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Influencing factors and pollution sources on groundwater quality deterioration: A case study in Kolar District, Karnataka, India

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Abstract
Kolar, which serves as Karnataka's eastern entrance, lacks a reliable water supply. Although it is drained by the Palar and Pennar river basins, both of which are minor and only carry water during the monsoon season, the situation worsens as all smaller water bodies dry up throughout the summer. Due to the overexploitation, highly intervention of anthropogenic activities (mining, removal of sandy soil, agriculture expansion and yet not cutting down and eradication of Eucalyptus and Acacia) and decrease in rain fall, many of the "physico-chemical parameters" influencing on the quality of groundwater. Among them most important "physico-chemical parameters" such as "pH, chloride, nitrate, fluoride and total hardness". In the present study, for two years 2014 and 2015 in two different seasons of every year fifty groundwater samples were collected from fifty selected sources of bore wells from all talukas of entire District. The analyzed results revealed that all the parameters for all samples, except some samples showed concentration within permissible limit and some samples showed that concentration above the permissible limit. Especially the bore wells installed nearer to the sewage fed tanks and dry area of village limit have more prone to contamination of groundwater. This study helps us to better understanding of potential threats of various phsico-chemical parameters on quality of groundwater and deteriorating level of groundwater. The main factor that controls the groundwater quality in Kolar Distinct is growing of water intense trees such as Eucalyptus, declining in rain fall data and overexploitation of groundwater.

Keywords: Groundwater, anthropogenic activities, Eucalyptus, rainfall, overexploitation, Kolar District

Introduction
Groundwater contamination is a serious, but relatively ignored issue in the district. This contamination occurs in either through geogenic or anthropogenic means. Changing climate influences the physio-chemical parameters of groundwater. The analysis groundwater samples showed that "groundwater quality variation is mainly explained by dissolution of minerals from rock water interactions in the aquifer" (Mohammad Shahid Gulgundi and Ambashetty, 2018) [11]. The quality of ground water may change when it moves from recharge to discharge zones as a result of interactions between rocks and water (Malini *et al*., 2003) [9]. Leaching from salts deposited in the vadose zone during the post-monsoon regulates the geochemistry of groundwater by controlling the dissolution of carbonate and silicate minerals and ion exchange during pre-monsoon (Diana *et al*., 2016) [4]. The main cause of groundwater deterioration is concentrations of "major ions, trace elements, and uranium" (Manoj *et al.,* 2017) [10]. The persistent overexploitation over the past 20 years or more is the primary cause of Bangalore Urban District's declining groundwater levels. "The pollution of aquifers in Bengaluru, India, by benzene, toluene, ethyl benzene, and xylene (BTEX) compounds is known to occur through leakage from underground storage tanks (USTs) in gas stations, indicated that differences in BTEX concentrations between pre- and post-monsoon periods underlined the effect of season on BTEX concentrations in the aquifer, with greater BTEX concentrations being seen in groundwater samples during post-monsoon than pre-monsoon" (Sudhakar Rao *et al*., 2017) [16]. For home, agricultural, and industrial

uses, groundwater is a major source of supply in many nations. But because of industrial and human activity, the groundwater is poisoned. This is currently the biggest issue. Leaching has contaminated groundwater as a result of industrial, municipal, and agricultural waste that contains pesticides, insecticides, fertilizer residues, and heavy metals with water (Richa Guptha *et al.,* 2018) [15], Groundwater pollution has numerous repercussions and geogenic sources account for the majority of groundwater pollution (Madhukar *et al*., (2016) [8]. The main causes of water pollution are residential sewage that has been dumped into rivers from the urban periphery and untreated raw industrial effluents. Because of this, groundwater quality has been drastically degraded, making it unfit for human consumption and agricultural usage (Nagaraj *et al*., 2005) [12]. There are various factors responsible for deterioration of groundwater among them few major once are unskilled technical and managerial water supply agencies, improper water treatment systems and lack of knowledge and awareness about groundwater significance (Dinesh Kumar M and Tushar Natawarlal Shah, 2006) [5]. Radioactive contaminants in groundwater can originate from geological deposits of radionuclides however also can originate from anthropogenic sources, including wastes from nuclear electricity plants, nuclear guns checking out, and fallacious disposal of scientific radioisotopes (Henning Dahlgaard *et al*., 2004) [7]. The number one anthropogenic resources of groundwater pollution in India are from sewage disposal, agriculture, and industry (Dipankar Chakraborti *et al*., 2011) [6]. Ground water fine and quantity is deteriorating at a very fast fee due to anthropogenic activities (De Silva and Weatherhead, 1997) [3]. The biggest motive of water pollutants is industrialization and boom in population (Chaudhry FN and Malik MF, 2017) [2]. The excellent of groundwater mirrors the best of surface water. On this examine, seasonal variations in hint detail concentrations highlights that human perturbation of the surface water ends in deterioration of the groundwater (Ramesh R and Purvaja GR, 1995) [13].

Study area

"Kolar District, spread over 4,012 sq Km, has population of about 16.50 lakhs.5 Taluks of Kolar District are Kolar, Bangarpet, Malur, Mulbagal and Srinivaspur. It is stretched between north latitude $12^{o}45^{l}$ 54^{ll} to east latitude $77^{0}50^{l}$ 29^{ll}". 1798 villages in 156 gramm panchayats make up the District Kolar. Agriculture, which exclusively receives water from borewells, is the primary activity of the population. The District has a semiarid climate with a tropical monsoon, hot summers, and moderate winters. It has a dry agroclimatic according to the weather. In the research area, the primary groundwater (borewell) source of drinking water because there are no significant surface water sources. Totally, fifty groundwater samples were collected seasonally from fifty different bore wells distributes all over the five different talukas of Kolar District and different parameters such as pH, chloride, nitrate, fluoride and total hardness along with other parameters of groundwater were analyzed.

"Table 1: Showing parameters and methods used in the analysis of ground water quality"

Sl. No.	Parameters	Unit	Methods used
1	pH	-	"Digital pH meter"
2	chloride	mg/liter	"Titrimetric method BY using $AgNO_3$"
3	Nitrate	mg/liter	"Spectrophotometric method"
4	Fluoride	mg/liter	"Electrode screening method by using fluoride electrode"
5	Total hardness (TH)	mg/liter	"Titrimetric method by using EDTA"

Results and Discussion

In the present study, for two years such as 2014 and 2015 in two different seasons of every year fifty groundwater samples were collected from fifty selected sources of bore wells from all talukas of entire District. The analyzed results revealed that with respect to all the parameters, some samples shown concentration within permissible limit and some samples shown that concentration above the permissible limit. Especially the bore wells installed nearer to the sewage fed tanks and dry area of village limit having Eucalyptus are more prone to declining in quality and contamination of groundwater. "Each tree can extract 15 to 20 liters of water per day. Introduced by the state government in the 1960s under its afforestation programmes, the tree became popular in the 80s. Today, the majority of the District's eucalyptus is found in all talukas". This study helps us to better understanding of potential threats of various phsico-chemical parameters on quality of groundwater and deteriorating level of groundwater. The main factor that control the groundwater quality in Kolar Distinct is growing of water intense trees like Eucalyptus, Acacia, declining in rain fall data and overexploitation of groundwater.

Conclusion

Farmers must adopt to cultivate less water intense crops with crop rotation programs. Avoid encroachment of feeder channels of public water tanks, stop growing Eucalyptus and Acacia plus enforcement of strict laws are necessary in this regard. Adapt afforestation programs and promote agro forestry-based agriculture practice. Ultimate suggestion is using purified water for consumption by following swatch Bharathprograms.

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