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Ground Water Pollution in India- A Review

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ABSTRACT: Groundwater is the foremost source of water for domestic, agricultural and industrial purposes in several countries. Due to human and industrial activities the ground water is contaminated. This is the serious problem now a day. Due to industrial, municipal and agricultural waste containing pesticides, insecticides, fertilizer residues and heavy metals with water groundwater has been polluted by leaching process. The effects of groundwater pollution are wide. In this paper the overview of ground water pollution due to industrial as well as anthropogenic activities. Water quality is affected by both point and non-point sources of pollution. These include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Analysis of the water quality is very important to preserve and prefect the natural eco system. The assessment of the ground water various technologies has been developed and management practices should be carried out periodically to protect the water resources.

Keywords: Ground water, Water pollution, Heavy Metals, Water Quality Index.

I. INTRODUCTION

Water is the most important in shaping the land and regulating the climate. It is one of the most important compounds that profoundly influence life. Groundwater is used for domestic and industrial water supply and also for irrigation purposes in all over the world. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices [1]. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization [2]. It is estimated that one third of the world's population use groundwater for drinking. Ground water has excellent natural quality usually free from pathogens, colour and turbidity and can be consumed directly without treatment [3]. Rigorous agricultural activities have increased the demand on groundwater resources in India. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices [1]. Although global attention has focused primarily on water quantity, water-use efficiency and allocation issues, poor wastewater management has created serious water-quality problems in many parts of the world, worsening the water crisis. Human settlements, industries and agriculture are the major sources of water pollution. Globally, 80 percent of municipal wastewater is discharged into water bodies untreated, and industry is responsible for dumping millions of tonnes of heavy metals, solvents, toxic sludge and other wastes into water bodies each year [4]. Farms discharge large quantities of agrochemicals, organic matter, drug residues, sediments and saline drainage into water bodies. The resultant water pollution poses demonstrated risks to aquatic ecosystems, human health and productive activities [5]. Water quality is affected by both point and non-point sources of pollution. These include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Water quality is also affected by floods and droughts and can also arise from lack of awareness and education among users [6]. In recent years, the increasing threat to groundwater quality due to human activity has become the matter of great concern. The overexploitation of groundwater in some parts of the country induces water quality degradation [7]. India accounts for 2.2% of the global land and 4% of the world water resources and 16% of the world population. It is estimated that one third of the world's population use groundwater for drinking [8]. Both surface and subsurface water sources are getting polluted due to developmental activities [9]. Contamination of drinking water may occur by percolation of toxics through the soil to ground water [10]. Industries are responsible for water pollution. Waste water from industries includes sanitary waste and process water.

The rapid and unregulated growth of industrialization has led to an alarming deterioration in the quality of life and has given rise to a number of environmental problems. Safe drinking water is primary need of every human being. Rapid industrialization is also having a direct and indirect adverse effect on our environment [11]. Several countries have different types of industries. There liquid and solid waste is directly dumped into the soil as well as river. Some industrial wastes are so toxic that they are strictly controlled, Making them an expensive problem to deal with some companies try to cut the cost of safety dealing with waste by illegally dumping chemicals [12].

II. MAJOR ISSUES OF GROUND WATER POLLUTION

Contaminated Land- Industrial activity has left land contaminated with a variety of inorganic and organic contaminants, frequently including heavy metals, hydrocarbons, and organic solvents, which can lead to serious groundwater pollution. In comparison with other countries, In the UK contaminated land is a major source of groundwater pollution. The legacy of contamination resulting from past and present anthropogenic activities has led and will continue to lead, to serious groundwater pollution incidences [13-14].

Heavy Metals- Heavy metals are commonly present in groundwater at trace concentrations. The most common sources of contamination include mining, urban and industrial effluents, agricultural wastes, sewage sludge, fertilizers and fossil fuels. Heavy metals are dangerous because they tend to bioaccumulation. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment [15]. Heavy metals can be extremely toxic to humans even at low concentrations. Heavy metals like Chromium (Cr), Mercury (Hg), Lead (Pb), Cadmium (Cd), Zinc (Zn), Arsenic (As), copper (Cu), nickel (Ni) are more toxic in nature.

Landfill- Landfills have been identified as one of the major threats to groundwater resources [16-17]. Landfill leachate is potentially highly contaminative to groundwater. With over 4000 active landfill sites in the UK, some existing since the 1970s, there is concern over the pollution threat posed to groundwater. The impact of landfill leachate on the surface and groundwater has given rise to a number of studies in recent years [18-23].

Microbiological Contaminants- Microbiological contamination of groundwater is derived from sewage from either humans or animals. The large variety of pathogens that may be present in sewage includes pathogenic bacteria, viruses and protozoa. These contaminants can represent a potentially serious threat to public health if they are present in a water supply. Microbiological contaminants may enter the subsurface environment via leaking sewers, leaking cesspits, septic tanks, soak ways, mineshafts used as a disposal route, landfills, or horn sewage applied to the land as a fertilizer. The potential for the transmission of infectious disease by contaminated groundwater has been widely assumed and several individual contamination events have been reported [24-25].

Pesticide- Pesticides include insecticides, fungicides and herbicides, all of which are widely used by industry, public authorities and in agriculture. Pesticides are both toxic and persistent in the environment and can represent a potentially significant health hazard; especially given their capacity for bioaccumulation in the food chain. The pollution of ground water, related to nitrogen fertilizers and pesticides, from widespread, routine land application, as well as point sources has become a serious concern [26]. The EC Drinking Water Directive set a maximum admissible concentration in drinking water for individual pesticides at a very low level (0. 1µs/cm).

Sewers, Soakaways & Septic Tanks- Sewers, soak ways and septic tanks can cause contamination of groundwater as a result of the discharge of waste water or sewage directly to the subsurface environment. The occurrence of sewage contamination is related to the operation and structure of the waste water containment and treatment system and local hydrogeology. Sewers are responsible for the unintentional discharge, via leaks, of large volumes of sewage to the groundwater below cities and lesser urbanized areas from which the sewage is initially derived. The most common contaminants found in groundwater below these systems include bacteria, viruses, and nitrates.

Several researches were done on ground water pollution. Various technical research papers on assessment of ground water quality for hand pump of different locations of different cities and countries. Reported work on assessment of ground water quality index is summarized below. Some countries have used and are using aggregated water quality data in the development of water quality indices. The study states that Water quality index (WQI) is valuable and unique rating to depict the overall water quality status in a single term that is helpful for the selection of appropriate treatment technique to meet the concerned issues [2]. Initially, WQI selecting 10 most commonly used water quality variables like dissolved oxygen (DO), pH, coliforms, specific conductance, alkalinity and chloride etc. and has been widely applied and accepted in European, African and Asian countries [27].

The work is carried out on Physico-Chemical Properties of Ground Water of U.P., (India) [28]. The physic-chemical parameters such as pH, D.O., E.C., T.D.S., alkalinity, turbidity, Ca (calcium) and Mg (magnesium) hardness, total hardness, NO_3 (nitrate), F (fluoride), Fe^{+3} (iron) and Cl^- (chloride) have been tested. It has been found that parameters are not in limit when compared with W.H.O. standards.

For Evolution of water quality index following parameters are examined: pH, E.C., T.D.S., Total hardness, D.O., C.O.D., B.O.D., Cl^-, NO_3 and Mg. The WQI for these samples ranged between is 244 to 383.8. The analysis reveals that the groundwater of the area needs some degree of treatment before consumption [29].

Research work on Bidar city (Karnataka) for their characteristics of ground water and Water quality index (W.Q.I.). The parameters are pH, total hardness, Ca (Calcium), Mg (magnesium), chloride (Cl), NO_3 (Nitrate), SO_4 (sulphate), T.D.S., Fe^{+3} (Iron), F (Fluoride), sodium (Na), potassium (K), alkalinity, manganese (Mn), D.O., total solids and Zinc (Zn). Tested results were used for suggest the models for water quality analysis [30].

Physico-Chemical analysis of drinking water quality from 32 locations in Delhi. Delhi is an old town. It is one of the important business centers of India and thickly populated as well [31]. The rural population from Romania is dealing even today with the absence of access to sure drinking water source. Therefore in 2002 only 65% of the Romanian population had access to drinking water, distributed in 90% from the urban environment and 33% from the rural one[32].

III. CONCLUSION

Ground water pollution is becoming a greater threat to the environment, especially as populations and industrial economies expand the toxic elements and chemicals enter the body mainly through water, food and air. The first step towards evolving measures to prevent and cure groundwater quality deterioration is generating reliable and accurate information through water quality monitoring (WQM) to understand the actual source/cause, type and level of contamination [33]. More research is needed to assess to affect on human health. Public awareness should be created. There should be monitoring and control over the concentration of harmful chemicals on drainage of effluents. Preventive and curative measures against pollution and contamination of groundwater may continue to receive low priority for years to come, Demineralization using RO system can remove all hazardous impurities from drinking water and would be cost effective in many situations where TDS, nitrate and fluoride in groundwater are above permissible levels. Low cost treatment methods are available for removal of heavy metals from groundwater. For operation of CETP plants, new technologies should be developed for treatment of industrial waste water.

However, there are several challenges to control ground water pollutions but awareness should be needed and to install various water purifications systems.

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