

Quality of Groundwater and Seawater Intrusion Along Northern Chennai Metropolitan City (India)

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Abstract

Fifty-five groundwater samples were collected during each monsoon season representing the pre-monsoon and post monsoon seasons for four consecutive years from 2014 to 2018 to assess the groundwater quality. As the study area represents a coastal aquifer, seawater intrusion studies were also carried out in the northern region of Chennai Metropolitan City, Tamil Nadu, India. They were analyzed to establish the physical and chemical characteristics, such as pH, EC, TDS, Ca^+ , Mg^+ , Na^+ , K^+ , Cl^- , HCO_3^- , SO_4 and NO_3 . Chennai Metro city experienced more than 40 cm of rainfall within two days due to a cloudburst during December 2015 and its effect is being reported.

Keywords

Chennai metropolitan city • Coastal aquifer • Physico-chemical characteristics • Quality of groundwater and seawater intrusion

1 Introduction

The quality of groundwater in coastal regions is generally affected by natural processes such as saline water intrusion, evaporation and interaction of groundwater with hard rock formations [1]. The study area covers the northern region of Chennai Metropolitan City, which has a coastal aquifer constituted mainly of alluvium and basement rock Charnockite. The region extends from Ennore to Santhome, from north to south, and comes under the Thiruvallur district of Tamil Nadu. To the east is Bay of Bengal and to the west is part of Chennai Metropolitan City where the thickly populated residential areas are common. It covers an area of

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250 km² that falls between 13° 4'N and 13° 12'N latitude and from 80° 16'E to 80° 24'E" longitude, as shown in Fig. 1, where sample locations are indicated within the river and water ways.

2 Materials and Methods

One liter of water sample was collected from polyethylene bottles from 100 bore wells from the same aquifer. Temperature, pH, conductance (EC), and total dissolved solids were measured in situ using a portable kit. Calcium, magnesium, potassium and sodium, and major anions like sulphate, nitrate and chloride were analyzed by Ion Chromatography in the laboratory. Bicarbonate were analyzed by the titration method. The analytical procedures followed are as per the American Public Health Association [2]. The base map of the study area was prepared using the Survey of India toposheets 66 D/1 and 66 D/5 and was digitized using surfer 9.0 software.

3 Results and Discussion

3.1 Physico-Chemical Parameters

The minimum, maximum and average values for different parameters of the eight seasons are presented in Table 1. From the table, it is evident that the groundwater has been alkaline in nature for the past four years, irrespective the seasons. TDS decreases during post-monsoon compared to the pre-monsoon season during the reported number of years. TH decreases during post-monsoon season compared to pre-monsoon season, except for the post-monsoon season in January 2016; and the same trend can be seen for Ca, Mg, Na, K, and SO_4 . The cloudburst, which brought more than 40 cm of precipitation within 48 h on December 2015 is attributed to the increase in the concentration of various