International Journal of Scientific Research in Chemistry (IJSRCH)
© 2021 IJSRCH | Volume 6 | Issue 5 | ISSN : 2456-8457

Water Pollution Due to Population and Its Impact on the Environment

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Article Info
Volume 6, Issue 5
Page Number : 45-54

Publication Issue :
September-October-2021

Article History
Accepted : 10 Oct 2021
Published : 30 Oct 2021

ABSTRACT

Water covers about 70% Earth's surface. Safe drinking water is a basic need for all humans. Water resources in the world have been profoundly influenced over the last years by human activities, whereby the world is currently facing critical water supply and drinking water quality problems. In many parts of the world heavy metal (HM) concentrations in drinking water are higher than some international guideline values. "Population and Pollution" is one of the most important environmental and public health issues. The WHO reports that 80% diseases are waterborne. Industrialization, discharge of domestic waste, radioactive waste, excessive use of pesticides, fertilizers and leakage from water tanks are major sources of water pollution and rapid population growth are major driving forces of pollution in large cities, especially in megacities. These wastes have negative effects on human health. Different chemicals have different affects depending on their locations and kinds. Bacterial, viral and parasitic diseases like typhoid, cholera, encephalitis, poliomyelitis, hepatitis, skin infection and gastrointestinal are spreading through polluted water. Heavy metal (HM) pollution in drinking water, the incorporation of them into the food chain, and their implications as a global risk for the human health. It is known that there are million people with chronic HM poisoning which has become a worldwide public health issue, while 1.6 million children die each year from diseases for which contaminated drinking water is a leading cause. There is also evidence of HM in drinking water that are responsible for causing adverse effect on human health through food chain contamination. It is recommended to examine the water quality on regular basis to avoid its destructive effects on human health. Domestic and agriculture waste should not be disposed of without treating.

Keywords: Critical, Heavy Metal, Radioactive Waste, Gastrointestinal.

I. INTRODUCTION

Essential elements in our earth for survival of mankind are water, air and soil. Water covers 71% of the Earth's surface, mostly in oceans and other large water bodies. According to biologists, all life form came from the sea means water. We are living on this planet due to the blessing of water. From the dawn of civilization to till

now, humans (cave dwellers to city dwellers) have been using water for various seminal purposes: drinking, bathing, watering animals, and irrigating lands. Water pollution occurs when unwanted materials enter in to water, changes the quality of water and harmful to environment and human health. Water is an important natural resource used for drinking and other developmental purposes in our lives. Safe drinking water is necessary for human health all over the world. Being a universal solvent, water is a major source of infection. According to world health organization (WHO) 80% diseases are water borne. Drinking water in various countries does not meet WHO standards. 3.1% deaths occur due to the unhygienic and poor quality of water. Almost 71% of the earth's total surface is covered with water, only 2.5% of this amount can be considered as freshwater (Shiklomanov,1993). At present, 1.6 billion of people are facing economic water shortage, and two-thirds of the world's population is experiencing water scarcity at least one month in a year (FAO, 2007; Mekonnen and Hoekstra, 2016). Recently scientists have found that 21 of the world's 37 largest aquifers around the world have crossed their sustainability tipping points (Richey et al., 2015). The condition of water stress and scarcity will be worsened. Almost 1.8 billion people living in various regions all over the world may face absolute water scarcity by 2025 (WWAP, 2012). However, these limited water resources are under threat from the pollution, chiefly generated by human factors. The agricultural sector, industrial production, mining, power generation, and other factors are some of the contributors to the pollution of water bodies, which will eventually affect humans in general (UN-Water, 2001). Diseases: cholera, diarrhea, dysentery, hepatitis A, etc. are directly linked to the unhygienic and contaminated potable water. It is estimated that each year more than 842,000 people die from diarrhea globally (WHO, 2017a,b). Arsenic pollution is one of the major groundwater contaminations, and it affects nearly 70 million people worldwide (UNESCO, 2009). The proportion of the global burden of disease associated with environmental pollution hazards. Include infectious diseases related to drinking water, sanitation, and food hygiene; and vectorborne diseases with a major environmental component, such as malaria. Each pollutant has its own health risk profile, which makes summarizing all relevant information into a short chapter difficult. Nevertheless, public health practitioners and decision makers in developing countries need to be aware of the potential health risks caused by water pollution and to know where to find the more detailed information required to handle a specific situation. Although, there is no clear definition of what a heavy metal (HM) is; density is in most cases taken to be the defining factor. HM are thus commonly defined as those elements having a specific density of more than 5 g cm-3. The main threats to human health from HM are associated with exposure to cadmium, lead, mercury and arsenic (arsenic is a metalloid, but is usually classified as a HM), but additionally, there are others 19 elements known as HM: antimony, bismuth, cerium, chromium, cobalt, copper, gallium, gold, iron, manganese, nickel, platinum, silver, tellurium, thallium, tin, uranium, vanadium and zinc. Interestingly, small amounts of HM are common in our environment and diet, even some of them are necessary for good health, for example, living organisms require varying amounts of HM such as iron, cobalt, copper, manganese, molybdenum and zinc, which are required by humans too. However, large amounts of any of them may cause acute or chronic toxicity (poisoning) (Kabata-Pendias and Mukherjee, 2007). Soils represents a major sink for HM ions, which can then enter the food chain via water, plants or leaching into groundwater. HM toxicity can result in brain damage or the reduction of mental processes (Gaza et al., 2005) and central nervous function (Bouchard et al., 2011), lower energy levels (Holmstrup et al., 2011), damage to DNA (Jomova et al., 2011), alterations on the gene expression (Salgado-Bustamante et al., 2010), skin (Burger et al., 2007), muscle (Visnjic-Jeftic et al., 2010),

blood composition (Di Gioacchino et al., 2008), lungs (Thomas et al., 2009), kidneys (Johri et al., 2010), liver (Burger et al., 2007), heart (Otles and Cagindi, 2010), and other vital organs for humans and other living organisms. Discharge of domestic and industrial effluent wastes, leakage from water tanks, marine dumping, radioactive waste and atmospheric deposition are major causes of water pollution. Heavy metals that disposed off and industrial waste can accumulate in lakes and river, proving harmful to humans and animals. Human health is affected by the direct damage of plants and animal nutrition. Water pollutants are killing sea weeds, mollusks, marine birds, fishes, crustaceans and other sea organisms that serve as food for human. Insecticides like DDT concentration is increasing along the food chain. These insecticides are harmful for humans. Large amount of domestic sewage is drained in to river and most of the sewage is untreated. Domestic sewage contains toxicants, solid waste, plastic litters and bacterial contaminants and these toxic materials causes water pollution. Different industrial effluent that is drained in to river without treatment is the major cause of water pollution. Hazardous material discharged from the industries is responsible for surface water and ground water contamination. Contaminant depends upon the nature of industries. Toxic metals enter in to water and reduced the quality of water. 25% pollution is caused by the industries and is more harmful. Increasing population is creating many issues but it also plays negative role in polluting the water. Increasing population leads to increase in solid waste generation. Solid and liquid waste is discharged in to rivers. Water is also contaminated by human excreta. In contaminated water, a large number of bacteria are also found which is harmful for human health. Government is incapable to supply essential needs to citizens because of increasing number of population. Sanitation facilities are more in urban areas than rural areas. Polythene bag and plastic waste is a major source of pollution. Waste is thrown away by putting it in to plastic bags. Urbanization can cause many infectious diseases. Overcrowding, unhygienic conditions, unsafe drinking water are major health issues in urban areas. One quarter of urban population is susceptible to disease.

POLLUTION DUE TO HEAVY METALS

Increase in toxicity of heavy metal is caused by localisation of a high amount of the metal. In some areas, chimneys have been built higher to dilute the emissions of the metal as they are dispersed more and thus not fall in a localized spot. Although sometimes this still has other effects, as being emitted higher make it more prone to acid rain. Even though the Earth is seen as one compartment, it can be subdivided into many other compartments such as an organism or individual cells. Potential toxins on organisms may be compartmentalized into insoluble deposits; thus, this prevents any interactions with essential biochemical reactions that occur in the cytoplasm. Since metals are non-biodegradable and hence remain persistent in the environment for a very long time, they cannot be broken down. Heavy metals present in soils and sediments remain present for an extended period until they are eluted to other compartments. They can also react with other elements in the soil or sediment and form or degrade to become more toxic. An example of this is the formation of poisonous methyl mercury from the inorganic mercury and activity of bacteria found in water, sediment and soil. Anthropogenic activity has left a very high concentration of metals in contaminated sites such as disused mining sites, or previously used metal-containing pesticides. In these areas, vegetation is sparse, and only metal-tolerant strains grow in the area. In these zones, sometimes capping is introduced, meaning that an impermeable layer is placed on top of the contaminated site, and new soil is put on top of it. Capping will help the vegetation not absorb any metals and also help the water going down not to take heavy metals into the groundwater.

Metal containing pesticide contained arsenic, copper, lead and chromium and these may still be found in some areas where it had been used. Farmers sometimes use sewage sludge and mix it in the soil, though this may contain heavy metals, primarily if the sludge has been produced by industries. Heavy metals, such as copper, zinc, lead, cadmium and chromium, have been found in the soil of these agricultural lands at a high concentration. Smelting causes localized pollution through atmospheric pollution, which then deposits on the soil. Some areas were smelting occurs shows dead vegetation and absence of life such as earthworms and woodlice, which help in vegetation to be decomposed. Lead-contaminated gasoline was used with a high concentration of lead, lead shotgun pellets, and lead fishing weights all contributed to lead being found in our environment. Some have been banned in certain parts of the world. Shotgun pellets have been taken up by birds, and this then moves through the food chain, the weights have caused lead to be found in wetlands also. Metals are bound more to the soil if the clay content, organic matter, and the pH, are higher. The more acidic the soil, the less elemental elements have been found as these become more soluble and leach lower in the ground where the roots do not reach causing nutrient deficiency to the plants. In the water sector, most rivers are polluted especially those that pass from near industries and mining areas. These then flow down to the sea where they mostly descend to the bottom and since the current slows down. The solubility of the metals depends mostly on the pH of the water. As soon as the streams containing heavy metals flow into the sea, the acid rises, and the solubility of the metals decrease and thus precipitate downwards towards the bed.

POLLUTION OF RIVERS IN UTTAR PRADESH DUE TO INDUSTRIALISATION

Rivers are the chief contributor of human civilization. Ecologically, it helps in recharging ground water, controlling floods, supporting wild life and adaptation for climatic changes. Numerous chemical plants, textile mills, distilleries, and hospitals prosper and flourish in a large number of industrial cities situated along the bank of the rivers where they cause pollution due to the discharge of untreated waste into it. Ganges, the lifeline of the millions of Indians who live along its course caters their daily needs however, presently this is highly polluted due to industrialization resulting in many hormonal and other physiological diseases. Approximately 210,000 tons of fly ash (containing toxic heavy metals such as lead and copper) from coal-based power plant was dumped in Kanpur in Pandu River, a tributary of Ganges. Industrial effluents accounts for about 12% of the total volume of effluents being discharged in the Ganges. Though a relatively low proportion they are a cause for major concern due to their toxic and non-biodegradable nature. Industrial discharges are the major sources of aquatic pollution. Depending on type of industry, various types of pollutants are released into the environment directly (industrial outlets) or indirectly (domestic sewages) due to various anthropogenic activities which in turn may pose serious threat to human health. Wastewater released from various industries has high concentration of organic pollutants, toxic components such as heavy metals, pesticides, polychlorinated biphenyls (PCBs), dioxins, poly-aromatic hydrocarbons (PAHs), petrochemicals, phenolic components etc. These are harmful for surrounding water bodies, human health and aquatic life if discharged directly into the aquatic medium. When industrial effluent containing heavy metals (Cr, Pb, Hg, Ni, Cu, Zn, As, Cd etc.) reaches into the aquatic ecosystem, its biomagnifications takes place through food chain. Progress in toxicology has advanced our knowledge regarding the excessive accumulation of heavy metals and their adverse impacts on human health including developmental retardation, cancer, kidney damage, endocrine disruption, immunological disorders (autoimmunity) and even death.

WATER POLLUTION DUE TO AGRICULTURAL SECTOR

A large number of chemicals are used to maintain crop production and to increase agricultural growth rate every year. Other than this, several tons of pesticides are consumed to control pests, weeds, insects and other microorganisms. These pesticides and other chemicals generally contain hundred different types of active ingredients that directly impart toxicity to humans and other biota. These chemicals not only pollute soil, water resource, biota and ecosystem but also it stretches its effect to farmers and consumers (Galt 2008; European Commission 1991), and these contamination due to their continuous exposure to living organisms are of great concern. Very high concentrations of pesticides and their intermediate products such as triazines and chloroacetanilides are detected in US rivers, and due to their high permissible range, it can effect nontarget organisms in soils and whole aquatic systems and also affect the quality of surface and groundwater (Gilliom 2007). Pesticides like dichlorodiphenyltrichloroethane (DDT), hexachlorocyclohexane (HCH), aldrin and dieldrin which are organochlorine in nature are commonly used in developing countries like India due to low cost and effectiveness among several pests. Use of pesticides like HCH, DDT, endosulfan, phorate are common in some parts of India like Punjab, Maharashtra, Karnataka, Gujarat and Andhra Pradesh (Abhilash and Singh 2009). These pesticides are used for crops like cotton, vegetables, sugarcane rice. Effective mitigation measures have to be designed to prevent pesticides and others chemicals to reach surface and groundwater. Pesticides runoff is dependent on hydrological properties of soil like water flow patterns, permeability, topography, meteorological conditions and absorption behaviour of chemical composition 2 Water Pollution, Human Health and Remediation 15 of pesticides (Leu et al. 2004). Pesticides applied to crop at first were degraded by soil microbes and chemical reactions, further it also absorbs in organic matter present in soil. It transforms into other metabolites but does not completely degrade. The final pathway of pesticides in environment takes place through volatilization in atmosphere, runoff in dissolved and particulate form to surface water bodies like river and mixing in groundwater through leaching process (National Research Council 1993). Water contamination takes place through runoff of pesticides containing rainwater from roofs and roads in urban areas, which lead to pollution in drainage and sewer system. Pesticides application in agricultural practice causes direct exposure and health risk for workers, and extensive use of pesticides leads to water and soil pollution. In the area prone to high pesticides concentration, effective mitigation measures have to be applied by replacing or restricting extensive use of pesticides (Leu et al. 2004a; b). To maintain ecological balance and biodiversity, extensive use of pesticides in agricultural land has to be controlled and further direct exposure of pesticide chemicals to workers and farmers has to be regulated. Report shows that due to accidental exposure of pesticides, poisoning of 3 million people and 20,000 accidental deaths takes place per year in developing countries (United Nations Environment Programme 2007). The main role of the agricultural practices in most developing countries is to attain and sustain food security issues for the emerging populations, also keeping in mind about type of agricultural practices, pesticides and agrochemicals usage and their effect on human and other living being. With increasing trends in urbanization and industrialization, development in agricultural practices also increases which lead to water usage and quality issues. Due to extensive pesticides usage per hectare of agricultural land in developing countries, their concentration monitoring and effect assessment for human and plants health are often limited and implementation of regulations for maintaining pesticide concentrations are limited (Menezes and Heller 2008; Agrawal 1999).

SURFACE WATER CONTAMINATION FROM MINING OPERATIONS

Mining activities worldwide mobilize more than 50×109 metric tons of geological material per year, which is similar to the flux of particles transported by rivers from the continents to the sea. Most mining operations trigger significant environmental and social problems as they result in large waste deposits, which are exposed to oxidation by air and weathering by precipitation, and subsequent pollution of water resources. Mining for coal, lignite, building materials, and iron involves the largest mass movements with a significant yield of end products. The extraction of rare metals, such as copper, nickel or gold, however, produces up to 1,000 tons of waste materials per kilogram of pure metal. These massive waste streams are accompanied by problematic geochemical weathering reactions and specific pollutant loads, which are introduced as mining chemicals. Ores, such as coal, iron, and copper, typically contain large fractions of sulfide material; this material is oxidized in contact with air and water and releases sulfuric acid in the form of "acid mine drainage". Because the sulfur concentrations can reach high proportions (1–20 wt% pyrite in the case of coal), a conservative worldwide estimate assumes that about 20,000 river kilometers and 70,000 ha of lake and reservoir area are seriously damaged by acidic mine effluent. In addition, mining and extraction of precious metals are associated with intense use of chemicals, energy, and water that poses greater pollution hazards and environmental risks. Gold production serves as an illustrative example. As the average ore grade decreased over the past two centuries, chemical extraction either by mercury amalgamation in artisanal gold mining or via the industrial cyanide extraction process became increasingly important. Both reagents are extremely toxic to humans and the environment. Artisanal gold mining with mercury is increasingly practiced by about 13 million miners in 55 countries, such as Brazil, Tanzania, Indonesia, and Vietnam. Traces of gold are dissolved in liquid mercury, which is then removed by heating and evaporation to the atmosphere. Mine workers are thereby directly exposed to hazardous levels of the neurotoxic metal, and the local environmental contamination of water resources can be severe. A review based on detailed case studies in Brazil estimates that more than 100 tons of mercury are discharged into the environment every year, and about 50% of this is mobilized into surface water, where mercury biomagnifies up to 106-fold in predatory fish and then represents a health risk to indigenous populations. At lower gold concentrations and larger volumes, the cyanide extraction facilitates oxidative leaching of gold as a complex into aqueous solution. Dissolved gold is then adsorbed, and the cyanide solution is recycled. Typically, 700 tons of water and 140 kg of cyanide are required to extract 1 kg of gold. Cyanide blocks the function of iron- and copper-containing enzymes in the respiratory chain of higher organisms. It is acutely toxic to humans at a level of a few 100 mg for an adult person. Fish react at about 1,000 times lower levels and are killed in water containing as little as 50 μg/L of cyanide. Gold mining operations are therefore often associated with spectacular fish kills. Most aquatic organisms were killed along the main stem of the Tisza River in Hungary, and most water supplies were closed when a dam failure at a tailing pond in Romania triggered the release of about 100,000 m3 of cyanide-containing waste in January 2000. More sustainable mining practices require mitigation measures for existing tailings and improved processes and safety procedures for ongoing activities. Highly toxic chemicals, such as cyanide or mercury, should be replaced by less harmful extraction agents, such as halogens or thiourea, or a zero-emission policy should be enforced. Such technical measures should be supplemented by clear international regulations and corporate social responsibility in the mining industry, which is based on open information policies. Although international

agreements and practice codes cannot substitute for stronger enforcement of environmental regulations by developing countries, they represent helpful benchmarks for protecting water quality.

II. CONCLUSION

The stress on our water environment as a result of increased industrialization, which aids urbanization, is becoming very high thus reducing the availability of clean water. Polluted water is of great concern to the aquatic organism, plants, humans, and climate and indeed alters the ecosystem. The preservation of our water environment, which is embedded in sustainable development, must be well driven by all sectors. While effective wastewater treatment has the tendency of salvaging the water environment, integration of environmental policies into the actor firm's core objectives coupled with continuous periodical enlightenment on the present and future consequences of environmental/water pollution will greatly assist in conserving the water environment. Since water forms a core of the existence of human and other living things, its preservation and sustainable availability cannot be overemphasized. The availability of clean water is greatly threatened by various human activities and of interest is pollution which in turn affects the ecosystem and causes various climatic changes. While various wastewater treatment methods are being explored by industries and various treatment plants, untreated wastewater is still being discharged into the water bodies by some industries. Thus, effective environmental protection policies compliance drive will be of immense benefit to the environment and by extension to human. Factoring these environmental protection policies into the goals and objectives of various factors involved in environmental deterioration will help policies performance. This will serve as a step forward in the direction of ameliorating water pollution.

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Cite this article as :

Prem Prabhakar, "Water Pollution Due to Population and Its Impact on the Environment", International Journal of Scientific Research in Chemistry (IJSRCH), ISSN : 2456-8457, Volume 6, Issue 5, pp.45-54, September-October.2021

URL : https://ijsrch.com/IJSRCH21655