

A Case Study on “Assessment of Groundwater Quality in and Around Namakkal District in Tamil Nadu”

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ABSTRACT

This case study paper reviews ground water pollution to agriculture soil due to the natural shale value of heavy metals in soil system. Thus, untreated industrial effluents can cause an environmental threat to ground water resources and affects soil quality and agricultural plant productivity. To achieve unpolluted wastewater discharge into receiving water bodies, careful planning, adequate and suitable treatment, regular monitoring and appropriate legislations are necessary. Parameters that may be tested include temperature, pH, turbidity, salinity, nitrates, TDS, Cations, Anions and phosphates. Rapid Increase in population, Construction of residential complexes and wide spread Industrialization in Namakkal Town has drastically reduced the land area for wastewater disposal Groundwater pollution occurs when untreated or partially treated Industrial waste water are discharged on to the land or used for Irrigation, enabling the waste to migrate down the water table through soil. Rapid industrialization and use of chemical fertilizers and pesticides in agriculture are causing deterioration of water quality and depletion of aquatic biota. This aim of the case study was to assess the quality of the ground water and the impacts of the Municipal wastewater. This study will be very helpful to under-stand the impact/evaluation of the rate of dumping of effluent water in ground water and impact on the quality of water in terms of irrigation and the impacts onto the environment.

Keywords: Ground water, Drinking water, Municipal wastewater, Water quality parameters

1. INTRODUCTION

Groundwater is generally recognized to be good for human consumption and is used as a potential source of drinking water. Agricultural development, urbanization and industrialization are the major causes for all changes in the quality of water¹. In order to meet the rising water needs, evaluation of water quality is important for allocation to various uses. Only during the last three decades of the twentieth century, the concern for water quality has been exceedingly felt so that, water quality has now acquired as much importance as water quantity². According to WHO³, about 80% of all the diseases in human beings are caused by contaminated water. Once the groundwater is polluted, its quality cannot be renovated by stopping the pollutants from the source. It is therefore vital to regularly monitor the quality of groundwater. Groundwater pollution by heavy metals has been given much attention due to their low biodegradability and toxic effects^{4,5}. The water from the sources viz., streams, falls, lake, hand pump, open well and bore well are

contaminated with domestic, agricultural and industrial wastes and likely to cause water related diseases⁶. Similarly, Bullard⁷ inferred that polluted surface water always results in an unhealthy socio-economic environment. In this study, physicochemical parameters are determined to draw a conclusion on the quality of water whether it is good or unfit for drinking purpose.

Statistical analysis of physicochemical parameters of water has been reported from the different parts of World and India. C. R. Ramakrishnaiah *et al.*¹³, have assessed the Water Quality Index for the Groundwater in Tumkur Talk, Karnataka State, India. Linear correlation analysis study of drinking water quality data for Al-Mukalla city, Hadhramout, Yemen was carried out by Sami G. Daraigan *et al.*,¹⁴ and from this study they showed that all the physicochemical parameters of drinking water in Mukalla city are more or less correlated with each other. Papita Das Saha *et al.*,¹⁵ have assessed the water quality characteristics of River Ganga at Kolkata Region, India using water quality index and ANN simulation method¹⁵. Dadolahi - Sohrabet *et al.*¹⁶. Have studied the Water quality index as simple indicators of watersheds pollution in southwestern part of Iran and from this study it is revealed that quality declined significantly during the dry season. So, an attempt is made to study the physicochemical parameters of water samples taken from Yercaud Talk in Salem, Tamil Nadu, and India.

To monitor the water resource and ensure sustainability, national and international criteria and guidelines established for water quality standards are being used. (WHO-1993; 2005). The chemistry of water is very dynamic, largely controlled and modified by its medium of contact. Since the chemistry of water directly hints the quality of water for various purposes, its monitoring and assessment gained substantial importance in the present century. A tremendous increase in the population increased the stress on both surface and the groundwater. It is believed at the beginning of the human civilization itself, groundwater was the most trusted form of drinking water because of the filtering effect of the aquifer. However, in the present world drinking the water directly from the source without proper treatment is a tough task.

The groundwater analysis for physical and chemical properties is very important for Public health studies. These studies are also main part of pollution studies in the environment. The groundwater contains dissolved solids possesses physical characteristics such as odor, taste and temperature. The natural quality of groundwater depends upon the physical environment, the origin, and the movement of water. As the water moves through the hydrological cycle, various chemical, physical and biological processes change its original quality through reactions with soil, rock and organic matter. Natural processes and human activities cause the changes in groundwater quality, directly or indirectly. According to WHO organization, about 80% of all the diseases in human beings are caused by water.

LITERATURE REVIEW

The extensive literature review was carried out by referring standard journals, reference books and conference proceedings. The major work carried out by different researchers is summarized below. Dinesh Kumar Tank *et al.* [01] study focused on the hydrochemistry of groundwater in the Jaipur city to assess the quality of groundwater for determining its suitability for drinking and agricultural purposes. Groundwater samples were collected from eleven stations of Jaipur city during monsoon season and were analyzed for physico-chemical parameters such as pH, EC, TDS, sodium, potassium, calcium, magnesium, chloride, sulphate, carbonate, bicarbonate, nitrate and fluoride. Comparison of the concentration of the chemical constituents with WHO (world health organization) drinking water standards of 1983, the status of groundwater is better for drinking purposes. The parameters like pH, sodium, potassium, carbonate, bicarbonate, chloride are within permissible limit as per WHO but calcium, magnesium and nitrate values exceeding the limit. The calculated values of SAR, RSC and percentage sodium indicate that the water for irrigation uses is excellent to good quality. US Salinity diagram was used for evaluating

the water quality for irrigation which suggests that the majority of the groundwater samples were good for irrigation.

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The study reveals that the concentrations of major constituents are well within the permissible limits of IS-10500-1994, except in few cases where total hardness and fluoride concentrations are high. The fluoride conc. exceeded the permissible limit. From the analysis it was observed that the groundwater is polluted in the entire study area. During last few years, the utilization of surface and groundwater for drinking, industrial and agricultural purposes has increased manifolds but consequently it is observed that the water is polluted and affecting the human health, soil nutrients, livestock, biomass and environment in certain areas. The spatial distribution map of pH, Chlorides, Magnesium and Sulphate shows that, these parameters are within range as per standard. TDS and Nitrate concentrations in ground water of the study area exceed the permissible limit at central. People can use the ground water for drinking and domestic purpose in study area. The study is carried out on parameters which are selected for testing is pH, TSS, TDS, COD, and Nitrate.

The hydrogen-ion concentration is an important quality parameter of both natural and waste waters. It is used to describe the acid or base properties of wastewater. A pH less than 7 in wastewater influent is an indication of septic conditions while values less than 5 and greater than 10 indicate the presence of industrial wastes and non-compatibility with biological operations. The pH concentration range for the existence of biological life is quite narrow (typically 6-9). An indication of extreme pH is known to damage biological processes in biological treatment units (EPA, 1996; Gray, 2002). Another parameter that has significant effect on the characteristics of water is dissolved oxygen. It is required for the respiration of aerobic microorganisms as well as all other aerobic life forms.

Based on the hydro geochemical facies it has been found that the groundwater regime is severely deteriorated by the anthropogenic activities. Groundwater suitability for domestic and irrigation purposes was assessed by using WHO and USDA standards. SAR values and the sodium percentage (Na%) in locations indicate that majority of the groundwater samples are suitable for irrigation. This investigational study indicates that water in many cities of Pakistan is unsafe for human consumption due to presence of both bacterial and chemical contamination.

ASSESSMENT OF WATER QUALITY

In now days due to increase in population, industrialization, agricultural activities and urbanization, large quantities of sewage and industrial wastewater are discharged into water bodies has significantly contributed to the pollution of the surface and ground water. The

objective of the present study was to assess water quality of various ground water sources in India for drinking and agriculture. For the assessment of water pollution status of the water bodies, the following water quality parameters were analyzed: (1) pH (2) Conductivity (3) Temperature (4) Total dissolved solid (TDS) (5) Total Alkalinity (6) Hardness (7) Cations and Anions (8) Carbonates and Bicarbonates. (9) Sulphates.

The suggested measures to improve the ground water quality includes total ban on the activities that causes pollution, avoid use of pesticides and prevent entrance of sewage in to ground water.

Water quality assessment shows that the most of the water quality parameters slightly higher in the wet season than in the dry season. Water quality is dependent on the type of the pollutant added and the nature of self-purification of water.

The quality of wastewater effluents is responsible for the degradation of the receiving water bodies. This is because untreated or inadequately treated waste water effluent may lead to eutrophication in receiving water bodies and also create environmental conditions that favor proliferation of waterborne pathogens of toxin-producing cyan bacteria. In extension, recreational water users and anyone else coming into contact with the infected water is at risk. Although various microorganisms play many beneficial roles in wastewater systems, a great number of them are considered to be critical factors in contributing to numerous waterborne outbreaks. Also, wastewater effluents have been shown to contain a variety of anthropogenic compounds, many of which have endocrine-disrupting properties.

Since large amounts of wastewater effluents are passed through sewage treatment systems on a daily basis, there is a need to remedy and diminish the overall impacts of these effluents in receiving water bodies. In order to comply with wastewater legislations and guidelines, there is a need for adequate treatment before discharge. This can be achieved through the application of appropriate treatment processes, which will help to minimize the risks to public health and the environment. To achieve unpolluted wastewater discharge into receiving water bodies, careful planning, adequate and suitable treatment, regular monitoring and appropriate legislations are necessary.

The world is faced with problems related to the management of wastewater. This is due to extensive industrialization, increasing population density and high urbanized societies. The effluents generated from domestic and industrial activities constitute the major sources of the natural water pollution load. This is a great burden in terms of wastewater management and can consequently lead to a point source.

CONCLUSIONS

Wastewater effluents are major contributors to a variety of water pollution problems. Some of these problems include eutrophication, which can stimulate the growth of algae, increased water purification cost, interference with the recreational value of water, health risks to humans and livestock, excessive loss of oxygen and undesirable changes in aquatic populations. Since large amounts of wastewater effluents are passed through sewage there is a need to remedy and diminish the overall impacts of these effluents in receiving water bodies. In order to comply with wastewater legislations and guidelines, wastewater must be treated before discharge. This can be achieved through the application of appropriate treatment processes, which will help to minimize the risks to public health and the environment. To achieve unpolluted wastewater discharge into receiving water bodies, there is the need for careful planning, adequate and suitable treatment, regular monitoring and appropriate legislation. This is will enhance science-based decisions and ensure the sustainability of the environment and the health of plants and animals.

There is also a need to ensure that effluents standards and limitations, as set by regulatory bodies are not compromised.

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Conflict of Interest

None of the authors have any conflicts of interest to declare.

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