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Effects of Water Pollution - A Review Article

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ABSTRACT

Water is a universal solvent for ions, required for cell signalling, enzyme activation, mineralization of organic compounds and properties. Water is an important component of natural environment. Water is not only essential for drinking purposes, but it also provides shelter to many of the organisms. It is a tasteless and colourless substance that covers about 3/4th of the earth's surface. Pure water does not occur in nature. It contains impurities which causes water pollution. According to WHO 80% disease are water borne. Contaminated water causes harmful effect on human health and environment.

Key words: *Water, Environment, Impurities, Water pollution, Water borne diseases*

INTRODUCTION

Water is the most precious substance of the earth. Water is a molecule with one oxygen atom and two hydrogen atoms, bonded together by shared electrons. It is a V-shaped polar molecule, which means that it charged positively near the hydrogen atoms and negatively near the oxygen atom. The earth comprises two thirds of water and one third of land. The earth has both the fresh as well as saline water. About 97.3% of the earth's water is saline while only 2.7% is fresh. Fresh water is also found in the rivers, streams, ponds and lakes. Melting snow is a source of fresh water. Most of the fresh water bodies are inaccessible. Only one percent of it is available and useful for human beings. The oceans contain saline water of the earth. Due to extreme salinity, it is not for human consumption.[1,2]

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WATER POLLUTION

Pure water does not occur in nature. It contains- natural and man made impurities. Natural impurities are not essentially dangerous, but human activities are serious cause of water pollution. Water pollution is the aquatic contamination of water bodies, usually as a result of human activities, in such a manner that negatively affects its legitimate uses. Water pollution reduces the ability of the body of water to provide the eco system services. Water pollution results when contaminants are introduced into the natural environment. Mainly two main sources of water pollution are-

1. **Point sources -** It includes factories, waste water treatment facilities, septic systems and other sources that are discharging pollutants into water sources.
2. **Non-point sources -** Non-point sources are more difficult to identify because they cannot be traced back to a particular location. It include run off including sediment, fertilizer, chemical and animal wastes from farms, fields, construction sites and mines.[3]

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Causes of Water Pollution

The main reasons for the pollution of water in our rivers and lakes are:[4-7]

- Discharge of untreated domestic sewage into rivers and lakes. The untreated sewage contains food wastes, detergent, microorganisms such as bacteria, viruses, fungi, and parasites These microorganisms may cause diseases like cholera, typhoid etc.
- Discharge of toxic industrial wastes into rivers and lakes.
- Excessive use of fertilizers and pesticides in agriculture.
- Contamination of water-bodies with toxic metals such as, lead, arsenic, cadmium, mercury, nickel etc.

Effects of Water Pollution

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.[8] 3.1% deaths occur due to the unhygienic and poor quality of water.[9] Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries.[10] The harmful effect of polluted water on human health and whole environment are following;

A. Effect of Polluted Water on Human Health[11]

1) **Bacterial Diseases :** Many diseases like cholera, typhoid, diarrhoea, shigellosis etc. are bacterial diseases which can be caused by polluted water. They affect the digestive tract of humans and damage the intestinal epithelium. Sometimes they are fatal specially in childrens.[12]

Some water borne bacterial disease their agent, source and symptoms are describe as follows:

Botulism

- **Agent -** Clostridium botulinum
- **Source -** Bacteria can enter a wound from contaminated water sources. Can enter the gastrointestinal tract by consuming contaminated drinking or (more commonly) food.
- **Symptoms -** Dry mouth, blurred and double vision, difficulty in swallowing, muscle weakness, blurred speech and diarrhea. Death is usually caused by respiratory failure.

Cholera

- **Agent -** Vibrio cholerae
- **Source -** Drinking water contaminated with the bacterium.
- **Symptoms -** In severe forms it is known to be one of the most rapidly fatal illness known. Symptoms include watery diarrhoea, nausea, cramps, vomiting.

Dysentery

- **Agent -** Shigella
- **Source -** Water contaminated with the bacteria.
- **Symptoms -** Frequent passage of feces with blood and mucus.

E. Coli Infection

- **Agent -** Certain strain of Escherichia
- **Source -** Water contaminated with the bacteria
- **Symptoms -** Mostly diarrhea. Can cause death in immunocompromised individuals.

Salmonellosis

- **Agent -** Caused by many bacteria of genus Salmonella
- **Source -** Drinking water contaminated with the bacteria.More common as a food borne illness.
- **Symptoms -** Symptom including diarrhea, fever, vomiting, abdominal cramps

Typhoid Fever

- **Agent -** Salmonella typhi
- **Source -** Ingestion of water contaminated with feces of an infected person.

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- **Symptoms -** Characterized by sustain fever up to 40℃ (104℉), diarrhea, splenomegaly and hepatomegaly.

2) **Viral Diseases -** Hepatitis, gastroenteritis, poliomyelitis etc. are viral diseases which can be caused by polluted water. Hepatitis and gastroenteritis mainly affect the liver and intestine.Poliomyelitis causes paralysis in Human. Some water borne Viral disease their agent, source and symptoms are describe as follows:[13]

Hepatitis A

- **Agent -** Hepatitis A Virus (HAV)
- **Source -** Can manifest itself in water (and food)
- **Symptoms -** Symptom are only acute (no chronic Stage of the virus) and include Fatigue, fever, abdominal pain, nausea, diarrhea, weight loss, jaundice and depression.

Poliomyelitis

- **Agent -** Polio virus
- **Source -** Enters water through the feces of infected individuals.
- **Symptoms -** 90 - 95% of patients show no symptom. 4-8% have minor symptoms with delirium, headache, fever and occasional seizures and spastic paralysis. 1% have symptoms of non-paralytic aseptic meningitis.

3) **Protozoal Diseases -** Amoebiasis, cryptosporidiosis and giardiasis are main protozoal diseases which occur due to infected water. In these diseases diarrhoea is main symptom. Giardiasis is also known as traveller's disease. Some water borne Protozoal disease their agent, source and symptoms are describe as follows:

Amoebiasis

- **Agent -** *Entamoeba histolytica*
- **Source -** Sewage, non-treated drinking water, flies in water supply
- **Symptoms -** Abdominal discomfort, fatigue, weight loss, diarrhea, bloating, fever

Cyclosporiasis

- **Agent -** *Cyclospora cayetanensis*
- **Source -** Sewage, non-treated drinking water
- **Symptoms -** Cramps, Nausea, vomiting, muscle aches, fever and fatigue.

Microsporidiosis

- **Agent -** *Microspordia*
- **Source -** *Encephalitozoon intestinalis* has been detected in ground water, the origin of drinking water
- **Symptoms -** Diarrhea and wasting in immune compromised individuals.

4) **Effect of Metals -** Metals like lead, zinc, arsenic, copper, mercury and cadmium in industrial waste water have many adverse effect on humans and other animals like immune suppression, reproductive failure and acute as well as chronic poisoning. Beside these arsenic causes skin cancer, mercury causes mental derangement and minimata disease in humans and dropsy in fishes, lead causes mee's line on gum and cadmium cause lung cancer and itai itai disease. Some metals their general source and common effects are as follows:

SN	Elements	General Sources	Common effect
1.	Lead	Industry, Coal, Gasoline, mining plumbing	Anemia, colic pain, wrist drop, kidney disease, nerves disorder.
2.	Mercury	Industrial waste, disposed fluorescent light, paints, batteries, pesticides.	Gingivitis, diarrhea, anaemia, tremor of hands and tongues (Minamata disease), paralysis.
3.	Arsenic	Pesticides, chemical waste and mining by-products.	Indigestion, nausea, neurological problems, Carcinogenic
4.	Fluorine	Industrial waste mining	Teeth deformity, skeletal fluorosis

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			(Knock knee syndrome)
5.	Zinc	Industrial waste, metal planting	Abnormal cramps, vomiting, diarrhea.
6.	Chromium	Temporary discharge, metal plating	Malfunctioning of gastrointestinal, urogenital system, central nervous system.
7.	Copper	Metal plating, industrial and domestic waste mineral leaching	Sporadic fever, anemia, coma.
8.	Cadmium	Industrial discharge, mining waste, metal plating	Suppresses kidney activities

5) Effect of other chemicals: Human health is affected by the direct damage of plants and animal nutrition. Water pollutants are killing seaweeds, 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. They damage the nervous system and causes cancer, blue baby syndrome, reproductive and endocrinal damage.

B. Effect of water pollution on environment

Much of aquatic pollution involves sewage in which organic waste predominate. This waste can increase secondary productivity while altering the character of the aquatic community. Most fishes especially the species desired as food by man are among the sensitive species that disappear with the least intense pollution

1. Micro-organisms consume lot of oxygen in biodegradation of organic matter found in sewage water and make water oxygen deficient killing fish and other aquatic creatures.
2. Many chemicals like DDT can undergo biomagnifications in aquatic food chain. High concentration of DDT disturb calcium metabolism in birds, which causes thinning of eggshells and their premature breaking, finally it decline birds population.
3. Thermal waste water eliminates or reduces the number of plants and animals which are sensitive to high temperature, and these organisms are shifted to other areas, this phenomena cause imbalance in ecosystem.
4. Aquatic organisms take up pesticides from water which enters into the food chain and transmit in upper trophic level. At higher trophic level they get concentrated and this phenomenon is called biomagnifications.
5. Polluted water reduces dissolved oxygen (DO) amount in water so they eliminate sensitive organisms like plankton, mollusks and fish etc.
6. Acid rain has been shown to have adverse impacts on forest, fresh water and soil, killing insects and aquatic life forms, causing paint to peel, corrosion of bridges and weathering of stone building as well as having impacts on human health.

Preventive approach to control water pollution[14]

The government of India has formulated comprehensive legislation to enable the institution like pollution control boards for effective protection of the environment. Some important acts in this direction are:

1. The water (prevention and control of pollution) Act, 1974
2. The water (prevention and control of pollution) Rules, 1975
3. The water (prevention and control of pollution Cess Act, 1978
4. The Environment (protection) Act, 1986.

Water pollution can be prevented by following suggestions given below:

- Do not throw the garbage into rivers/lakes. The rivers/lakes should be cleaned from time to time
- Trees and plants must be planted along the banks of rivers.

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- Toxic industrial waste should be treated chemically to remove the harmful substances present in it. Only the treated waste should be discharged into rivers/lakes.
- The city sewage should be treated at the sewage treatment plant to remove all suspended impurities and organic matter before discharging it into water.
- Excessive use of fertilizers and pesticides should be discouraged. The use of synthetic detergents should be minimized. If possible, use biodegradable detergents.
- We should not wash clothes, clean utensils and take bath near the source of water.
- Well should be properly covered.

Conservation of Water

Water can be conserved by the following methods:

By maintaining the water cycle: The water cycle can be maintained in perfect form by

1) Conserving forests
2) Planting more trees
3) Constructing check-dams to prevent flow of rain water into rivers and finally to sea.
4) Adopting water-harvesting technique to replenish the ground water.
5) Saving water, Use modern methods of irrigation, such as sprinklers, drip irrigation method.
6) Constructing dams and reservoirs to control floods and use water for irrigation during dry season.

By preventing water pollution: Water pollution can be prevented by disposing sewage and industrial wastes into rivers & lakes only after proper treatment.

Discussion

Discussion is the most important part in any review article. The aim of this review article is to find out the whole concept related to water and water pollution. In this portion all the actual facts are presented in a concise way.

Conclusion

A brief description about water and water pollution is very well explained. Safe drinking water is necessary for human health all over the world. With the time, crisis of pure water is increasing day by day. Water pollution impact harmful effect on human health and environment. Water pollution is a global issue. Major causes of water pollution are discharge of untreated domestic sewage, toxic industrial wastes, Excessive use of fertilizers and pesticides. Bacterial, Viral, Protozoal diseases are spreading through polluted water. These diseases are affecting human health. Water pollution also affecting environment.

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