Assessment of Groundwater Quality of Taluka Larkana, Sindh, Pakistan

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Abstract—Groundwater contamination issues are arising in various parts of the world, including Taluka Larkana, Sindh, Pakistan.Where most of the people use groundwater to meet their domestic needs. Keeping in view the gravity of the problem and concerns of the local communities of the area, about water quality issues, the present study was conducted to assess the quality of groundwater of Larkana Taluka, Sindh, Pakistan for domestic use. About 43 groundwater samples were gathered from hand pumps, electric motor bores installed at various public spots of the studied Taluka. Water samples were analysed for various physical and chemical parameters including pH, electric conductivity (EC), total hardness (TH), and total dissolved solids (TDS) using standard available field and laboratory methods. Results were compared with drinking water quality guidelines prescribed by the World Health Organization (WHO 2011). Analysis revealed that, about 53.48%, 83.72%, 20.93%, and 83.72% of the groundwater samples had pH, EC, TH, and TDS concentrations beyond the desirable limits suggested by WHO. Overall, the study revelaed that the quality of groundwater in rural areas of the study area is unsuitable for human consumption. Thus, it should be properly treated before its use for drinking purposes.

Index Terms—Groundwater; physicochemical parameters; TDS; Taluka Larkana

1 Introduction

Water is component, which has major importance in all aspects of human life. The water also plays a remarkable role in the survival of ecosystems. But due to various factors like climatic variations, global warming, deforestation, increase in population, improper management and rapid increase in urbanization has led to a scarcity of potable water [1-2].

Pakistan is also one of the countries facing water shortage and safe drinking water quality issues. It is found that the main source of waterborne diseases in Pakistan is the mixing of contaminated water from hazardous industries, agrochemical at several locations of the water distribution system. Pakistan has been suffering from dangerous waterborne diseases such as parasitic worms, diarrhoea, gastro, typhoid, etc. As per IUCN (International Union on Conservation of Nature 2017) reports, in Pakistan 60 percentage of infant's lives are lost by diarrhoea. In Asia, this toll is highest [3].

In the Sindh province of Pakistan, the safe water conditions are worst. Overall, 41% of the population in Sindh has access to tap water, and this amount declines to 7% if only considering the rural areas. In 2017, the Pakistan Council of Research in Water Resources (PCRWR) found by taking water samples from at least14 districts of Sindh including Karachi, Hyderabad, that 80% of the collected water samples were not suitable for human consumption. Also, in Karachi, 90% of water samples were not safe for drinking. Every year, in Tharparkar many lives are being lost including children and women, due to unavailability of drinking water. The public of the part of Sindh is severely undernourished due to water shortage and the incapability of growing food [4].

2 Experimental Work

2.1 The Study Area

The Larkana city of Sindh Pakistan is situated on the right bank of River Indus. There are five subdivisions of Larkana district i-e taluka Dokri, taluka Bakrani, taluka Larkana, taluka Ratodero and taluka Naudero. Taluka Larkana is major of all five talukas. Google map showing the location of the study area is depicted in Fig. 1. Taluka Larkana is located between geographical coordinates of 27°33'18" N and 68°12'51" E [5].

. Fig 1: Google map showing the location map of the Study Area

2.2 Analysis of the Groundwater Samples

About 43 groundwater samples were collected from hand pumps, tube wells and electric motors installed at various locations of the study area. The samples were collected in about ½ litres, properly washed plastic bottles. The bottles were sterilised and washed properly with water to remove any possible contamination. During the study, it was found that the average depth of hand pumps varied from 15-30 m throughout the Taluka. According to the depth the purging process was applied for hand pumps. If the hand pump was bored at 15 m depth, it needed 45 strokes. All groundwater samples collected were properly coded, sealed and preserved and then brought to the laboratory for physicochemical analysis.

2.3 Water Quality Parameters

The collected samples were tested for various physical and chemical properties including color, odor, taste, pH, total hardness (TH), electrical conductivity (EC) and total dissolved solid (TDS). For determination of all parameters standard

methods were followed. Color (TCU), odor, and taste such as either water is bitter, salty, sour or sweet were determined by sensory test. However, Lamotte turbidity meter, EC, pH and TDS meters were used to observe turbidity, EC, pH and TDS values in water respectively.All these test were carried out at Drainage and Reclamation Institute of Pakistan (DRIP) Tandojam campus. All the results were then compared with WHO permissible limits.

3 Results and Discussion

3. 1 Color, odor and Taste

Analysis for color, taste and odor in the groundwater samples of the study revealed that most of the samples were colorless, odorless. Also, most of the samples were found sweet by taste. However, the taste of the groundwater samples collected from Lashari village, Zakario Mahesar, Rasheed Wagon, Hashim Chawro, Gul Muhammad Chawro and Shahbeg Jamali villages were bitter in taste, and found unsuitable for drinking purpose. It means 13.95% of area was using bitter taste water for consumption.

3.2 Turbidity

The analysis of groundwater samples revealed that the turbidity in the groundwater of the study area ranged from 0-3 NTU with average value of 0.49 NTU while the recommended value for drinking water is 5 NTU [6]. Turbidity is measurement of suspended particles in water. The particles suspended in the water strengthen the contact of too many metals and other dangerous minerals and pesticides, which makes the water cloudy and opaque, thus creating human health problems [10].

3.3pH

The analysis of groundwater water samples disclosed that the pH value of samples varied from 7.9-7.2 with an average value of 7.54.While the permissible limit of pH in drinking water is 7 [6]. The samples collected from twenty three (23) locations had pH value beyond the WHO guidelines and remaining twenty (20) samples possessed the pH value within permissible limits as decribed graphically in Fig.2.

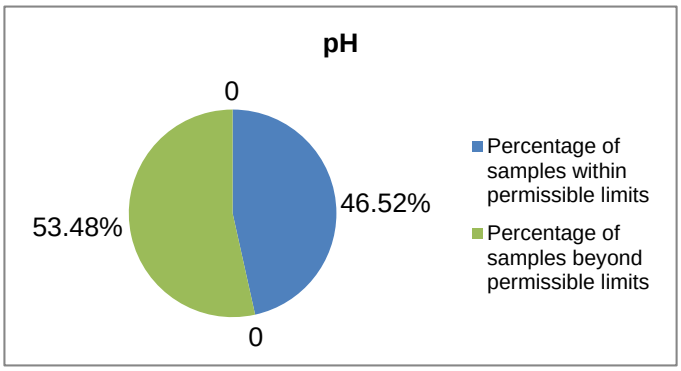

Fig 2: Status of pH in the groundwater of the study area

3.4. Electrical Conductivity (EC)

The EC is the most important parameter that is used as a primary index for deciding whether water is suitable for consumption and irrigation [7-8]. For drinking purposes the recommended value of EC is 0.7 dS/m [6]. The analysis of groundwater samples in this study revealed that, the EC ranged from 0.56 – 7.22 dS/m with an average value of 1.74 dS/m. The results found that only seven (7) locations possessed the EC within permissible limits and remaining thirty six (36) locations showed the EC value within permissible limits as depicted in Fig. 3. The high concentration of EC in groundwater might be due to leaching of soil salts [9].

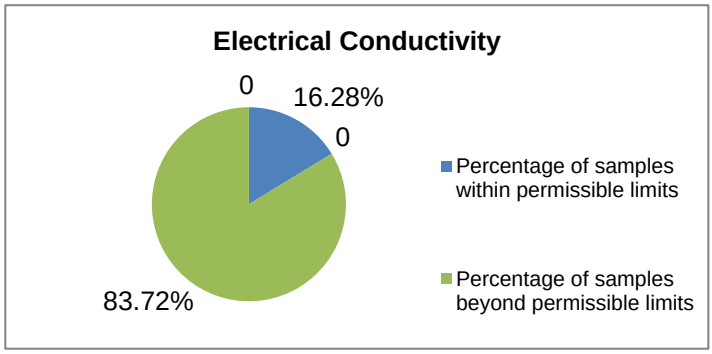

Fig 3: Status of EC in the groundwater of the study area

3.5Total Hardness

Calcium and magnesium are key parameters for the overall hardness in the groundwater. With hard water, excessive use of soap is required for cleaning [10].According to WHO guidelines, the most desirable total hardness limit for drinking water is 100 mg /L and the maximum allowable limit is 500 mg /L [6].However, the values of total hardness in the study area varied from 78-1100 mg/L with a mean value of 413.44 mg/L.The results showed that nine (9) locations of the Taluka Larkana had total hardness value above the permissible limits and only thirty four (34) locations found having total hardness value within permissible limits as depicted in Fig. 4.

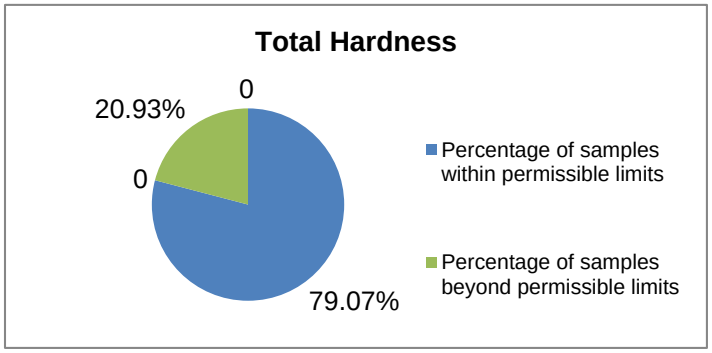

Fig 4: Status of TH in the groundwater

3.6 Total Dissolved Solids (TDS)

Total dissolved solids (TDS) refer to the sum of positively charged ions and anions (negatively charged ions) in water. As per WHO guidelines permissible limit of TDS for drinking water is 500 mg/L [9]. In analysis of groundwater water of Taluka Larkana it was revealed that the value of TDS varied from 351-4620 mg/L with an average value of 1217.72 mg/L. The results revealed only seven (7) location possessed TDS value within permissible limit and remaining thirty six (36) locations had TDS value beyond permis-

sible limits as shown in Fig.5.

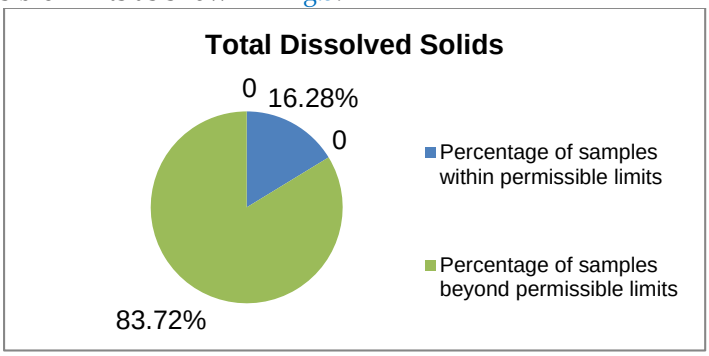

Fig 5: Status TDS in the groundwater of the study area

Analysis revealed that, about 53.48%, 83.72%, 20.93%, and 83.72% of the groundwater samples had pH, EC, TH, and TDS concentrations beyond the desirable limits suggested by WHO limits as depicted in depicted in Fig. 6.

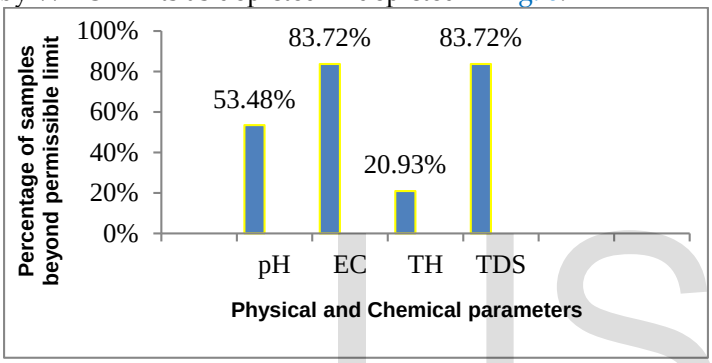

Fig.6.Status of Physicochemical Parameters lying beyond the WHO Guidelines

4. Conclusions

Analysis based on the physicochemical investigation of the groundwater samples revealed that the groundwater of the study area is colorless, odourless, having no turbidity. However, about 13.95 % of samples had bitter and salty taste. Furthermore about 53.48%, 83.72%, 20.93%, and 83.72% of the groundwater samples had pH, EC, TH, and TDS concentrations beyond the desirable limits suggested by WHO limits. Overall, the present study revealed that the quality of groundwater samples collected from rural areas of the study Taluka Larkana was unsuitable for human consumption. However, most vulnerable areas having all the physical and chemical parameters above the permissible WHO limits include Lashari Village, Zakario Mahesar, Rasheed Wagan, Shah Hasan, Village Gul Muhammad Chawro, Village Shahbeg Jamali, and Mehmodero. In these areas, people either fetch the water from other areas or are compelled to drink this contaminated water. Overall 27.9% of the study area had unsuitable groundwater for consumption.

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