

Chemical and Biological Assessment of Water Resources of Sia – Mansoor area, Dezful

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Introduction

In recent years, more emphasis has been put on water quality rather than surveying for new groundwater resources in industrialized countries. In contrary, in most developing countries groundwater quality and specifically pollution problems has not yet been taken into account as a result of finance allocation problems and scientific complication of such investigations.

The most interesting discussion in hydrochemistry is the evaluation of water quality for various goals. However, more attention is paid to water resources for drinking purposes, specifically groundwater resources, due to accessibility and economical reasons, with respect to surface water. In general, these resources contain better quality as compared to surface water, but they are also subjected to chemical and biological contamination, as a result of fertilizer usage and swage intrusion into groundwater reservoirs and eventually harming public health.

The area under investigation is the area where some parts of the Sia Mansoor aquifer suffer from bacterial pollution. In this area, chemical concentration of ions such as sulfate, chloride and sodium exceed water quality standards range. As the utilization of this aquifer is for drinking purposes, in this investigation an attempt has been made to evaluate groundwater quality and to demarcate vulnerable zones.

Material and methods

Sampling stations were mainly selected based on the vulnerability of groundwater and uniform distribution of sampling points was assumed. Samples were collected before and after rainfall and the collected samples were analyzed for major anions and cations including; bicarbonate, sulfate, chloride, nitrate, calcium, magnesium, sodium and potassium and water born diseases bacteria. The conventional methods were used for the analysis of major anions and cations. For the detection of water born bacteria, culture method was employed. In this process, direct colony counting and concentrated water method were applied.

Physical characteristics of the area

The study area (longitude 48° 15' to 49° 0' and latitude 32° ' to 32° 30'), is located in the north of Khuzestan Province and occupies an area of 518 km². The Sia Mansoor alluvial plain consists of heterogeneous alluvial deposits produced as a result of the surrounding rocks comprising of the Bakhtiari conglomerate formation and Lahbari member of the Aghajari formation. Groundwater is extracted from 232 shallow and bore wells for various purposes, including drinking, irrigation and industrial. Agriculture is the main groundwater consumption in the area and over 90% of the available groundwater will be used to irrigate crops from August to April in the next year. On the other hand, groundwater is the major drinking source for the progressively increasing population in the area. Inhabitants are dominantly engaged with agricultural activities, as well as animal husbandry and most of the farmers have their own land.

Results and discussion

In order to study the status of groundwater in the area, information regarding geology, hydrogeology, wells and piezometers log were collected. In addition, quantitative and qualitative data concerning available water resources were also acquired. The assemblage information indicated that the groundwater flow path follows topography and dominantly moves from east and northeast toward south and southwest. Water table ranges from 5 to 62 m. For chemical and bacterial evaluation of groundwater quality, samples were analyzed and the results were interpreted. The iso-line of temperature, electrical conductivity, sulfate, chloride and total dissolved solids indicated that maximum values of these parameters are located in the north-eastern and southern parts of the area. In some parts of the study area the concentration of sulfate exceeds 250 mg/l which indicates that aquifer is being recharged from Galal River and longer groundwater flow paths. The presence of soluble minerals and the input of polluted swages into groundwater results in the increase of total dissolved solids in the vicinity of Konak and Bedalian villages. Piper diagram demonstrates the mixing characteristics of groundwater. Dominant water types as shown in Fig. 1 are HCO₃-Ca, SO₄-Cl, SO₄-Cl and SO₄-Na.

Composite diagram depicted a good correlation between chloride and sodium ions where in turn demonstrates the mixing nature of groundwater in Sia Mansoor plain. Also a good correlation exists between chloride and sulfate ions revealing the solution of equivalent amounts of halite and gypsum in major parts of the area. With respect to drinking purposes, groundwater quality varies from good to unfavorable. The worst quality is observed in Bedelian and Ghysar villages and also close to Konak River.

The concentration of nitrate in the groundwater varies from 3.29 to 36 mg/l and falls within acceptable limits. Maximum values are observed in stations W3, W15 and R16.

The collected data from microbial study of water resources (Fig.2) in the command area reveals that the whole groundwater has been polluted and mainly proteus vulgaris is responsible for bacterial contamination of groundwater. Other most frequently observed bacteria are shigella dysenteries.

The reasons for the development of such harmful bacteria are being in the vicinity of cesspools and accumulation of garbage and landfilling near the utilized wells. Another source which facilitates bacteria growth and groundwater pollution is animal waste materials (manure).



Fig. 1: Piper diagram, showing Dominant water types

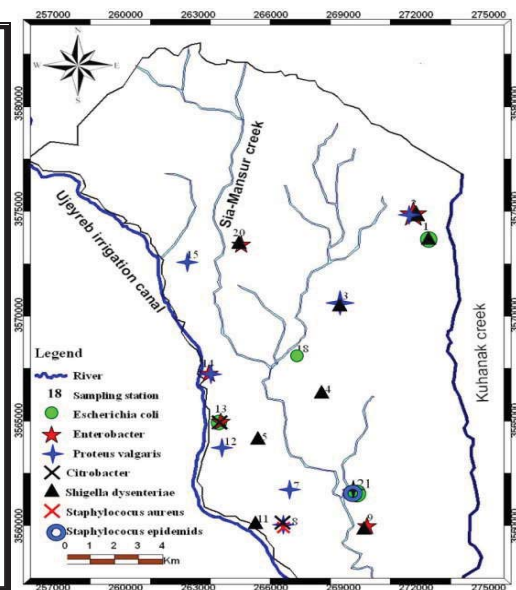


Fig. 2: Microbial distribution in the study area

Conclusion

The detailed assessment of the study area has brought out that:

- 1) The Sia Mansoor alluvial plain consists dominantly of clay, silt, fine sand and sand and two sources including rain and surface water are governing agents in recharging the aquifer,
- 2) Electrical conductivity of groundwater and surface water ranges from 660 to 3800 and 570 to 910 μ seimen/cm respectively,
- 3) The dominant cations and anions are sodium, calcium, sulfate and chloride and water types are bicarbonate-calcium, sulfate - calcium, sulfate –sodium and chloride – sodium
- 4) The best groundwater quality for drinking purposes was witnessed around SefiAbad and Benot villages.
- 5) Groundwater pollution map of the study area indicates that a large portion of the region is subjected to bacterial pollution and the most frequent bacteria effecting water quality are proteus vulgaris and shigella. These bacteria originate from liquid leakages from cesspools, leaching from manure and landfill materials.

Key words

Aquifer, Groundwater, Chemical and biological contamination, Sia- Mansoor, Dezful

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