



Hydrogeochemical investigation of groundwater quality in west Delhi, India

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ABSTRACT

The hydrogeochemical parameters for groundwater of west Delhi were studied to evaluate the major ion chemistry and solute acquisition processes controlling water composition, scaling potential and permeability of groundwater. Ninety three groundwater samples were collected randomly from dug wells and hand pumps in west Delhi and analyzed for various chemical parameters. The concentrations of major cations and anions were in the order of $Na^+ > Mg^{2+} > Ca^{2+} > K^+$ and $Cl^- > SO_4^{2-} > HCO_3^- > NO_3^-$, respectively. The main hydrochemical facets of water were Na-K-Cl- SO_4 and Ca-Mg- SO_4 -Cl types. The electrical conductivity (EC) represents a clear sign of groundwater contamination from drain water and salts of unused agrochemicals. The Gibbs diagram indicates that evaporation is the dominant mechanism that control groundwater ion chemistry. Chloride distribution in the study area showed that, groundwater with chloride concentration of $< 30 \text{ meq L}^{-1}$ is originated naturally, but the origin of higher concentration is anthropogenic in nature. 86% of the samples have scale forming ability and only 14% are showing corrosive tendency. The encrustation tendency is due to $CaCO_3$ precipitation and hence need for treatment of water to prevent scaling. In general, the permeability index indicate good to permissible use of water for irrigation, and only a few locations demand remedial measures for better crop yields. USSL and Wilcox diagram showed that nearly 60% of the groundwater samples are not suitable for irrigation. Thus, this kind of investigation can create suitable management plans to protect aquifer as well as remedial measures for contaminated groundwater by natural and manmade activities.

Keywords:

Delhi,
Groundwater pollution,
Hydrochemistry,
Irrigation suitability,
Wilcox diagram

1. INTRODUCTION

The hydrochemical characteristics of groundwater are the governing force for its suitability for various uses. In many areas, particularly in arid and semi-arid regions of the world, groundwater quality has become a major concern which limits the supply of potable fresh water. Therefore, for effective utilization and protection of groundwater, it is necessary to understand the hydrochemical characteristics of the groundwater and its evolution under natural water circulation processes (Prasanna *et al.*, 2011). Important hydrogeologic factors such as rainfall, mineral weathering, topographic relief, and biological activity in a given basin are important for controlling recharge and hydrogeochemical reactions

responsible for chemical constituents contaminating the groundwater (Raju *et al.*, 2011).

The transport of contaminants in the groundwater has been significantly studied in recent years because of the importance of groundwater for various uses. Many researchers have focused on hydrochemical characteristics and contamination of groundwater in different areas that resulted due to anthropogenic intervention mainly by agricultural activities and industrial and domestic wastewater. The groundwater quality of lower Varuna river basin of India has been assessed using hydrochemical method (Raju *et al.*, 2009). Adhikary *et al.* (2009) characterized the groundwater pollution of west Delhi through correlation and regression analysis. In another