DETERMINATION OF WATER QUALITY INDEX TO ASSESS DRINKING WATER QUALITY

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Abstract

Water is the most important component of life. Natural sources affecting quality of water are lithological, climatic, hydrological, topographical and atmospheric factors. Pollutants accumulate in the water bodies because of extensive economic and social growth resulting in the variation of quality of the source of water.To determine drinking quality, groundwater samples from different locations of the study area are drawn as per APHA and tested as per the standards given by APHA and IS. Samples are tested for various parameters such as pH, TDS, total hardness, total alkalinity, Ca^{2+}, Mg^{2+}, Cl^- , F^-, $SO_4^{2-}$and NO_3^- ions. Using values of various parameters, water quality index (WQI) of the study area is determined.

Keywords: Natural sources, Pollutants, TDS, total hardness, WQI

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Introduction

Water is the most important component of life. But quality of drinking water is getting deteriorated with the passage of time. Natural and anthropogenic activities both play a big role in deteriorating the quality of both surface as well as groundwater. Natural sources affecting quality of water are lithological, climatic, hydrological, topographical and atmospheric factors [1]. Among anthropogenic factors responsible for affecting water quality adversely, few are, improper disposal of agricultural, municipal and industrial waste, change of land use causing soil erosion, mining, and farming of livestock [2]. Heavy metals are another big factor responsible for contamination of water [3]. Pollutants accumulate in the water bodies because of extensive economic and social growth resulting in the change of quality of source of water [4]. Essential requirement for survivability is the acceptable water quality. To maintain this acceptable quality is a big challenge in water resource management sector [5]. In order to test water quality, samples of various locations are collected and analysed for different biological, physical and chemical parameters to generate a data [6]. It is difficult to evaluate extensive data sets of water quality parameters. Therefore Water Quality Index (WQI) is a tool to express water quality as a single numerical value. Complex datasets are converted to a single value which is easy to understand and manage water quality.

Study area

Groundwater samples are collected from agricultural lands of villageSalarpur, Tehsil Tijara District Alwar, Rajasthan, India. The area is surrounded by a big industrial cluster which is supposed to affect its groundwater quality. Taste of groundwater is not good according to the residents of the area.

Materials and methods

Groundwater samples from different locations of the study area are drawn as per APHA and tested as per the standards given by APHA and IS. Samples are tested for various parameters such as pH, TDS, total hardness, total alkalinity, Ca^{2+}, Mg^{2+}, Cl^- , F^-, $SO_4^{2-}$and NO_3^- ions.

Results and discussion

Mean values of the parameters expressed in the Table 1. Permissible values of these parameters given by Bureau of Indian standards (BIS) are also expressed. Correlation analysis was also done in MS-Excel.

Table 1 Mean values of water quality parameters of the study area

Parameter	Mean values	Permissible values (IS)
pH	7.446	8.5
TDS	743.2	2000
Total hardness	263.16	600
Total alkalinity	365.04	600
Ca^{2+}	65.818	200
Mg^{2+}	23.964	100
Cl^-	221.598	1000
F^-	0.308	1.5
SO_4^{2-}	64.006	400
NO_3^-	24.746	45

Units of all parametersexcept pH are mg/l.
Abbreviations: TDS=Total Dissolved Solids

Determination of water quality index (WQI) [7]

Overall quality of water at a particular location is described by water quality index (WQI). Complex data of different parameters is converted into a single numerical value that can be easily understood and utilized for water quality management [7].

WQI can be calculated (Brown et al., 1972) using unit weight factor (Wn) for each parameter and Standard permissible value of nth parameters (Sn). Sub index (Qn) is calculated by using mean values of concentration of nth parameter (Vn) and actual value of parameter in pure water (Vo). Generally Vo is equal to zero for most of the parameters except pH. Then Overall WQI can be calculated using formula-

$$\text{Overall WQI} = \frac{\sum WnQn}{\sum Wn}$$

The value of Water Quality Index (WQI) of the groundwater of agricultural lands of Village Salarpur comes out to be 31.2187 .Therefore the water quality of the study area is of Good Quality (26-50). [8-10]

Conclusion

There is strong correlation between Total alkalinity and pH, EC, TDS, Chloride as per correlation analysis. As per Water Quality Index the quality of ground water of the study area is Good (WQI=31.2187)but not Excellent (0-25). Thereforewatching the effluents from industrial area isessentialor else with time, the groundwater quality may get worse and cause severeillnesses on ingesting.

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