ABSTRACT

Water, an ‘Elixir for life’. The quality of water is a vital concern for mankind since it is directly linked with human welfare. Worldwide, freshwater resources are being threatened by anthropogenic disturbances causing huge biodiversity losses. India is endowed with a rich and vast diversity of natural resources, water being one of them. The water resources of India are enormous but they are unevenly distributed in several terms. The rainfall is distributed unevenly not only in space but also in time. Almost 80% of rainfall occurs in the four monsoon months of June to September. Within these four months also, most of the rainfall comes in a few spells of intense rain. India being an agricultural country needs dams for storage of rain water for longer use. A study in the year 2007, stated that the discharge of untreated sewage is the single most important source of pollution of surface and ground water in India. There is a large gap between generation and treatment of domestic waste water in India. The problem is not only that India lacks sufficient treatment capacity but also that the sewage treatment plants that exist do not operate and are not maintained.

Almost 70 per cent of the surface water resources and a growing percentage of groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs. This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem. According to the UN World Water Assessment Programme, about 2.3 billion people suffer from diseases associated with polluted water, and more than 5 million people die from illnesses each year.
In this study, an attempt has been made to assess the impact of surface water eutrophication on the ground water due to rigorous industrial and community activities in the catchment and upstream area of Thenpennaiar River around Kelavarapalli Dam area, Krishnagiri District of Tamil Nadu, India. The study of pollution potential over the surface waters and ground waters in the catchment area around the Kelavarapalli reservoir has been done to analyse the impact in near future.

The surface waters from the reservoir have been sampled for seven consecutive years i.e., from 2007 to 2013 to analyse the pollutants levels and an appropriate remediation strategy by adsorption technique using ESP fly-ash (EFA) was proposed to handle the problem. The EFA composition was analysed using Energy dispersive X-ray analysis (EDAX). The adsorbent EFA showed positive results for the removal of nitrate and phosphate from the surface waters and hence can be used as cost-effective remediation strategy. Further, Brunauer Emmett Teller (BET) analysis was done for analysing the pore size, pore volume and pore diameter of the EFA before and after adsorption. The removal of nitrate and phosphate from surface waters was confirmed with Fourier Transform Infrared (FTIR) spectroscopic studies.

Similarly, the ground water from twenty-five different points at various distances around the reservoir catchment area were sampled for analysis of all water quality parameters and spatial distribution of these parameters were mapped by Inverse Distance Weighted (IDW) interpolation technique using ArcGIS 9.2 version software. An important parameter Water Quality Index (WQI) has been implemented to study the quality of water from both the surface water (pre-monsoon and post-monsoon seasons) and ground water during pre-monsoon season at various distances from the dam area. The results exhibited poor quality of surface water in pre-monsoon season and good quality in post-monsoon season. Likewise, the quality of ground water
was assessed to be in good condition in most of the samplings points except at point GW1 at distance of 27.3m from the reservoir (shortest distance from the sample), whereas the ground water quality was excellent at the distance of 1709m (GW16). Statistical analyses ANOVA (Analysis of Variance) was performed by season and by distance to find trends in the data. This was performed in order to understand the relationships of the water quality indicators in a better way.

The models fit for the experimental data revealed that the rate of increase in concentration of nitrate and phosphate are 3 mg L\(^{-1}\) and 0.216 mg L\(^{-1}\) per year respectively. The data clearly showed that the values of both nitrate and phosphate concentration in the ground water at varying distances are increasing steadily with time. The predictions showed that the data could increase dangerously to higher level unless proper remedial measures are taken.

Thus, the present study unlocked the present situation of the surface waters of Kelavarapalli Reservoir and the ground waters around the reservoir area. The GIS spatial distribution climaxes the polluted areas, thereby making aware of the alarming situation to the local governing bodies. The adsorption technique using EFA proved to be economical and efficient for removal of nitrate and phosphate species from the surface waters, the main culprits for eutrophication. Moreover, the linear power model predicted the quality of water in the near future i.e., till the year 2025, if same conditions persists. On the whole, the present study highlights the need for interference of local governing bodies and the public to preserve and protect our water resources for our future.