

## Groundwater Quality Assessment of Arid Northern Gujarat (India)

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**Abstract:** Availability of groundwater and its quality has always been a major concern for developing irrigated agriculture particularly in arid regions where surface water resources are insufficient or meagre to meet irrigation demand. An assessment of groundwater quality has been done for arid northern Gujarat state (India) mainly consist of Banaskantha district. Based on EC, SAR and RSC values the quality of groundwater has been classified in Dhanera, Deesa, Tharad, Vav, Diyodhar and Bhabhar tehsils of Banaskantha district. The analysis of groundwater samples indicated that in majority of area (75%) groundwater has moderate sodicity with SAR<18. The SAR ranges from 0.1 to 89 with an average of 13.3. Highest SAR was found in Tharad (>18) tehsil followed by moderate in Vav and Bhabhar (10-18) and low(<10) in Dhanera, Deesa and Diyodhar tehsils. About 55% area has EC >3.0 dS m<sup>-1</sup> reflecting moderate to high salinity whereas in about 97% of area RSC found to be <2.5 Me L<sup>-1</sup>. Based on EC, SAR and RSC criterion, the irrigation quality of groundwater has been assessed for each tehsil and classified as C1S1R1, C2S2R1, C2S3R1, and C3S2R1.

**Key words:** Banaskantha, groundwater quality, salinity, sodicity, irrigation class.

The groundwater quality is a major constraint in developing irrigated agriculture (Oster and Jayawardane, 1998). To assess the groundwater quality a study was carried out in arid northern part of Gujarat state (India) lies at N 24°00' to N24°45'; E71°15' to E72°15' covering an area of 6367 km<sup>2</sup> in Banaskantha district (Fig. 1). The climate of the district is extreme and droughts are frequent. The average annual rainfall of the district is about 675 mm. Alluvium covers the entire study area belonging to Quaternary era.

It comprises of unconsolidated to semi consolidated sand, gravels, pebbles, boulders and clay at places, in varying proportions. These are windblown sand with fluvial deposits vary in thickness and also encountered at depths. Schist/phyllite/gneisses belonging to Aravalli super group occupy small portion on eastern part of the Dhanera tehsil. It does not expose anywhere but encountered at depth 50-55 m and more. These are argillaceous meta sediments, generally susceptible to weathering. The area is drained by ephemeral river Bargaon in the north and Sukal River which flow the entire length through centre of Dhanera tehsil from east to west. Another major ephemeral river in the area is Banas which flows from NE-SW through heart of Deesa tehsil. The chemical characteristics of groundwater are largely dependent on hydrogeological formations

(Oster *et al.*, 1999; Saxena *et al.*, 2003) through which it circulates and depicts the chemical and physical behavior of the aquifer. Though the attempts to classify the water for agriculture have been made in the past by several researchers, these studies mostly emphasized the problem and distribution of salinity (Dhir, 1977; Gupta, 1979) and lack in providing detailed information regarding distribution pattern of Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) which are considered as important sodicity and alkalinity criterion for irrigation water. The present study is therefore, an attempt to classify groundwater quality under different formations of the district on the basis of SAR and RSC along with salinity level. Since entire area is composed of single Alluvium aquifer, therefore tehsil wise groundwater classification has been adopted in the present study.

### Material and Method

A total of 301 groundwater samples were collected from entire area from different locations during hydrogeological survey of the district conducted during 2010-2012. The samples collected were chemically analyzed for all major chemical constituents as per standard methods. SAR and RSC were determined to know the sodicity and alkalinity level in groundwater. Salinity, SAR and RSC maps were prepared using GIS ARC/INFO workstation.

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