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Factors Affecting Water Pollution: A Review

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Abstract

This study was conducted at University of Gujrat during 2016 to 2017 as a term paper for Master of Philosophy. The data regarding effect of ozone depletion on human was reviewed and compiled as a review paper from various published articles of international reputed journals annual/environmental reports of recognized organization and e-books. Factors which are effecting water pollution are addressed. Water pollution is very important problem of 21st century. Due to water pollution pure water is becoming less scare day by day. The biggest cause of water pollution is industrialization and increase in population. By drinking polluted water people becoming more and more ill.

Keywords: Water pollution; Pesticides and herbicides; Surface water quality; Chemical pollution; Agricultural pollution; Herbicides; Pesticides; Chemical pollution; Sediment pollution; Urban water runoff; Salt water intrusion

Introduction

Water pollution has become a global problem now a day's ongoing evaluation of water resource policy is needed to counter this problem. Deaths and diseases are caused worldwide due to water pollution and approximately 14000 people die every day due to water pollution [1-3].

Both developed as well as developing countries are facing water pollution problems [4]. Water quality is influenced by many factors like precipitation, climate, soil type, vegetation, geology, flow conditions, ground water and human activities. The greatest threat to water quality is posed by point sources of industries and municipalities. Activities like mining, Urban development and Agriculture also effect water quality. Non-point source pollution also includes nutrients, sediments and toxic contaminants [5].

Pollutants

It is a substance which when introduced into environment causes undesirable effects or spoils resources. Long or short term damage may be caused due to pollutant. Biodegradable pollutants only cause short term damage. Some pollutants like DDT again produce pollutants upon degradation like DDD and DDE.

Pollutants may be of different types and having different properties like Stock pollutants which include non-biodegradable plastics, synthetic chemical and heavy metals have no or very little absorptive capacity. These pollutants accumulate in environment with the passage of time. Their damage increases as their quantity increases. For future generations stock pollutants are burdens. Similarly Fund pollutants have some absorptive property in environment. They only cause problem when their quantity increases beyond environment absorbance capacity. E.g., Carbon dioxide only causes problem when its amount increases. These pollutants can only be diluted to reduce their toxicity or recycled into non harmful substances [6].

Point source pollution

When source of water pollution is known or pollutants that are entering into water are from identifiable source like ditch, pipe industry, storm drain and sewage treatment plants etc. pollution is known as point source pollution [7]. It can be distinguished from other pollution sources [8].

Non-point source pollution

When source of water pollution is not known or pollution does not come from single discrete source pollution is known as non-point source pollution [9]. It is very difficult to control and may come from different sources like pesticides, fertilizers industrial wastes etc. [10]. Non-point source pollution is the main and leading cause of water pollution in USA [11,12].

Ground water pollution

When pollutants which are present on ground enter the water bodies under earth they cause ground water pollution. When fecal water containing pathogens reaches under earth it makes it unfit for drinking. Pathogen polluted ground water may contain viruses, protozoa and bacteria and rarely in some cases helminth eggs. Consumption of this water causes diseases like diarrhoea and cholera [13,14]. Similarly nitrates also causes ground water pollution causing disease in children called blue baby syndrome in rural population of Bulgaria and Romania. It is observed that when nitrates concentration exceeds above 10 mg/L (10 ppm) in ground water chances of blue baby syndrome increases [15,16]. Excessive use of nitrate fertilizers can also cause water pollution because very small amount of nitrates is utilized by plants most of it accumulates in soil which later on reaches to ground water by leaching and contaminate it [17-21]. Ground water polluted with high levels of fluoride causes dental and skeletal problems [22].

Urban storm water runoff

It is due to highly populated cities. It comes from homes and office places [1]. In suburban and urban areas pavement and buildings covers

much of land surface so whenever there is snow melt or rain the water does not soak into ground. This storm water carries much type of pollutants like dirt, oil, lawn fertilizers and chemicals directly to rivers and streams where they cause water pollution [1]. In the case of natural landscape these pollutants are trapped into pores soil and water is filtered but in cities as water is not able to soak into ground so it wash away all of these pollutant's into water bodies thus polluting them. Moreover this storm water has high speed of flowing which erodes more sediment from embankments of water bodies thus causing water pollution.

Agricultural pollutants

As in rural areas population is less so it mostly contains fertilizers, pesticides and eroded soil and these pollutants reach to water bodies through runoff after rain and flood [1]. Agricultural runoff cases fresh water body's eutrophication. Half of lakes in US are eutrophic. Phosphate is the main contributor to eutrophication its high concentration promotes Cyanobacteria and Algae growth which ultimately reduces dissolved oxygen in water [23]. Harmful toxins which accumulate in food chain are produced by cyanobacterial blooms [24]. Nitrogen rich fertilizer compounds causes dissolved oxygen deficiency in rivers, lakes and coastal zones which have devastating effects on oceanic fauna. In America and Northwest Europe nitrogen fertilizer use is controlled from 2006 [25,26]. Nitrogen fertilizers have high water solubility and increased runoff and leaching rate which results in ground water pollution [27-29].

Similarly pesticides are used to control pests these pesticides leaches to ground water thus polluting ground water. Water soluble pesticides leach more. Sandy soil also favours leaching [30,31].

Selenium (Se) is a heavy metal that occurs naturally in soil but due to irrigation practices it accumulates in the soil. This accumulated selenium reaches to water reservoirs and is very toxic for animals and humans [32].

Atmospheric pollutants

It is due to small particles which are present in air which it reaches to water bodies through rain. It includes carbon dioxide which produced by burning of fossil fuels its quantity is increasing which it combines with water molecules its forms sulphuric acid. Sulphur dioxide produced from volcanoes and industries also combines with water molecules to form sulphuric acid. Sulphur dioxide is also produced by combustion of coal and petroleum products. Similarly Nitrogen dioxide also combines with water to form nitric acid. Particulates also play very important role in effecting water pollution these particulates reach to water bodies through rain [1,9].

Pathogens

Pathogens are the microorganisms which causes disease. Most bacteria in nature are non-pathogenic or beneficial but few are pathogenic and these pathogenic bacteria also pollute drinking water. Coliform bacteria are a bacterial indicator species used for the identification of water pollution. Disease causing bacterial species includes Cryptosporidium parvum, Burkholderia pseudomallei, Giardia lamblia, Norovirus, Salmonella and Parasitic worms like Schistosoma [33-35].

Pesticides and herbicides

Herbicides and pesticides are used to control weeds and pests. Both of them also contribute to water pollution [36]. Their leaching also pollutes ground water. Leaching is influenced by soil texture, pesticide properties, irrigation and rain fall. If soil is sandy and pesticide is water soluble more will be the leaching. Similarly pesticides and herbicides also reach natural water bodies through runoff. These pesticides residues when reach to natural water bodies they disturb flora and fauna there. Pesticides which don't degrade easily or take time to degrade are more harmful [37-39].

Chemical pollutant

It comes from waste of harmful chemicals factories it is a material which is left as a by-product during manufacturing process and it also plays a big role in polluting water bodies [40-42]. Hazardous chemical waste may be in solid, liquid or in gaseous form. The characteristics which make material hazardous are corrosively, Ignitability, toxicity and reactivity [41]. It started with the start of industrial revolution [42]. Industrial waste chemicals can only be treated by using special waste treatment plants they cannot be treated by sewage treatment plants [43].

Sediment pollution

Sedimentation due to runoff effects water quality. It decreases the capacity of streams, ditches, navigation channels and rivers. It decreases the penetration of light into water due to which due to under water flora is disturbed. So the fishes and other fauna feeding on that flora are also disturbed and whole food chain is disturbed. Pollutants like pesticides and phosphorus are transported and accumulated due to sedimentation [38]. Sediment particles also attach to fish gills so fishes feel difficulty to respire in this way they causes fish death. Similarly sediments carry dangerous chemicals like pesticides and petroleum products to water bodies thus polluting them [1].

Saltwater intrusion

Salt water intrusion is another very important factor which pollutes ground water. It occurs when saline water from sea enters into ground water near coastal areas. It occurs naturally but some human activities like pumping of fresh groundwater also increases salt water intrusion. Navigation channels, drainage channels and agriculture channels also play important role in salt water intrusion [44].

Conclusion

Water is polluted by many factors among which industrial wastes are the most important. Beside industrial wastes other factors include herbicides, pesticides and atmospheric pollutants. Pathogen in polluted water causes serious diseases in humans. The whole ecosystem of water bodies is disturbing due to water pollution.

Recommendations

To treat industrial wastes there should be special industrial waste treatment plants with every industry. Similarly there should also be urban runoff pounds to remove pollutants from runoff and to prevent floods. Toxic pesticides and Herbicides should be replaced with non-toxic ones or Pesticides should be replaced with biological control.

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