Drinking water problem: A review Based Study

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Water is essential for the survival of humans, animals and plants.Water is also home to a very wide range of micro flora and micro fauna, creating a fascinating environment of extreme biological importance, but which attracts too little attention.Fresh water is emerging as one of the most critical natural resource issues facing humanity. Water is, literally, the source of life on earth. The human body is 70**%** water. Human beings can survive for only a few days without fresh water. It is estimated that 31 countries, accounting for fewer than 8% of the world population, face chronic fresh water shortages. By the year 2025**,**however, 48 countries are expected to face shortages, affecting more than2.8 billion people -35**%** of world's projected population. Among countries likely to run short of water in the next 25years are Ethiopia, India, Kenya, Nigeria, and Peru**.** Parts of other large countries, such as China, already face chronic water problems (WHO, 1997).In most parts of the world polluted water, improper waste disposal and poor water management cause serious public health problems. Such water-related diseases as cholera, typhoid, and schistosomiasis harm or kill millions of people every year. Overuse and pollution of water supplies also are taking a heavy toll on the natural environment and pose increasing risks for many species of life. The quality as well as the quantity of water is deteriorating globally as a result of rapid urbanization, population growth and industrialization. Most countries however currently are aware of the necessity of fresh water as a requirement for survival. Fresh water needs to occupy highest priority, on the international agenda.

The primary source of NO3-N in ground water is leaching from soils. Shrivastva et al, (1988) and Olaniya and Saxena (1 977) have reported the leaching of nitrate ions from the soil into ground water. Nitrate itself is relatively nontoxic but when ingested with food or water it may be reduce to nitrite (N02-) by bacteria present in mouth and gut. If nitrite containing water is utilized for drinking purposes (Qian-Feng et al, 1983) it can react with secondary arsines present in the human body, and may form carcinogenic nitrosamines. . High levels of nitrates present a health problem and can cause infant methaemoglobinemia (blue baby disease) and cancer(Apse, 1991). Nitrates affect young babies less than three months old by depriving them of oxygen.

Health problems due to nitrates present in water sources have attained a serious state almost in every country. In over 150 countries nitrates from fertilizers have seeped into water wells, fouling the drinking water (Maynard, et a1 1988). Excessive concentrations of nitrates cause blood disorders (Bowman, 1994). They are also found to cause digestive tract cancers (Linda Nash, 1993). High levels of nitrates and phosphates in water encourage growth of blue green algae, leading to deoxygenating (eutrophication). Oxygen is required for the metabolism of the organisms that serve **as** purifiers which break down organic matter polluting the water. Therefore the amount of oxygen contained in water forms a key indicator of water quality. .

The use of agricultural chemicals (nitrate -nitrogen fertilizers and pesticides) and their occurrence in groundwater is examined by Goodrich (1 99 1). The concern over the toxicological hazards caused due to pestic is growing over the last three decades. The extent of ground water contamination from both nitrate - nitrogen and from a range of pesticides is discussed based on numerous surveys throughout U.S.A. Technologies available for removing these chemicals, to acceptable drinking water levels are outlined. Several different drinking water treatment methods, involving both centralized treatment and individual household point of entry devices, were evaluated through case studies and field - scale research projects in Suffolk country, New York, and in California. Processes available for removal of nitrate from drinking water were reviewed presenting their strengths and weaknesses (Burke, 1991). The processes were ion exchange, reverse osmosis, electrolysis and biological gentrification. A combination of biological gentrification and electrode analysis is available offering such benefits as conversion of nitrates to nitrogen in continuous operation. It is suitable for flows above 300 m3 per day and with a nitrate concentration of50 - 100 mg/l.

Pollution is a vexing problem in developing countries where the population is growing rapidly, development demands are increasing, and governments have different investment priorities. In developing countries, on an average, 90% to 95%of all domestic sewage and 75% of all industrial waste are discharged into surface waters without any treatment (Carty, 1991; Alleluia, 1998).

In Thailand and Malaysia water pollution is so heavy that rivers often contain 30 to 100 times more pathogens, heavy metals, and chemicals from industry and agriculture than is permitted by government health standards (Niemczynowicz, 1996). Over three-quarters of China's 50,000kilometers of major rivers are so filled with pollutants and sediment that they no longer support fish life. In 1992 China's industries discharged 36billion metric tons of untreated or partially treated effluents into rivers, streams, and coastal waters (UNEP, 1998). In 1986, along the Liao River, which flows through a heavily industrialized part of northern China, almost every aquatic organism within 100 kilometers was killed when over 1billion tons of industrial wastes were dumped into the river in a period of three months (Hinrichsen, 1998a).

In greater Sao Paulo, Brazil, 300 meme tons of untreated effluents from 1,200 industries are dumped into the Tiete River every day as it flows through the city. As a result, the river flows with high concentrations of lead, cadmium, and other heavy metals. The city also dumps some 1,000metric tons of sewage into the river each day, of which only 12% is estimated as treated (WHO, 1992).Karachi, Pakistan's largest city, has completely overwhelmed the capacity of its outdated sewage treatment plants. Because of frequent breakdowns and clogged sewage pipes, these plants often operate at no more than 15% of capacity. Majority of all sewage water leaks out into the surrounding soil, contaminating the wells used by city residents for drinking water (Rah man, 1995).

Furthermore, pollutants such as sulfur dioxide and oxides of nitrogen, which combine in the atmosphere to form acid rain, have had pervasive effects on both freshwater and land ecosystems. Acid rain lowers the pH of rivers and streams. Unless buffered by calcium (as contained in limestone), acidified waters kill many acid-sensitive fish, including salmon and trout. In the soil, acids can release heavy metals, such as lead, mercury, and cadmium, that percolate into waterways (Hinrichsen, 1998b).

Some of the worst pollutants are synthetic chemicals. Some 70,000different chemical substances are in regular use throughout the world(Pullen and Hurst, 1993). Every year an estimated 1,000 new compounds are introduced (World resources Institute, 1587). Many of them find their way into rivers, lakes, and groundwater aquifers. In the US alone, more than 700 chemicals have been detected in drinking water, 129 of them considered highly toxic (Maynard et al, 1988).

A number of synthetic chemicals, particularly the group known as persistent organic pollutants (POPS), which includes halogenated drocarbons, dioxins, and organ chlorines such as DDT and PCBs, are long-lived and highly toxic in the environment (World Bank**,** 1993). They do not break down easily under natural processes and thus tend to accumulate in the biological food chain, until they pose risks to human health. For example, Beluga whales swimming in the highly polluted St.Lawrence River, which connects the Atlantic Ocean to North America’s Great Lakes, have such high levels of PCBs in their blubber that, under Canadian law, they now qualify as "toxic waste dumps" (Pullen andHurst,1993). Indigenous communities that once hunted these whales no longer are permitted to take any because of the health risks.

Some 60% of all infant mortality is linked to infectious and parasitic diseases, most of them water-related (Rowley, 1996). In some countries water related diseases make up a high proportion of all illnesses among both adults and children. In Bangladesh, for example, an estimated three-quarter of all diseases are related to unsafe water and inadequate sanitation facilities. In Pakistan one-quarter of the people attending hospitals are sick only due to water-related diseases (Ali, 1992).

While water-related diseases vary substantially in their nature, transmission effects and adverse health effects related to water can be organized into three categories: water-borne diseases, including those caused by both fecal-oral organisms and those caused by toxic substances; water -based diseases; and water-related vector diseases (Bradley, 1994).

Another category-water-scarce (also called water-washed) diseases-consist of diseases that develop where clean freshwater is scarce (Kjellenand Mc Granahan, 1997).

Water-borne diseases are "dirty-water" diseases-i.e. those caused by water that has been contaminated by human, animal, or chemical wastes. Worldwide, the lack of sanitary waste disposal and the lack of clean water for drinking, cooking, and washing is the cause for over 12 million deaths a year (USAID, 1990).

Water-borne diseases include cholera, typhoid, shiegella, polio, meningitis, and hepatitis A and E. Human beings and animals act as hosts to the bacterial, viral, or protozoan organisms that cause these diseases. Millions of people have little access to sanitary waste disposal or to clean water for personal hygiene. Over 1.2 billion people are at risk because they lack access to safe freshwater (Khan, 1997).

Where ever proper sanitation facilities are lacking, water-borne diseases can spread rapidly. The extent to which disease organisms occur in specific freshwater sources depends on the amount of human and animal excreta that they contain (Bowman, 1994).Diarrhoea1 disease, the major water-borne disease, is prevalent in those countries where there is inadequate sewage treatment. An estimated 4billion cases of diarrhoea1 diseases occur every year, causing3 million to 4million deaths, mostly among children

(Olshansky et a1 1997).Using contaminated sewage as fertilizer has resulted in epidemics of diseases like cholera. In the early 1990s, for example, raw sewage water that was used to fertilize vegetable fields caused out breaks of cholera in Chile and Peru (Mish, 1991). In Buenos Aires, Argentina, a slum neighborhood faced continual outbreaks of cholera, hepatitis, and meningitis because only 4% of homes had either water mains or proper toilets. Besides poor diets and little access to medical services, the health problems are also aggravated (Einstein, 1996).

Toxic substances that find their way into freshwater are another cause of water-borne diseases. Increasingly, agricultural chemicals, fertilizers, pesticides, and industrial wastes are being found in fresh water supplies. Such chemicals, even in low concentrations, can build up overtime and, eventually, can cause chronic diseases such as cancers among people **that** use **the water** (Silverberg, 1994).recent study of ground water samples collected in an area of about 270 **km2** from Madras city, India, showed that the arsenic levels exceeded the maximum permissible limit over the entire city and a positive correlation of arsenic with other toxic metals showed all these toxic elements to be anthropogenic in origin (Rarnesh et al., 1995).Poor management and negligence has compelled villagers in several districts of West Bengal to **drink** water contaminated with arsenic even 18 years after the calamity was first discovered. People are suffering clinically and sub clinically, with more and more cancer cases cropping up in the affected villages. The status of the arsenic calamity, in West Bengal by January 1999 had 1000 villages affected in 9 districts (including southern **part** of Calcutta). It was also identified that in these 9 districts more than 4.5 million people are drinking contaminated water with arsenic above 0.05 mg/l and that about 300,000 people have arsenical skin lesions. About 10,000 of hair, nail, urine samples were examined and revealed that, on an average, 80% of the people had arsenic in the body above normal level. Therefore it may be assumed that a large number of people are sub clinically affected (Chakraborti, 1999).

A team of scientists from the Central Soil Salinity Research Institute found arsenic in the groundwater of Gohana block in Stonecat district of Haryana. The peak concentration of arsenic found in three villages out of the five tested was more than **27** mg/l. The WHO prescribed norms allow 0.05 mg/l of arsenic in drinking water and those of FA0 was only 0.10 mg/l in waters used for irrigation purposes (Down to **Earth,**2002).

In India more than 25 million people of 15 States are consuming high fluoride (2 to 20 mg/l) contaminated water and are under severe threat of fluorosis. In rural India, ground water remains the main source of drinking water. The content of fluoride in ground water is increasing due to heavy withdrawal and poor recharging of aquifers. Medically it is advised that water used for human consumption should not contain fluoride beyond 1.0 mgtl (WHO, 1984). Hydro fluorosis caused by intake of **drinking** water containing excessive amounts of fluoride has been reported room all five inhabited continents of the world **(WHO,** 1970). **High29**Fluoride content in drinking ground waters and endemic fluorosis in 15States of India including Rajasthan have also been reported (Susheela, 1993). In the state of Rajasthan the fluoride content in drinking waters monitored, were found to contain higher in 27 out of 32 districts (Gupta eta1 1993) and a few sporadic studies on fluorosis have been reported. As per the survey carried out by the Public Health Engineering Department, Rajasthan in the year 1991-93, on the status of water supply in villages habitations, nearly 16560 (about 20% of the total)villages habitations were found to be affected by excess fluoride (more than 1.5 mg/l), out of which 5461 villages habitations had fluoride higher than 3mgll. The WHO standards permit only lmg/l fluoride in drinking water as a safe limit for human consumption (WHO, 1970, 1984). As per the manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organization (CPHEEO, 1991) the permissible limit of fluoride in drinking water is 1.0-1.5 mg/l and the U.S Public Health Service Drinking Water Standards allow fluoride concentration in drinking water from 0.8 to 1.7mg/l (USPHS, 1962).

The latest information shows that fluorosis is endemic in at least 25countries across the globe. The total number of people affected is not known, but a conservative estimate would number in tens of millions. In1993, 15 of India's 32 states were identified as endemic for fluorosis(RGNDWM, 1993). In Mexico, 5 million people (about 6% of the populations)are affected by fluoride in groundwater. Fluor sis is prevalent in some parts of central and western China, and caused not only by fluoride in groundwater but also by breathing airborne fluoride released from the burning of fluoride-laden coal. Worldwide, such instances of industrial flours is are on the rise.

Kerala is facing health hazards based on water quality problems in many parts. Clean water in Kerala has become a precious commodity and the quality is threatened by activities such as agricultural discharges, domestic sewage and industrial effluents. The ground water contamination in many places is caused by mineralogical origin. The water quality problems in the coastal areas are mainly because of the presence of excess of chloride. The chloride concentration>250mg/1 was detected in the well water samples of Azhikode, Kakkathuruthi, Kadalundi, Anjengo, Chellanum, Nallalam, Mankombu and Harippad. The wells at Aiyur (near

Mahe River), Payyoli and Chaliyam have high concentrations of iron and TDS. The bore well samples in Kozhikode city have high concentrations of chloride (20200mg/l), iron (0.40-0.90mg/l), total hardness (9000-l0600mg/l), and sulphate (2200-2300mgll).

In Thrichur, the concentration of fluoride, iron and chloride were found to be higher in the case of few bore well samples. Also 52% of the wells were found to be bacteriologic ally contaminated. (Remani and Harikumar,1998). In the midlands of Thiruvananthapuram, Kottiyam, Muvattupuzha, Kannur and Kasargode the water quality probemsarema~nly associated with pH and iron. In the highlands, the water samples analyzed from Myladurnpara of Idukki district indicated a high concentration of iron and coli forms (0.84-1.15mg/l Fe and450MPNcoliforms) (Harikumar, 1998).

Water quality studies of major rivers of Kerala indicated that the quality of water in all the rivers is not in good condition. The water quality of Bharatapuzha indicated the presence of mineral oil and high concentration of iron (0.69mg/l). Organ chlorine pesticides like hexachlorohexane (14ng/l) was also detected in Bharatapuzha.Regularmonitoring of the quality of 12 major rivers and a couple of lakes in the State by the Kerala State Pollution Control Board (KSPCB,2000) shows that they have a high level of faecal pollution as indicated by the high count of coliform bacteria. According to KSPCB lack of adequatesanitary facilities in urban centers for collection and treatment of sewage and the practice of open defecation in rural areas are seen as the cause for the abnormally high coli form counts in the natural water bodies.

The KSPCB studies show that fecal pollution at the upper zone of the rivers far exceeds the levels specified for using the river as a drinking water source. The upper zone implies the upstream portion of a river including its tributaries and roughly about two-thirds of the length of the river from the point of origin and it is a fact that the river water from this zone is a direct source of drinking water for large sections of people. The rivers monitored by the State Pollution Control Board authorities for the study are the Karamana, Kallada, Achenkovil, Pamba, Manimala, Meenachil, Muvattupuzha, Periyar, Chalakudy, Bharathapuzha, Chaliyar and Vallapattanam. Some of these rivers are the main source of drinking water for cities and a couple of other major rural drinking water supply schemes. While the high fecal count may not have any immediate or apparent consequence on the prevailing water use practices at all the three zones, remedial measures will have to be adopted for keeping the system under control as there could be a potential for contagious diseases to spread if continued to be neglected. The fecal pollution problem plagues the major lakes in the State too. The Ashtamudi Vembanad and Sasthamcotta lakes have alarmingly high coli form bacterial counts. Of these only the Sastharncotta Lake has fresh water and the water from this lake is subjected to disinfection beforedistribution for Kollam city by the water supply authorities.

Water quality monitoring of all the natural water bodies in the State1s carried out by the KSPCB primarily under the national and international schemes, Monitoring of Indian National Aquatic Resources (MINAR) and the Global Environmental Monitoring Scheme (GEMS), respectively. Samples are taken regularly each month from marked water sampling state on along the rivers and lakes for studies (Ignatius Pereira, 2002).Providing clean supplies of water and ensuring proper sanitation facilities would save millions of lives by reducing the prevalence of waterrelateddiseases. Thus, finding solutions to these problems should become high priority for developing countries and assistance agencies.

On the basis of different international, national and local level studies conducted by different scholars, a brief study on drinking water problem in Kerala with special reference to Navaikulam Panchayat in Thiruvananthapuram district is analyzed in this thesis.

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