WATER POLLUTION A REVIEW

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Abstract:

Water is considered as the Elixir of life. Every living thing needs water to survive. Earth the water planet is richly endowed with water, about 2/3 of the total area of the Earth's surface is covered with water, but all water on the planet is not usable for man as most of it is saline. Fresh water is limited, but enough to sustain man. The fresh water what is available is under great demand due to misuse of the fresh water and mainly due to pollution the water becomes useless and some time poisonous. This paper tries to evaluate the causes of water pollution and its consequences.

Introduction:

Pollution is the unwanted substance which has been introduced in the environment and it contaminates the environment. Pollution is caused by human action and sometimes due to natural disasters. Pollution has detrimental effect on all living organisms and is also a aesthetic nuisance and it makes virtually difficult to sustain life. The Environmental Protection Agency defines pollution as 'the presence of a substance in the environment that, because of its chemical composition or quantity, prevents the function of natural processes and produces undesirable environmental and health effects.' Any material that causes the pollution is called the pollutant (Wright, 2008- page 438). Pollution are not always the result of deliberate mistreatment of the environment but the by-product of otherwise worthy and essential activities like producing crops, producing energy, manufacturing products and our biological activities (Wright, 2008- page 438).According to Fereidoun et al, 2007; Environmental pollution is a worldwide problem and its potential to influence the health of human population is great. According to Kromm, 1973; the most serious danger of pollution is seen in highly industrialized developed countries, but Mara & Cairncross,1989; in poor countries of the worlds 80% of the polluted water from the industries have been used for irrigation of field. It has been reported by Kimani, 2007 that over the last three decades there has been increasing global concern over the public health impact attributed to environmental pollution. Human exposure to pollution is believed to be more intense now than any other time in human existence (Schell et al, 2006). According to Fereidoun et al, 2007; pollution can be caused by human activity as well as by natural forces, e.g. volcanic ash from Iceland (**World Health Organization [WHO], 2010a**) are one of the main reasons of pollution caused due to natural phenomena. Goodall (1995) refers tourism as a potential to damage the environment. Gautam et al (2009) has nominated

Indian cities as one among the most polluted cities in the world. According to Kan (2009), China has environmental problems, including outdoor and indoor air pollution, water shortages and pollution, desertification, and soil pollution, have become more pronounced and are subjecting Chinese residence to significant health risks. According to McGeehin et al, (2004), the cause of infectious disease like cancer, birth defects, and asthma in U.S. population may be due to environmental exposure. According to Kaufman (1993), there is no check on some 8,000 industrial units in the USA that are contributing to high rate of pollution.

Water Pollution:

Water Pollution may be defined as any chemical or physical change in water detrimental to living organisms. It can occur through natural process, for example through sediments produced by natural erosion, or may be caused due to extensive array of waste produced by man. The wastes may be discharged in the water bodies directly by man or by sewers or pipe from factories or be washed down from agriculture or urban areas, particularly after heavy rains. Under rather exceptional circumstances, water bodies may become significantly contaminated by the atmospheric deposition of pollutants. This indirect process of contamination is sometimes described as cross-media pollution (Jackson et al, 1996).

The irrigation sector is by far the biggest user of water, accounting for 61% of water withdrawal and 87% of water consumption. It is estimated that 30% of world food supplies are now reliant on artificial irrigation (**Lanz, 1995**). Industry is the second largest water withdrawal sector, followed by municipal use and the additional evaporation from reservoirs respectively. Total global withdrawal and consumption in 1995 are estimated to have been 3, 760 km3 and 2, 275 km3 respectively (**Shiklomanov,** 1997). Freshwater constitutes only about 2.5% of the total volume of water on Earth . Two-thirds of this freshwater is locked in glaciers and ice caps. Just 0.77% of all water (about 10, 665, 000 km3) is held in aquifers, soil pores, wetlands, rivers, plants and the atmosphere and so circulates reasonably fast (**Postel *et al.*, 1996).** Water, vital for life, plays a complex and multifaceted role in both human activities and natural systems. Its availability varies both spatially and temporally and both too little (i.e. droughts) and too much (i.e. floods) have negative effects on human well being. In an attempt to control water resources humanity has manipulated freshwater ecosystems for thousands of years. For example, both the Sumerian and Egyptian civilizations, flourished in part because of food surpluses derived as a consequence of elementary water management strategies (**Newson, 1992**).

Many areas of the world face water stress, millions of people die annually from water-related diseases, human-induced change of freshwater ecosystems continues apace and world-wide there are growing disputes over water. High population growth, increasing expectations and environmental degradation are increasing the severe strains on existing water resources. It is estimated that humans already appropriate

more than half of all accessible surface water runoff and that this may increase to 70% by 2025 (**Postel *et al.*, 1996**). Based upon principles developed at water conferences in Mar del Plata (**UN, 1977**) and in Dublin (**WMO, 1997**), Chapter 18 of Agenda 21 develops the concept of Integrated Water Resources Management (IWRM). This treats "water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilisation" (**UN, 1997**). Worldwide human induced changes to land-cover represent perhaps the most significant direct threat to natural freshwater ecosystems. Changes in land cover cause changes in the energy and material fluxes that support freshwater ecosystems. It has been shown that conversion of forest cover to agriculture may alter the radiation balance of the surface, soil structure, evapotranspiration and runoff generation (**Gash *et al.*, 1996**). For example, results of simulations using a global circulation model in which Amazon tropical forest and savannah were replaced by pasture predicted a weakened hydrological cycle with less precipitation and evaporation and an increase in surface temperature as a consequence of changes in albedo and surface roughness (**Lean and Warrilow, 1989**). Rainfall was reduced by 26% for the year as a whole (**Shukla *et al.*, 1990**). Reservoirs store surplus wet season runoff for use in dry periods or when required for hydropower production. They are essential for the well being of millions of people throughout the world. It is estimated that world-wide there are presently some 40 000 large dams (i.e. >15 m high) and more than 800 000 smaller ones. More than 400,000 km2 (0.3 % of the global land surface) has been inundated by reservoirs (**McCully, 1996**). The average world-wide risk of any dam failing in any given year is estimated to be of the order of 1 in 10,000 and it is thought there were "200 notable reservoir failures" between 1900 and 1980 (**McCully, 1996**). It is estimated that 12,000 people have been killed this century by dam-bursts outside China, excluding incidents caused by enemy action during war. The worst dam disaster occurred in Henan province in central China in 1975 when as many as 230, 000 people may have died when a large number of dams failed simultaneously. It is thought that 85 000 people died in the immediate flood wave and 145 000 in the epidemics and famine that followed (**McCully, 1996**).

It has been reported that in India alone a total of 33 million people may have been displaced by the construction of large dams (**Roy, 1999**). It is estimated that half the fish stocks endemic to the Pacific coast of the USA have been wiped out in the past century, often because of dam construction (**Chaterjee, 1998**).

The water we drink are essential ingredients for our wellbeing and a healthy life. Unfortunately polluted water and air are common throughout the world (European Public Health Alliance, 2009). The WHO states that one sixth of the world's population, approximately 1.1 billion people do not have access to safe water and 2.4 billion lack basic sanitation (European Public Health Alliance, 2009). Polluted water

consists of Industrial discharged effluents, sewage water, rain water pollution (Ashraf et al, 2010) and polluted by agriculture or households cause damage to human health or the environment. (European Public Health Alliance, 2009). This water pollution affects the health and quality of soils and vegetation (Carter, 1985). Some water pollution effects are recognized immediately, whereas others don't show up for months or years (Ashraf et al, 2010). Estimation indicates that more than fifty countries of the world with an area of twenty million hectares area are treated with polluted or partially treated polluted water (Hussain et al, 2001) including parts of all continents (Avdeev & Korchagin, 1994; Carter, 1985; Kan, 2009; Khan, 2010; Krześlak & Korytkowski, 1994; Wu et al, 1999) and this poor quality water causes health hazard and death of human being, aquatic life and also disturbs the production of different crops (Ashraf et al, 2010; Scipeeps, 2009). In fact, the effects of water pollution are said to be the leading cause of death for humans across the globe, moreover, water pollution affects our oceans, lakes, rivers, and drinking water, making it a widespread and global concern (Scipeeps, 2009). A drinking water contained a fluoride content ranging from 5.26 to 26.32 milligrams per liter and this is too high as compared to the World Health Organization's standard of 0.6 to 1.7 milligram per liter (Rizvi, 2000).

Apart from disposal of industrial effluents on land and/or surface water bodies, untreated effluents are also injected into groundwater through ditches and wells in some industrial locations in India to avoid pollution abatement costs (Ghosh, 2005; Behera and Reddy, 2002;). Safe utilisation of wastewater for irrigation requires proper treatment and several precautionary measures in use, as it may cause environmental and human health hazards (Qadir et al., 2005; Singh and Bhati, 2003; Bradford et al., 2003;). When treatment is not adequate, application of domestic wastewater on land might cause various environmental problems, like groundwater contamination (bacteriological and chemical), soil degradation, and contamination of crops grown on polluted water (McCornick et al., 2004, 2003 and Scott et al., 2004). In India only 24 per cent of wastewater is treated (primary only) before use in agriculture and disposal into rivers (Minhas and Samra, 2003), Environmental problems related to industrial effluent disposal on land have been reported from various parts of the country. Disposal on land has become a regular practice for some industries and creates local/regional environmental problems (Biradar et al., 2002; Salunke and Karande, 2002; Kannan and Oblisami, 1990).However, the disposal of industrial effluents on land for irrigation is a comparatively new area of research and hence throws new challenges for environmental management (Buechler and Mekala, 2005; Bhamoriya, 2004; and Tiwari and Mahapatra, 1999). Environmental and socio-economic aspects of industrial effluent irrigation have not been studied as extensively as irrigation using domestic sewage. Studies focused on different aspects of industrial effluent irrigation, with special reference to environmental, human health and livelihood impacts are rare (Mukherjee and Nelliyat, 2006).

In India, the supply of fresh water resources is almost constant and even if it is not falling, from which the agriculture sector draws the lion's share (80-90 per cent) (Kumar et al., 2005; Gupta and Deshpande, 2004; Vira et al., 2004 and Chopra, 2003). Hence, with the growing demand and rising scarcity for water, in future all the demands for agricultural use cannot be met by fresh water resources alone, but will gradually depend on marginal quality water or refuse water from domestic and industrial sectors (Bouwer, 2000).In experimental animal studies, several disinfection byproducts were found to cause cancer, including chloroform, other trihalomethanes, and some haloacetic acids (Cantor, 2006). Strong evidence from epidemiologic studies suggests that long-term exposure to disinfection byproducts in drinking water increases the risk of bladder cancer and possibly colon, rectal and esophageal cancers (Cantor et al , 2006). Disinfection byproducts are not the only water pollutants that may increase cancer risk. Radon in drinking water can contribute to a small but significant increase in the risk of lung cancer by contributing to radiation levels inside buildings (Krewski, et al 2005; Cantor et al , 2006). Exposure to arsenic is a well-established cause of bladder cancer as well as of lung, kidney, and non-melanoma skin cancers (Cantor et al , 2006). An estimated 30-40% of the 1.4 billion gallons of lubricating oils used in automobiles are either burned in the engine or lost in drips and leaks, and another 180 million gallons are disposed of improperly onto the ground or into sewers.2 Runoff from roads and parking lots has a high concentration of toxic metals, suspended solids, and hydrocarbons, which originate largely from automobiles.3 Highway runoff is toxic to many aquatic species.4 Large quantities of petroleum are released from leaks and spills during extraction, processing, and distribution.6 Road de-icing salts cause significant environmental and material damages.7 Roadside vegetation control is a major source of herbicide dispersal. Roads and parking facilities have major hydrologic impacts.8 They concentrate stormwater, causing increased flooding, scouring and siltation, reduce surface and groundwater recharge which lowers dry season flows, and create physical barriers to fish. One survey found that 36% of 726 Washington State highway culverts interfere with fish passage, of which 17% were total blockages (Tom, 1992).

Pathogens:

A small drop of fecal matter can contain millions of microorganisms of many types, some of which are pathogenic (Rose et al 1999, p8). Microbial pathogens in raw or inadequately treated sewage can cause illnesses ranging from temporary stomach cramps to life-threatening conditions such as inflammation of the heart. While, in a healthy population, most of the illnesses resulting from exposure to inadequately treated sewage are relatively minor (respiratory
illness; ear, nose or throat irritation; gastroenteritis), they can become serious in more vulnerable populations, including pregnant women, young children, the elderly, and people with suppressed immune

systems (such as people with HIV, transplant recipients, and cancer patients) (Gerba et al, 1999) This group accounts for 20 to 25 percent of the U.S. population and is rapidly growing in number(Rose et al 1999, p6). Infants and children show a higher incidence of waterborne illnesses than the general population (Laurenson, 2000). The elderly, too, are at greater risk.people older than 74 have the highest mortality from waterborne or food-borne diarrheal illnesses (Reynolds, 2000; Gerba, 1999,p112 -23). Most waterborne and seafood-borne diseases throughout the world are caused by viruses(National Academy of Science, 2000) While most of the waterborne pathogens enter the sewage system through human wastes, others may enter through animal wastes such as cat feces, which many urban pet owners flush down the toilet. Cat feces may contain the infectious protozoan *Giardia lambia* **(Simmons et al, 2001)** or the SARS (Severe Acute Respiratory Syndrome) virus (Martina et al, 2003,p915). Studies by the National Academy of Sciences and CDC suggest that most seafood-associated illnesses are related to seafood contaminated with untreated or inadequately treated sewage (CDCP, 1997; Farid, 1991; Centre for disease control prevention, 1995,1997). The *Vibrio* bacterium, a sewagerelated pathogen, is a growing problem in Florida, where almost 90 percent of fatal cases of *V. vulnificus* septicemia are due to consumption of raw Gulf Coast oysters (Rose, 1999). Recreational exposure usually occurs through ingestion, but also can occur through the eyes, ears, nose, anus, skin, or genitourinary tract(Henrickson et al, 2001) For example, 21 police scuba divers became ill after training in sewage-contaminated waters in New York City in 1982(Centers for disease control and Prevention, 1983). Chlorination, the most widely used form of disinfection for sewage, does not work well when the wastewater to which it is being applied is cloudy, as blended sewage inevitably is (Katonak et al, 2004). In addition, the high concentrations of suspended solids in the partially treated wastewater could impede the switch from chlorine to less toxic and hazardous disinfection methods such as ultraviolet light. UV disinfection is less effective when wastewater contains large amounts of solids (Katonak et al, 2004).Widespread and permissive use of antibiotics in agriculture and for human therapeutic use where antibiotics are ineffective have resulted in an explosion of drug resistance among environmental bacterial species (Kator, 2003). Relatively little is known about the health effects of most industrial chemicals registered for commercial use, including those produced in large volumes and those found in increasing quantities in blood, breast milk, and other body fluids;(Landrigan, 2003) . Several studies and reviews. indicate that contaminants can erode disease resistance in ways that make people mortally vulnerable to infectious diseases they might otherwise have been able to resist. Recent research shows that daily human exposure to DEHP, used most commonly as plasticizers in the food and construction industry and the most abundant phthalate ester in the environment is significant in the United States and is associated with changes in hormone levels (Akingbemi, 2004). The EPA reports that the largest known pollution sources

in impaired estuaries are municipal sewage treatment plant discharges, which contribute to 37 percent of the reported water quality problems in the impaired estuaries (U.S. EPA, 2000) Dissolved oxygen levels in Lake Erie, whose revitalization has often been trumpeted as one of the great success stories of the 1972 Clean Water Act,(U.S. EPA, 2001) remains .a persistent problem, according to the EPA , (U.S. EPA, 2001). Exposure to the toxin produced by one such organism, *Pfiesteria*, during episodes of red tides. are thought to cause memory impairment in humans (Trainer, 2002). Some pathogens present in raw or inadequately treated sewage will settle into bottom sediments of lakes, rivers, or streams, where they remain viable for days, months or years. Contrary to what many people assume, pathogens do not all die quickly once they enter the environment. One study, for example, found that when tracking a *Salmonella* species discharged in wastewater effluent, sedimentation effectively removed much of the bacteria from the overlying water column where it accumulated in the bottom deposits of a river. But the viable *Salmonella* species were still being recovered in the sediment over the 12-month study period(Hendrick, 1971)us, when water column testing indicated a reduced number of *Salmonella* present, this result missed the high concentrations present in the sedimentary materials of the river bottom. Storm events and increases in river turbulence and flow rates resuspend the bacteria and effectively move them further downstream over time. A few studies have shown that particulate associated pathogens may survive for months or even years in bottom sediments under certain circumstances (U.S.EPA, 2001). Lack of information and underreporting of waterborne illnesses is a serious obstacle to estimating their prevalence (Frey et al, 2002). All agencies that track waterborne illnesses agree that the number of reported cases is a small subset of the actual number of illnesses caused by sewage exposure or waterborne pathogens (Ford, 1999). In the small town of Cabool, Missouri, in 1990, a pathogenic strain of *E. coli* linked to a sewage overflow killed 4 people, hospitalized 32 and caused diarrhea and other problems for 243 more(U.S.EPA, 2001) . In July of 1998, as a result of a power outage from a thunderstorm, about 167,000 gallons of raw sewage flowed into Brushy Creek, Texas, where it contaminated drinking water wells. As a result, about 6,000 people were exposed to contaminated drinking water and 1,440 of those became ill with gastroenteritis (Environomics Inc, 2000). While bacteria die off comparatively quickly in the environment, viruses may remain active for days or weeks, and helminth eggs and protozoan cysts may remain active for many months (Katonak et al, 2004) Pathogens often survive long enough in the environment to be a potential health threat (Draft Onsite Sewage Risk Assessemnt System Rev, 2001). The Bush administration has recently begun to acknowledge the serious consequences of climate change (Claussen 2002; President Bush, 2001). Precipitation increased 5 to 10 percent over land areas of the Northern Hemisphere during the 20th century, (Hileman, 2003) and global warming is predicted to further increase the intensity of rainfall

events for parts of the United States (Tai, 2001). Scientists at the Johns Hopkins School of Public Health report a significant association between outbreaks of waterborne illness and rainfall, particularly during extreme weather events, which can contaminate both surface and ground waters (Curriero et al, 2001; Rose et al 2000). The toll associated with waterborne disease outbreaks in lost work days, medical costs, and even lives can be large (U.S. EPA. 2000) waters, where phosphorus concentrations are sufficient to support harmful algal growth. Nutrient enrichment and eutrophication lead to the decline of aquatic species, including those with commercial value. Sensitive crops such as tomatoes, cucumbers, conifers, and fruit cultures can be damaged by over-fertilization caused by ammonia deposition if they are cultivated near major ammonia sources (van der Eerden et al, 1998). The deposition of ammonia on soils with a low buffering capacity can result in soil acidification or basic cation depletion.

Conclusion:

The water which provides life, and is considered as the Elixir of life can become a poison if it gets associated with pollutants. Man is the only creature who pollutes water, and its man who suffers the most because of polluted water. The current study highlights the need to prevent water from being polluted and use it in such a way that it remains an elixir of life and not become venom.

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