

## Assessment of Shallow Groundwater Quality for Irrigation in parts of Agra District, Uttar Pradesh, India

P. K. Singh<sup>1</sup>, S. Atal<sup>2</sup> and S. K. Dubey<sup>3</sup>

<sup>1</sup> Geological Survey of India, Itanagar

<sup>2</sup> Geological Survey of India, Jaipur

<sup>3</sup> CSWCRTI, Chhalesar, Agra

Email: [pk\\_gsi@yahoo.co.in](mailto:pk_gsi@yahoo.co.in)

### ABSTRACT

Study of physiochemical properties of groundwater in an area of 1000 sq km around Agra city, Uttar Pradesh, India was carried out to decipher the suitability of groundwater for irrigation. About 78% of the study area is utilized for agriculture and most of the crops are irrigated with tubewells (*i.e.* from groundwater sources). Therefore, it is important to study the quality and suitability of the groundwater for this purpose. Since the area falls under the Semi-arid zone, the average frequency of irrigation is high for the crops being harvested, the proper soil management is needed for sustainable agricultural development of the area.

A total of 200 groundwater samples were collected (pre- and post-monsoon) from hand pumps, submersible pumps, and irrigation tubewells as per the availability on a grid pattern between the periods of June 2012 to February 2014. The samples were analyzed for major, traces and other physical properties of the water like pH, TDS, and electrical conductivity. To evaluate the quality of the groundwater different irrigational parameters like Electrical Conductivity (EC), Kelly's Ratio, Sodium Adsorption Ratio (SAR) values, Magnesium Adsorption Ratio and Sodium Percentage were worked out. Wilcox diagram indicates that 18% of water samples fall in unsuitable class while 14% samples are in Doubtful to Unsuitable class while about 47% of samples are good to permissible for irrigation. USSL diagram shows that the majority of the samples fall in S1C3 (50.5%) and S2C4 (20.3%) and only 2.3% samples are falling in S1C2 Class with low alkali and medium salinity hazard. Therefore, the majority of the water sources are either unsuitable for irrigation or may be used with adequate management of drainage and salinity treatments. The Magnesium Adsorption Ratio of the samples is even worse and more than 90% samples are failing this parameter for irrigation. 51% samples are showing Kelly's ratio of >1, failing to qualify the standard for irrigation water. Doneen's plot indicates that 39.3% of water samples are falling in Class-III field with <25% maximum permeability which is not suitable for irrigation in normal conditions.

**Keywords:** Groundwater quality, Irrigation, Sodium Adsorption Ratio (SAR), Kelly's Ratio, Wilcox diagram, USSL diagram, Agra

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