al., 1996).

All over the world during the last few decades, rapidly developing technologies, industrialization, increasing population and urbanization have resulted air, water and soil pollution. Similarly in Pakistan the deterioration of environmental quality has become a serious problem. Environmental profile of Pakistan indicated that 40% deaths are related to water borne diseases (Saleemi, 1993).

In Pakistan only 53% population has access to clean drinking water. It is noteworthy that 60% children die because of polluted water, 30% diseases of intestines and stomach are also caused by using contaminated water (Hussain, 2000).

Kala Shah Kaku is located at a distance of about 17 km from Lahore Gujranwala G.T road. Kala Shah Kaku industrial complex covers about 10 sq km area along both sides of G.T road with number of industrial establishment dealing with production of metals, chemicals, papers, leather, textile, ceramics and other industrial activities. Ground water of Kala Shah Kaku is contaminated by seepage of untreated effluents from various industries. Population of area use ground water as a source of drinking water. Present study was an effort to monitor the concentration and ratio of various pollutants present in the ground water of Kala Shah Kaku Area.

MATERIALS AND METHODS

Ground water samples were collected from fifteen different locations of Kala Shah Kaku industrial area, Lahore. Three sample from each sited was collected in clean polyethylene bottles. Bottles were washed with

detergents plenty of water and finally with deionized water. Before sampling each bottle was rinsed to pre concentrated with sample of water. Water samples were brought to the Punjab University CEES laboratory, immediately stored at 4 ˚C and analyzed. All necessary precautions were observed while sampling, storage and transportation of samples (ALPHA, 2005). A.R grade chemicals were used in the preparation of reagents and standards Analysis for each sample was performed in triplicate and average values were recorded. PH conductivity and temperature was recorded immediately after collection of each sample using pH and conductivity meters. All other analysis in this study was completed within 48 hours after each sampling. Sulfate by turbid metric method, Total dissolved solids were determined by heating at 180˚C, chlorides by argintometic titration, alkalinity by acidimetric titration with HCl, calcium and magnesium were determined by EDTA titration method whereas sodium and potassium by flame photometer (World Health Organization, 2004).

RESULTS AND DISCUSSION

The health risk due to toxic chemicals in drinking water differs from that caused by microbial contaminants. There are few chemical constituents of water that leads to acute health problems except through massive accidentals contamination of supply. In the present study drinking water samples were collected from different locations of Kala Shah Kaku. Analytical data of these samples are given in table 1.

Generally acidity in pure water is due to the presence of dissolved carbonic acid. The presences of free minerals acids in industrials make the water more acidic. Table 1 shows that pH in all the samples range from 7.2 to 8.3 which is within the permissive limit of WHO standard that is 7.0-8.3, (table 2).

Conductivity is dependent upon the presence of ions in the solution. The water samples of Kala Shah Kaku show conductivity from 685-2981microsciemens per centimeter (µs/cm). This variation is due to the difference in the concentration of free ion due to the presence of industry waste, which contain free ions like K^+ Cl^-. Similar results were reported by earlier workers (Bangash and Alam, 2003).

Total hardness in water is mainly due to the presence of carbonates of calcium and magnesium. Total hardness determined in the samples range from 28.3 to 278.2 mg/l. Water is characterized as very soft, if its hardness is < 15 mg/l as CaCO3, soft when it ranges 15-50 mg/l, medium hard when 50-100 mg/l, hard when 100-200 mg/l and very hard when it is >200 mg/l as $CaCO_3$ (Snell and Ettre, 1974). On the basis of our findings, ground water of Kala Shah Kaku may be characterized as hard to very hard.

Table 1 and figure 1 show that Total Dissolve Solids (TDS) varies between 487-2085mg/l. The maximum TDS were in Salamat Pura due to the presence of industry and minimum in agriculture area due to less polluted area. Figure 2 and 3 shows the hardness and electrical conductivity distribution in the area.

Alkalinity in water is mostly due to the presence of carbonates bicarbonates, hydroxides and basic radicals like calcium, magnesium sodium and potassium. The samples collected from different localities of Kala Shah Kaku show alkalinity 252-646. Which is above than the recommended standard for drinking water i.e 500mg/l. Beyond this limit, problems like hardness, gastrointestinal irritation, kidney stone and explosion of metallic pipes due to accumulation of scales in side are resulted (Madhavan, 2002). Chlorides in water bodies are mostly present in combination with sodium calcium and magnesium. Its concentration varies with physiological and biological actions. Chlorides make its routes through natural mineral rocks, seawater, irrigation discharge, or from industrial effluent. Table 1 shows the chloride concentration in the drinking water of Kala Shah Kaku and is in range of 48-674.5. Whereas the permissible level for drinking purpose is 250 mg/l. Thus some samples have the chloride concentration above permissible range. The high chloride concentration has toxic effect (Madhavan, 2002).

Sulphate in domestic water contributes to permanent hardness. Table 1 shows the quantity of sulphate in selected areas of Kala Shah Kaku. These are `in the limits of 58-352.5mg/l. whereas its maximum limit with regard to health is 400mg/l the determined concentration is thus below the optimum concentration. When the sulphate concentration exceeds that of recommended level, tan laxative and corrosive mode of action results.

Sodium is present in natural water in abundance. As we can see from table 1 that the sodium concentration is 80-440mg/l, which is below the threshold. The light concentration of sodium imparts taste to the water and makes it unfit for every day use (Trived and Gurrdeep, 1992).

Potassium is an important micronutrient for plants and human beings, playing an important role in the metabolism process of animals (Trived and Gurrdeep, 1992). The highest permissible concentration of potassium in drinking water with respect to health is 20mg/l. The samples collected from certain places indicate the high concentration of potassium contents as compared to permissible limits for drinking water in table 2.

Table 1 Quality Parameters in Drinking water samples collected from different locations of Kala Shah Kaku

Sample area	pH	Cond-uctance	Tur-bidity	Hard-ness	TDS	Cl^-	SO_4^{--}	Alka-linity	Na^+	K^+
		µs/ cm	NTU				mg/l			
Agricultural farm	7.5	698	15.2	46.8	487	48.0	58.2	252.0	80.0	2.0
Mauza jair	8.3	968	5.5	28.3	625	60.4	86.3	329.4	162.0	4.0
Chak No.44	7.4	1220	4.9	3.39	852	78.1	98.6	440.0	180.0	0.15
I.C Colony	7.2	1867	26	120.5	1305	376.3	270.0	336.7	197.0	5.0
Hakim Pura	7.2	2254	37	169.6	1580	674.5	157.5	291.6	278.0	8.0
I.C limited	8.3	1095	6.1	116.0	763	188.8	142.1	262.3	118.0	6.0
Chappa khana	7.7	1330	7.2	70.0	932	177.5	195.0	276.9	200.0	12.0
Fazal Pura	7.5	1428	7.1	112.2	1000	180.0	177.0	347.7	170.0	14.0
Rakh Bauli	7.4	1682	29	90.0	1180	210.0	192.0	431.9	250.0	4.0
Salamt Pura	7.2	2981	33	278.2	2085	350.3	352.5	646.6	440.0	7.0
Monno Abad	7.8	685	33	34.8	599.6	88.7	57.5	280.6	135.0	3.0
Zia abad	7.9	904	6.9	33.6	632	71.0	104.0	270.8	150.0	2.0
Ravi Rayan Pura	7.4	1645	13.4	125.8	1152	195.3	217.5	408.0	200.0	5.0
Kala shah kaku	7.7	2332	6.1	121.9	1632	259.8	365.0	510.0	350.0	25.0
Bhatta Abadi	7.5	1708	6.0	85.4	1196	180.0	142.0	456.0	225.0	8.0

Table 2 WHO Standards for drinking water

Parameters	Permissive	Excessive
pH	7.0-8.5	<6.5 or > 9.2
Total Hardness (as $CaCO_3$)	300 mg/l	600 mg/l
Turbidity	5 Units	25 Units
Total Dissolved Solids	500 mg/l	1500 mg/l
Sulphate	250 mg/l	400 mg/l
Chloride	250 mg/l	1000 mg/l

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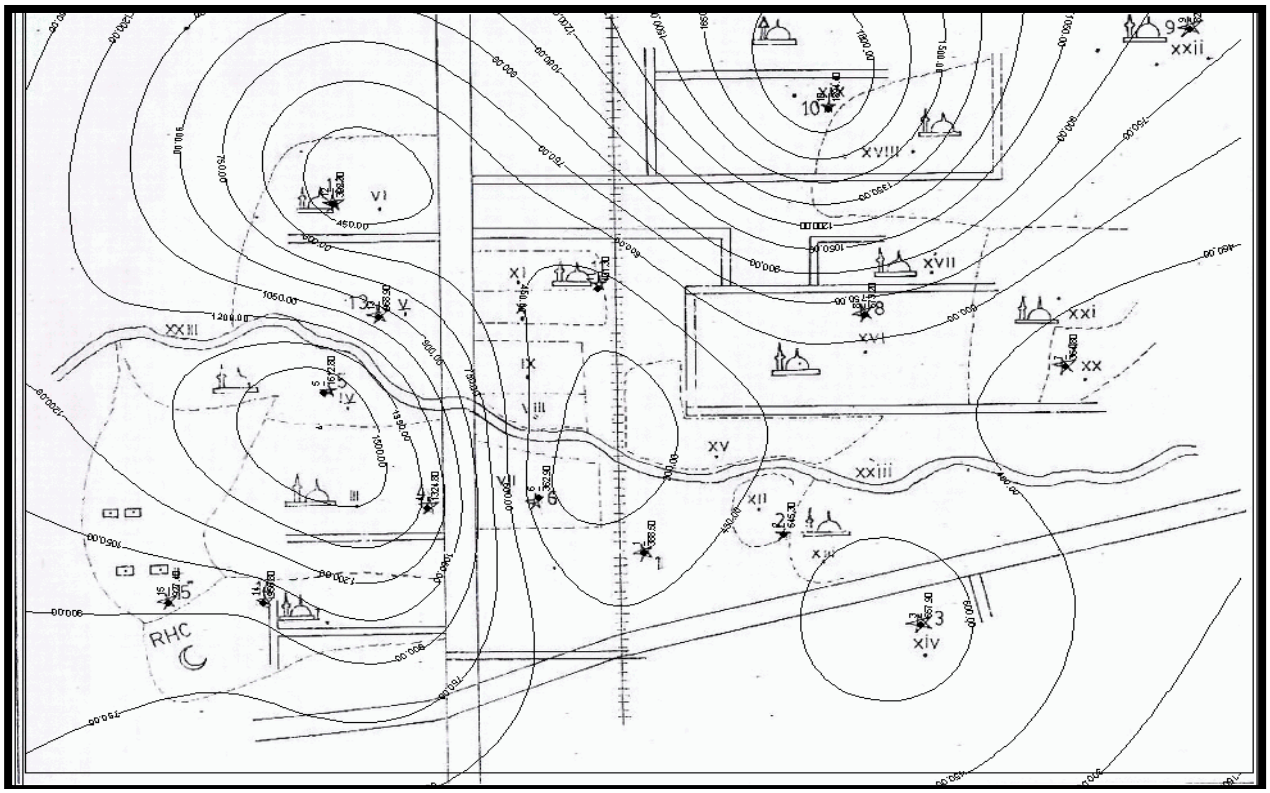

Figure 1 Contours of TDS **Symbols**

Road--Village Boundary Deg Nallah Railway Line Village

Health Center Mosque Brick Killen

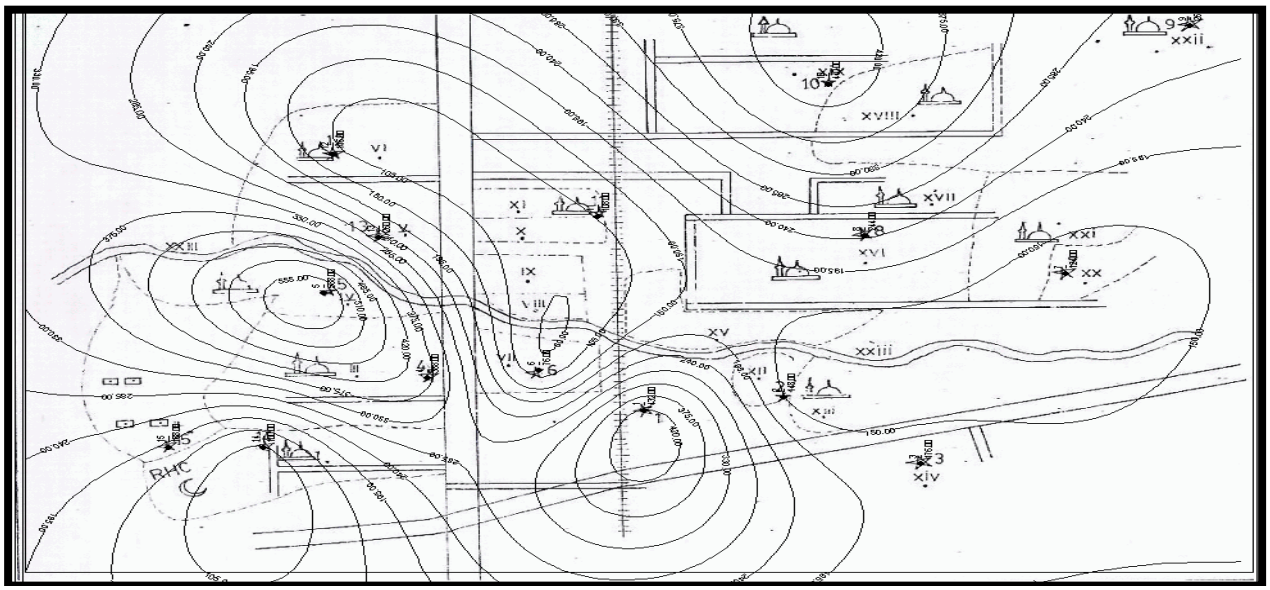

Figure 2 Contours of Total Hardness **Symbols**

Road--Village Boundary Deg Nallah Railway Line Village

Health Center Mosque Brick Killen

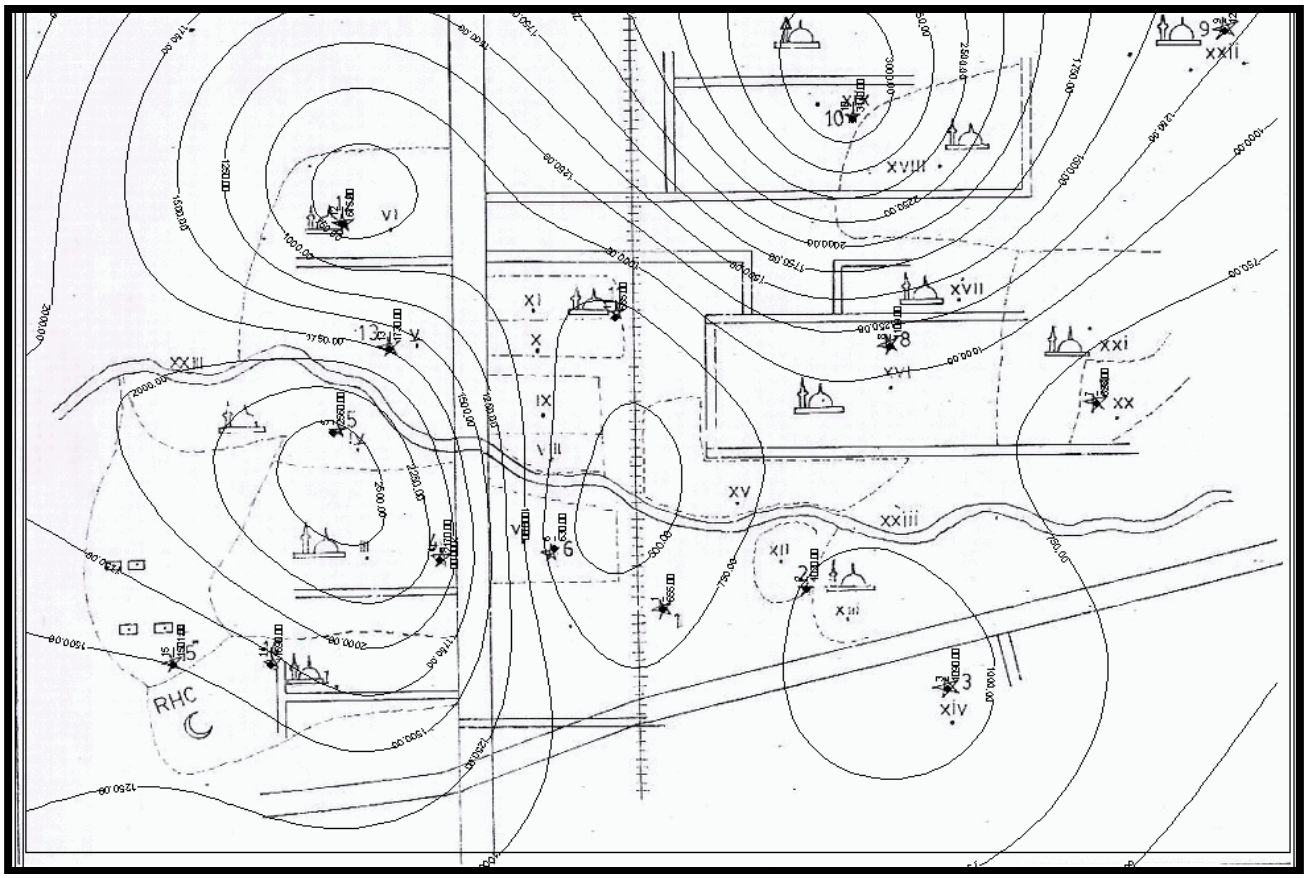

Figure 3 Contours of Electrical Conductivity

Symbols

Road--Village Boundary

Deg Nallah

Railway Line

Village

Health Center

Mosque

Brick Killen