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Investigation of Groundwater Quality in Jevargi Taluks of Gulbarga District, Karnataka state, India

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Abstract: ***Groundwater plays an important and critical component for public health, environment and the nation's economy. In recent times, the importance of groundwater and its accessibility has gained momentum as a major requirement of drinking water, industrial and agricultural needs. However, much concentration is not given to their utility, management and sustainability. The chemical composition of groundwater is influenced by various reactions such as acid base, oxidation reduction and solid phase interactions in the aquifer medium. The resultant composition of the water would be in keeping with the mineralogy of the aquifer and movement of groundwater. An attempt has been made to evaluate the groundwater quality through monitoring of network stations in Karnataka.***

Keywords: Pollution, Fluoride, industrial effluent

1. Introduction

Water is one of the most important natural resources. Clean water is essential for the survival of all living organisms. Unfortunately the quality of water in lentic and lotic systems has deteriorated immensely due to pollution. Modern civilization with rapid industrialization and increase in population are the real culprits. The population of the world is estimated to be around 6 billion, likely to be doubled by 2050. the major chunk of this will be in developing countries. The upward trend ipso facto has led to tremendous pressure the existing natural resources.

Water is essential for all the living beings in this globe. If improperly handled, it can be a deadly source of epidemics. Water is frequently getting polluted by domestic sewage, human wastes and industrial wastes. The industrial effluent load of the water ways with various chemicals that alter the bio-chemical nature of the water (Loring, 1945). The growing agricultural demand and industrial activities of man in recent times have faced the emergence of twin problems such as shortage and pollution.

The Earth is the only planet in our solar system, which possess water and oxygen, supporting billions of living systems of micro and macro levels. The first living organism originated in the form of anaerobic microbe in water. In the due course of evolution the aerobic and higher forms were originated in the water and later started life on the terrestrial region.

Water is elixir of life, a prime natural resource and a precious national asset. It is a basic human need and basis for existence of ecosystem (Tiwari, 2000). Water is the most vital resource for the life of a molecule to survive. Our modern civilization is dependent on water for all-purpose like irrigation, domestic needs, industrial purposes, shipping and disposal of domestic waste. It exhibits a number of physical and chemical properties that help the molecule to act as best suited medium for the life activities. Indeed, it is a part of life itself, since the protoplasm of most of the living cells contain about 80% of water and any substantial reduction in this is disastrous. Most of the bio-chemical reactions that occur in the metabolism and growth of the living cells involves water. Water has been referred as a universal solvent, since many of the components dissolve in water (Singh *et al*., 1988).

The water present in oceans, lakes and atmosphere act as an accumulator of heat. It absorbs heat in hot condition and gives up heat in cold weather, thus maintaining the planet in warm condition. Hence, it is indispensable and one of the most precious natural resource on this planet (Rao and Rameshwari, 1998).

From pre–historic period to modern time, from primitive loneliness to industrial madness, man has been on the move to safeguard his life against the adversities of nature. In order to attain the highest level of development in the present industrial era he has passed through evolutionary processes and controls energy and its various sources. This has increased the material capabilities to a tremendous degree and he has applied them to a technology, which has become more and more diversified and sophisticated especially in the fields of modern agriculture, industries, urban development, transport and health (Kumar, 2002).

The importance of the groundwater is unaware to many of the underdeveloped countries. A document prepared for the United Nations World Water Conference, held in Argentina in March 1977, revealed that if all the water of the world were represented by a half a gallon bottle, the quantity of fresh water would be about half a teaspoon, a single droplet would sufficient to represent the surface flowing water and the rest being the groundwater. A Syrian delegate warned the UN conference as "The day is not far off when a drop of water will cost more than drop of oil" (Rao, 2000).

India has been ranked a poor 120th nation for its water quality in the United Nation's evaluation system of global

waters resource and only Morocco and Belgium were ranked lower. India ranks 133rd, among 180 countries for its poor water availability of 1.880 m^3 / person annually. Further, India's quality indicator value stands at a pathetic condition – 1.31 as against first ranked Finland's 1.85. Belgium is considered to be the worst due to the low quantity and quality of its groundwater, which is worsened by heavy pollution and poor treatment of wastewater. Morocco, India, Jordan, Sudan, Nigeria and Burkina Faso rank just above Belgium (Press Trust of India, 2002).

The crisis for environment and the water issues are currently very prominent. One sixth of the world's population has no access to fresh drinking water. It may be more dramatic that there are fears of war over water in the coming years if the situation remains the same . One lakh seventy thousand tube wells are added every year in our country. Declining water tables leave dug up wells high and dry. If the present consumption pattern continues, all our water resources will be exhausted by the year 2025 (Tiwari, 2001).

Unfortunately, during these years the water resources have never remained the same as they were earlier as a consequence of increased human interferences. Infact, they are under severe ecological stress and a becoming dumping place for all the waste generated by human activities.

As a result, they are becoming unpalatable and the quality of water is being deteriorated and in many cases it is not suitable for drinking purpose. However, it is everybody's right to drink safe water and to get sufficient quantity of water for his daily needs.

2. Background of Water pollution

The history of water pollution goes with the history of *Homo sapiens* itself. All the activities of early man like clearing of trees, burning, cultivation and piling of maidens influenced the water bodies. The cutting of forests resulted in an increased run off, altering the river biology. Agricultural activities caused increased erosion of soil forming siltation and increase salts in the streams. Natural sources of pollution like leaf fall in the forest areas increased the organic matter in the water bodies to affect the fish. Such conditions might be prevailing beyond doubt, through out the history since the invasion of plants on the earth, much before the arrival of man. However, human activities had been a major factor for creating the most serious problems of water pollution.

Therefore, if pollution keeps pace with population growth, there will a loss of 18,000 km^3 of fresh water by 2050, almost the nine times the total amount of countries currently use each year for irrigation (Press Trust of India, 2003).

3. Significance of Groundwater

The word groundwater is generally understood to mean all the water underground, occupying the voids with in the geological formations. Groundwater is an important component of the global hydrological cycle. Atmospheric water reaching the earth surface, infiltrate into the ground, pass through the soil layers and fills into the voids (it builds an unsaturated layer). The continuous flow in the underground through fissured or large voids of consolidated rocks or through porous clastic (unconsolidated) sediments forming the groundwater as saturated layer and finally exfiltrate either on the surface of the earth or into marine domain (Danielopol *et al*., 2003). Groundwater occurs in many different geological formations. Geographical features of the earth crust region are the important factors that influence on the groundwater quality (Todd, 1980). Nearly all rocks in the upper part of the earth's crust, irrespective with their type, origins or age, possess openings called pores or voids in unconsolidated, granular materials. The voids are the spaces between grains, which may become reduced by compaction and cementation. In consolidated rocks, the only voids may be the fractures or fissures, which are generally restricted but may be enlarged solution. The volume of water contained in the rock depends upon the percentage of these openings or pores in a given volume of the rock. More spaces result in higher porosity and more stored water.

Groundwater is not usually stable but flows through the rock. Water infiltrate through the rock mass, depends on the combination of the size of the pores and degree of rock materials inter connected, which permits the water to pass through. These are called as permeable layers and those materials, which permit water to pass with difficulty and the compaction was found among the layers of the rock are said to be impermeable

4. Materials and Methods

The chemistry of water is influenced by the input of materials containing minerals, their solubility and the chemical equilibrium prevailing in the aqueous solution. For effective maintains, one needs continuous monitoring of water quality. For this purpose, it is very important to know about different physico- chemical parameters of water quality namely colour, Ph, Ec, TDS, total hardness, etc. Ground water samples were collected in pre-cleaned poly propylene bottles with necessary precautions (Brown et,al., 1974).

In developing nations, the water courses are polluted approximately twenty percent by industrial effluents and rest by untreated sewage (Saunders P.J.M., 1976).

To understand the quality of groundwater, the sampling of the bore well water was done in order to pursue the quality of the water and for making forecasts and to determine the extent of damage due to pollution (Allen and Harrel, 1978; Kotaiah, 1994). For developing a sampling design, due attention has been paid to the sampling unit, source and size of the sample, parameters of importance and sampling procedures.

As there are several sampling designs available, only one design has been chosen for the study area such that for a given sample size and for a given budgetary constraint will have a smaller sampling error. For the present investigation probability sampling design was selected. Probability sampling design is also known as random sampling or chance sampling has an equal chance of inclusion of every item of an object in the sample. Random sampling (Bisht,

1978) ensures the law of statistical regularity, which states that the sample should represent the composition and characteristics of the whole region as the object under consideration. This may be the reason why random sampling is considered as the best technique of selecting a representative sample.

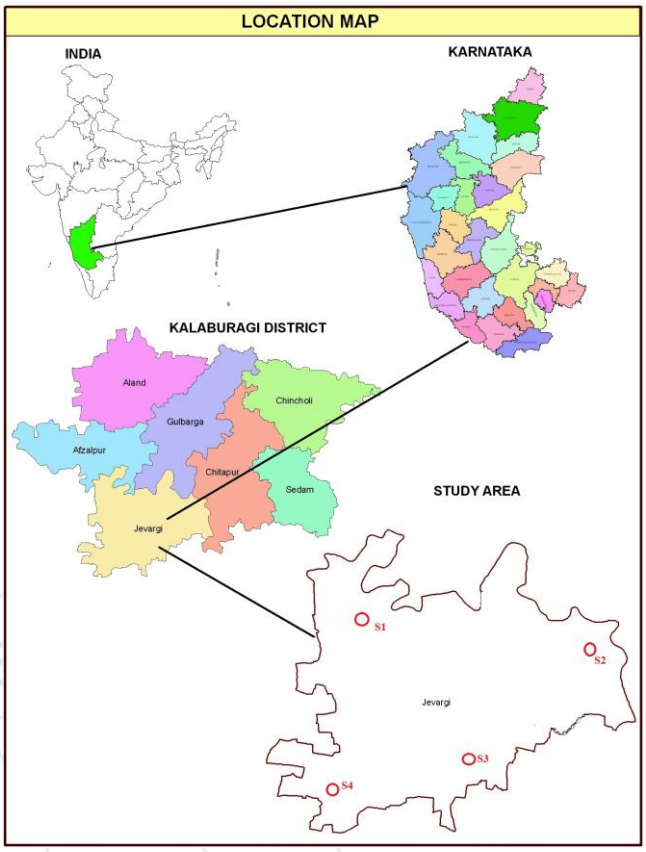
The occurrence and distribution of rainfall in the state is highly erratic. The annual normal rainfall is 1138 mm received over 55 rainy day's. It varies from as low as 569mm in the east to high as 4029 mm in west. About 2/3rd of the geographical area of the state receives < 750mm of annual rainfall. Even the assured rainfall areas of the state like Dakshina Kannada, Uttara kannada, and Kodagu districts experience scarcity of water in some years.

5. Study Area

This study is concentrated on Jevargi taluk , Gulbarga district where ground water had higher contamination of salts Jevargi is located at 17.02°N 76.77°E. It has an average elevation of 393 meters (1,289 ft). The town is spread over an area of 4.25 square kilometres (1.64 sq mi). As of the 2001 India census, Jevargi had a population of 19,174 people, Jevargi has an average literacy rate of 53%, lower than the national average of 59.5 percent.

The survey is conducted in the study area of the Jewargi taluks(Fig No; 1) with the help of a layout plan of the region,. The study area comprised of different parts of Jevargi taluks where almost all large and small scale industries are located. The sampling points are located in such a way that ,they are uniformly distributed in all the sites of the study area. 4 sampling locations are fixed up for sampling. Mostly ,bore wells are considered for sampling. At certain places a few open wells and hand pumps are also considered for the sampling. Water samples are collected from each sampling point and are analysed for the parameters called, pH, Dissolved Oxygen, TDS, Conductivity, Turbidity, Alkalinity, Hardness, Chlorides, Fluorides, Iron, Sulphates, Calcium and Nitrogen as per the standard procedures.

In many districts intensive development of ground water are has lead to critical situation resulting in manifestations of problems like declining ground water levels, shortage of water etc. this situation warrants for taking up programmes to augment ground water resources on strong scientific lines in the critical blocks of the state.



The groundwater quality monitoring in Jevargi taluk is carried out with an objective to detect and evaluate changes in groundwater quality in space and time. The rainfall in this taluke ranges from about 210 to 900 mm and the rainfall pattern broadly follows the physiographic diversions, high rainfall (about 3000 to 4830 mm) occurs in the malnad and coastal areas and decreases sharply towards east (about 2000 to 460 mm from west to east. Sub-humid to semi-arid climate prevails from west to east and southwest to northeast. The District of Gulbarga is drained mainly by Krishna river.

I have selected 5 Study sites of Jevargi taluks viz,
S1: Mandewal
S2: Andola
S3: Rasangi
S4: Ganwar
S5: Maradagi

Figure 1: Collection of Water samples from different study sites of Jevargi taluk

6. Results and Discussion

These are the findings of my study.

- The pH of the samples is found to be varying from a minimum value of 5.8 to a maximum value of 9.7. The maximum values are found in site no 3.
- Calcium is also found to be more in Site 4 . It varied from 4mg/l to 180 mg/l.
- Turbidity is found to vary from 0.4. NTU to 0.86 NTU with an average value of 0.41 NTU.
- Alkalinity is found to be more in the study site no 3 and varying from a minimum of 218 mg/l to a maximum of 1020 mg/l.
- Conductivity is found to be more in site no 4 indicating high TDS concentration in groundwater of these areas. Conductivity varied from a minimum of 230 micro-seimans to a maximum of 1800 micio-seimans.
- TDS is found to vary from 520mg/l to 1487mg/l
- DO levels are found to be in the permissible limits and they varied from a minimum of 5.0 mg/l to maximum of 8.0 mg/l.
- Iron is found to vary from a minimum of 0.2mg/l to a maximum of 0.52 mg/l.
- Fluoride concentration is varied from a minimum of 0.6mg/l to a maximum of 2.15mg/l and it is found to be more in site no 5.
- Chloride concentration is varied from a minimum of 45mg/l to a maximum of 456mg/l.
- Hardness is found to be more in site 2. The maximum and minimum values are found to be 989 mg/l and 132mg/l.

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