

## 310. Rainfall Impact on Ground Water Quality in Mirpur Sakro, District Thatta

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### Abstract

Ground water is considered as the precious source of water to live a happy life. In Pakistan, it has been widely used for drinking, cooking and sanitation purposes. The quality of ground water is a major concern in Pakistan specifically in rural areas. It is polluted by sewage effluent, oil residuals, excessive withdrawal, water table lowering and others. This study has focused on rural area of Sindh Province, Taluka Mirpur Sakro, and District Thatta which is situated at 100 km from Karachi city. The population of the study area heavily depended upon the ground water because no water supply scheme has been provided to the local residents. The assessment of pre-and post-rainfall scenario on ground water quality was conducted to monitor the variability in pollutants behaviour during different seasons. The samples were collected from representative site locations before and after rainfall. Those samples were promptly brought into the laboratory for physical, chemical and biological parameters. The obtained results indicated that the overall ground water quality is not aesthetic for the drinking purpose because of excessive concentration of total dissolved solids (TDS), chlorides and Magnesium in the range of 1200 mg/l to 2400 mg/l, 300 mg/l to 425 mg/l, 064.8 mg/l to 115 mg/l respectively. The results revealed that the ground water is not suitable for drinking purpose. From the results, it can be suggested to install reverse osmosis plant, constructed wetland and other treatment facilities to improve the overall ground water quality.

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**Keywords:** *Rainfall; Ground Water Quality, Excessive Concentration.*

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### 1. Introduction

Water available on variable depth of earth in the pore spaces of soil and the dividend joints of rocks is known as ground water. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells. The study of the distribution and movement of ground water is called Hydrogeology, also called ground water hydrology. [1]

The ground water is also a major and an adequate source of water in Pakistan. Mostly in rural areas, it has been used widely for drinking, cooking and sanitation purposes [2]. The problem has attacked the major cities of the country due to abstraction of ground water as result in a decrease in water tables. The quality of ground water is also a main issue, especially in Sindh and Baluchistan provinces [3]. Ground water utilization has been increased in Pakistan due to the increase in population and development of industrial and agriculture sectors. It is estimated that 75% area of Sindh and 17% of Punjab provinces are underlain by saline ground water [4]. In the coastal areas of Sindh, such as Sijawal, Thatta and Tharparkar, the ground water is mainly contaminated by salinity due to excessive withdrawal as a drinking water source, insufficient aquifer recharge and reduced fresh water flow in the lower basin of Indus delta which caused sea water intrusion in most of the areas. Therefore, local people do not have access fresh water and are suffering from chronic teeth and bone diseases. These factors have reduced

life span of people living in the areas. Arsenic is also found in extreme quantity which is also another common problem. Recent tests of wells in Indus plains have indicated ground waters that have very high concentration of arsenic [5]. In Thatta district ground water is mostly used for agricultural and domestic purposes. So, there is no observable impact on the quality of ground water. Many researchers advice that the ground water must be tested so that many troubles caused due to ground water quality on agriculture and human health could be overcome.

## 2. Study Area

In this study, Tehsil Mirpur Sakro in Thatta District has been selected as study area for the ground water quality analysis. It is one of the historical and oldest towns of Sindh, which is situated on the east of Karachi and encircled on the way south to the Arabian Sea and the northwest way by Hyderabad district. The geographical area of the district is about 17,355 kilometers. The aerial view of the site location is shown in fig. 1.



Fig. 1. Aerial view of site location map

The south-western part of Thatta is saline and sea water has intruded due to the shortage of river Indus water and long coastline of about 107 kilometres. The demographic population of district Thatta was about 1.113 million according to official census report in 1998 but it has increased exponentially in the last decade about 46.27%. The minimum and maximum temperature in District Thatta is about 25°C and 40°C. During the month of March to October, the sea gust blows for eight months of the year, making the hot climate fairly fresh, whereas, January is the coldest month as shown in fig. 2. Overall district yearly regular rainfall is about 200 mm.

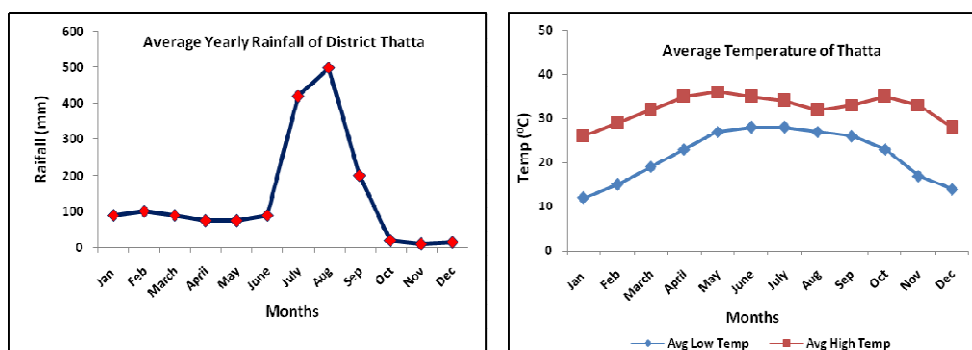


Fig. 2. (a) Annual average rainfall (b) Annual average temperature.

Mirpur Sakro is one of the Taluka of district Thatta where ground water is badly contaminated by salinity, fluoride and other pollutants due to deltaic and flood plains of Sindh and reduced flow of Indus River. The aim of this study is to find out the causes of ground water quality deterioration and to recommend the remedial measures to improve ground water quality. Waterborne diseases such as diarrhea, dysentery, Hepatitis C and Cholera were also noticed and according to a local Doctor, at least

200 patients with hepatitis C and 100 cases of diarrhea and cholera are being observed. Fig. 3 shows the on-site images of ground water hand pumps as a drinking water supply source in different areas of study site.



Fig. 3. Hand Pump Location at different sampling sites

## 2. Methodology

### 2.1. Samples Collection

Number of samples were collected from the Taluka Mirpur Sakro, District Thatta from 24 different locations using sterilized bottles (1 L) and were preserved and stored before and after rainfall period of the year 2016 for the villages Buhara, Khangan, Mirpur Sakro, Haji Gharano, Ghulamullah, Smoki, Sukhpur and Karampur.

### 2.2. Experimental Work

The collected samples were analyzed according to WHO standards for the physical and chemical parameters such as heavy metals, chlorides, sulfates, nitrates, phosphates, TDS, PH, Calcium, magnesium, and total hardness. The parameter pH was analyzed by digital meter, whereas, Chloride was performed by the titration method. In case of Total Dissolved Solids (TDS), a conductivity meter was used. Calcium, magnesium and total hardness were analyzed by titration method, whereas, sulfate, phosphates and nitrates were analyzed on a UV visible spectrophotometer.

## 3. Results & Discussion

Results of all samples collected from different locations of Hand pumps were analyzed and the results of different parameters were brought under discussion as shown in fig. 4. The standard value of TDS should be less than or equal to 1000mg/l. The concentration of total dissolved solids in the study area was found in the range of 530 mg/l to 2505 mg/l in pre-rainfall season and 450 mg/l to 1340 mg/l in post rainfall season. The overall concentration of TDS was reduced in the areas of Haji Gahrano, Buhara, Mirpur Sakro, Smoki and Karampur after rainfall because of on ground water recharge due to rain. The concentration of the areas of Khangan, Sukhpur and Ghulamullah was not reduced after the rainfall. It can be possible due to the impact of sea water intrusion in surroundings. The concentration of TDS in the areas of Buhara, Mirpur Sakro and Sukhpur was not found within the range of WHO standards which may lead to various physiological disorders such as gastrointestinal diseases, cardiovascular diseases and incidences of cancer. Total hardness was found in the range of 520 mg/l to 350 mg/l in pre-rainfall season and 175 mg/l to 450 mg/l in post rainfall season respectively. The overall concentration of total hardness was reduced and found in the range of WHO standard values except Khangan, Ghulamullah and Sukhpur after rainfall season. In case of Chloride, it was found in the range of 75 mg/l to 387.5 mg/l in pre-rainfall season and 150 mg/l to 550 mg/l in post rainfall season. The overall concentration of chlorides increased after rainfall season except Haji Gahrano and Mirpur areas. The concentration of turbidity in the study area was found in the range of 0.945 NTU to 1.175 NTU in pre- rainfall season and 1.14 NTU to 3.65 NTU in post rainfall season. The overall concentration of turbidity in the study area was observed

in the range of WHO standard values. The concentration of magnesium in the study area was found in the range of 36.mg/l to 50.4mg/l in pre-rainfall season and 25.2 mg/l to 64.8 mg/l in post rainfall season. Villages Ghulamullah and Sukhpur were not found in the range of WHO standard values. In case of sulphates, it was observed in the range of 7.86 mg/l to 219.31 mg/l before rainfall season and .49.2 mg/l to 311.6 mg/l after rainfall season. The overall concentration of sulfates in the study area was observed in the range of WHO standard values.

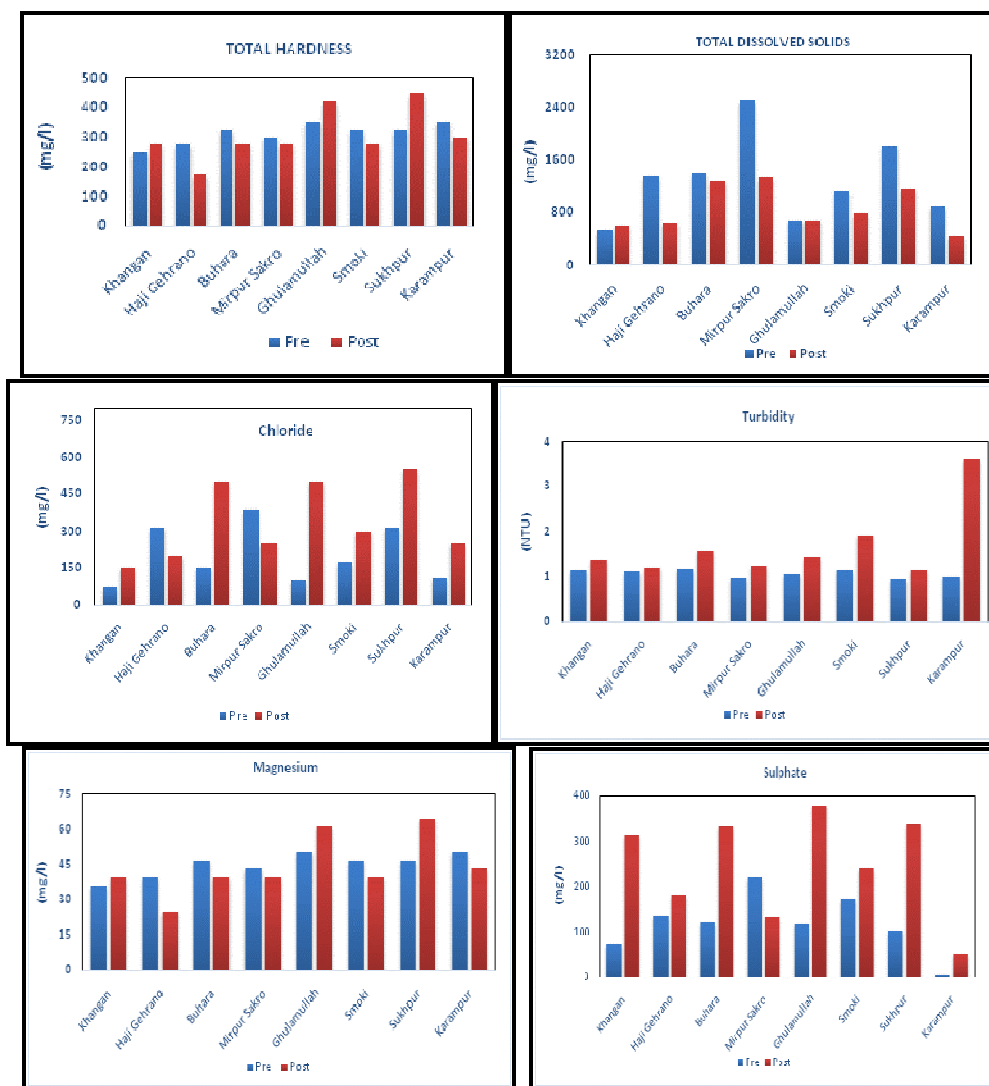


Fig. 4. Water quality parameters result analysis

#### 4. Conclusion

The present study has been conducted on the ground water quality of Taluka Mirpur Sakro district Thatta. The concentration of TDS exceeded the range of WHO standard values in the areas of Buhara Mirpur Sakro and Sukhpur after the rain fall season. The concentration of magnesium in Ghualmullah and Sukhpur areas were not in the range of WHO standard values. The concentration of chloride was exceeded the range of WHO standard values after rainfall season. This study data can help and support for the selection of suitable and cost effective methods for the treatment of Ground water according to seasonal variations.

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