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Causes, effects and control of water pollution in India

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Abstract
Urbanization industrialization and other human activities effect quality of water adversely as well as the availability of safe drinking water. This review presents causes, health hazards & effects of water pollution on biodiversity & its control. Water is essential for e existence of all life forms. In addition to household uses, water is vital for agriculture, industry, fishery and tourism etc. increasing population, urbanization and industrialization has led to the decreased availability of water. The quality of water used is also being deteriorated as it is getting more and more polluted. You may be aware of at least some health hazards and harmful effects of water pollution. In this lesson a detailed account of various types, sources and effects of water pollutants is given. Some methods of water pollution control and legislatures involved have also been discussed.

Keywords: pollution, health hazards, phytoremediation and control

Introduction
About 97% of the water on earth is present in the seas and oceans. It is too salty to be of any use for drinking, agriculture and industrial purposes. The remaining 3% is fresh water; 75% of which is locked up in the polar ice caps and in glaciers and quite deep under the earth's surface as underground water. The fresh water, which we can use, comes to us from two sources: i) Surface water ii) Ground water. The importance of water for sustenance of life cannot be overemphasized. Whether it is in use of running water in our homes, rearing cattle and growing crops in our farms, or the increased uses in industry, remain immeasurable. It is important therefore, to not that depletion of this commodity either through contamination, or careless use results in serious consequences.

Parameters
Contamination of streams, lakes, seas, underground water or oceans by substances, is harmful for living beings. Industrialization and population explosion are the main reasons for water pollution. Water pollution is a problem for eco system biodiversity and Water may be called polluted when the following parameters stated below reach beyond a specified concentration in water.

1. Physical parameters like Colour, odour, turbidity, taste, temperature and electrical conductivity constitute the physical parameters and are good indicators of contamination. For instance, colour and turbidity are visible evidences of polluted water while an offensive odour or a bitter and difference than normal taste also makes water unfit for drinking. Colour not necessarily harmful is undesirable in potable water.
2. Chemical parameters: These include the amount of carbonates, sulphates, chlorides, fluorides, nitrates, and metal ions. These chemicals form the total dissolved solids, present in water.
3. Biological parameters: The biological parameters include matter like algae, fungi, viruses, protozoa and bacteria. The life forms present in water are affected to a good extent by the presence of pollutants. The pollutants in water may cause a reduction in the population of both lower and higher plant and animal lives. Thus, the biological parameters give an indirect indication of the amount of pollution in water.

Sources
Water pollutants refer to the substances which are capable of making any physical, chemical or biological change in the water body. These have undesirable effect on living organisms. As mentioned earlier, the water used for domestic, agricultural and industrial purposes is discharged with some undesirable impurities in it. This contamination leads to the pollution of water, which is generally called the fresh water pollution. Fresh water pollution may be classified into two types: surface water pollution and ground water pollution. Water pollution in Nigeria according to Gbamanija (1998) arises from various activities, among which are:

1. Sewage leakages v. Industrial waste dumped into our waters
2. Pollution of ground water through drilling activities.
3. Flooding during rainy season which carries waste deposits into our waters.
4. Heavy metal
5. Toxic waste disposal at sea.
6. Mineral processing plant (e.g. coal production)
7. Eroded sediments
8. Deforestation
9. Mining
10. Pesticides, Herbicides & fertilizers.
11. House hold chemicals
12. Animal wastes.

The growth of human population, industrial and agricultural

practices is the major causes of pollution. Water pollution becomes worse as a result of overcrowding in urban areas. Agricultural, domestic and industrial wastes are the major pollutants of agnatic habitats. Sewage is the biggest pollutant of fresh water when discharged into them. Sewage is the waterborne waster of society and the discharge of untreated sewage into a river is very enormous and unhealthy. The striking consequence is a substantial and immediate drop in the amount of dissolved oxygen in the water. This happens because organic matter stimulates decomposers especially bacteria which break down suspended solids in the sewage. As they respire, the decomposers use up dissolved oxygen (O2) and the Biological Oxygen Demand (BOD) reduces. Highly polluted rivers have obnoxious smell and contain little or no flora or fauna. Another source of water pollution is the discharge of hot water from cooling engines in the industries. This increases water temperature and lowers the metabolic rate of organisms. This then raises their oxygen demand. The effects of pollution are greater in shallow, enclosed or slow flowing streams. Excess fertilizer, herbicides and pesticides when washed by rain into rivers causes serious danger to life. Detergent are also very toxic to marine life when washed into water. Textiles dye Plastic and other industries produce many by products. when they are discharged into rivers; they produce devastating effects on aquatic environments. Pollution poses a serious risk to life especially when the water is a source of drinking and for domestic purposes for humans polluted waters are potent agents of diseases such as cholera, typhoid and tuberculosis. A major water pollutants has been oil spilled in large quantities from tankers of broken oil pipes from oil industries which kills sea weeds, mollusks, marine birds, crustaceans, fishes and other sea organisms that serve as food for humans. This leads to calcium deficiencies in our diet. Some insecticides like DDT are particularly dangerous when allowed into bodies of water because its concentration increases along the food chain. water pollution has direct consequences on human well beings, an effective teaching strategy in the formal education sector is essential for a better understanding so as to develop the right attitude towards water.

Effects

When toxic substances enter into water reservoirs, they get dissolved or suspended in water or get deposited on the bottom. When fresh water is supplemented it results in abnormal increase in water palnts. Level of mercury in fish is mostly dangerous for human especially for pregnant women and infants. Mercury interferes in the development of control nervous system, leading long term side effects. Industrial waste contains toxic compounds damaging the health of apuatic lives. They may cause minor effects or may be fatal also. Heavy metals from industrial processes can accumulate in the water reservoirs. These are toxic to fish, shellfish, other apuatic lives & human eating them. Heavy metals like Cd may cause vomiting, abdominal pain, loss of consciousness, softening of bones etc. Pb may cause retarded development, Brain damage, uncoordinated, body movements. As being poisonous causes skin eruptions and may be carcinogenic also. Organic matter and nutrients cause increase in aerobic algae depleting oxygen from water causing suffocation of other apuatic organism. Water pollution has a harmful effect on nature. It has catastrophic effects on the living and also on the environment. Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries. An estimated 700 million Indians have no access to a proper toilet, and 1,000 Indians children's die of diarrhea every day and so many other countries too. Nearly 500 million Chinese lack access of safe drinking water. Water pollution leads to damage to human health. Disease carrying agents such as bacteria and viruses are carried into the surface and ground water. Drinking water is affected and health hazards result. Direct damage to plants and animals nutrition also affects human health. Plants nutrients including nitrogen, phosphorus and other substances that support the growth of aquatic plant life could be in excess causing algal gloom and excessive weed growth. Polluted water is unsuitable for drinking, recreation, agriculture & industries. Conetaminated water destroy apuatic life and reduces reproductive ability. We can not escape the effects of water pollution.

Water Pollutants

1. **Domestic and Municipal Pollutants:** The sewage contains garbage, soaps, detergents, waste food and human excreta and is the single largest sources of water pollution. Pathogenic (disease causing) microogranisms (baccteria, fungi, protozoa, algae) enter the water system through sewage making it infected. Typhoid, chloera, gastroenteritis and dysentery are commonly caused by drinking infected water. Water polluted by sewage may carry certain other bacteria and viruses cannot grow by themselves, but reproduce in the cells of host organisms. They cause a number of diseases, such as, polio, viral hepatitis and may cancer.
2. **Industrial Pollutants:** Many industries are located near rivers or fresh water streams. These are responsible for discharging their untreated effluents into rivers like highly toxic heavy metals such as chromium, arsenic, lead, mercury, etc. along with hazardous organic and inorganic wastes (e.g., acids, alkalies, cyanides, chlorides, etc.). River Ganges recives wastes from textile, sugar, paper and pulp mills, tanneries, rubber and pesticide industries. Most of these pollutants nonbiodegradable, therefore damage the growth of crops and the polluted water is unsafe for drinking purposes. Factories manufacturing plastic, caustic soda and some fungicides and pesticides release mercury (a heavy metal) along with other effluents in nearby water body. Mercury enters the food chain through bacteria, algae, fish and finally into the human body.
3. **Agricultural Waste:** Manure, fertilizers, pesticides, wastes form farms, slaughterhouse, poultry farms, salts and silt are drained as run-off from agricultural lands. The water body receiving large quantities of fertilizers (phosphates and nitrates or manures becomes rich in nutrients which leads to eutrophication and consequent depletion of dissolved oxygen. Consumption of water rich in nitrates is bad for human health especially for small children.
4. **Radioactive Wastes:** Water bodies are polluted by

accidental leakage of waste material from uranium and thorium mines, nuclear power plants and industries, research laboratories and hospitals which use radioisotopes. Radioactive materials enter human body through water and food, and may be accumulated in blood and certain vital organs. They cause tumours and cancer.

5. **Thermal Sources:** Various industries, nuclear power plants and thermal plants require water for cooling and the resultant hot water is often discharged into rivers or lakes. This results in thermal pollution and leads to the imbalance in the ecology of the water body. Higher temperature lowers the dissolved oxygen level (which is very essential for marine life) by decreasing the solubility of oxygen in water.
6. **Sediments:** Soil particles carried to streams, lakes or oceans form the sediments. The sediment become polluting due to their large amount.
7. **Petroleum Products:** Petroleum products are widely used for fuel, lubrication, plastics manufacturing, etc. and happen to be poisonous in nature. Crude oil and other related products generally get into water by accidental spillage from ships, tankers, pipelines etc.

Eutrophication

Eutrophication is a process by which a water body slowly becomes rich in plant nutrients such as nitrates and phosphates due to soil erosion and run off from the surrounding land. Let us try to understand this phenomenon. A water system like a lake or any reservoir may get a large inflow of organic matter from domestic wastes and run off from the surrounding land. Increasing human population, intensive agriculture and rapid industrial growth have led to an increasing release of domestic waste, agricultural residues, industrial wastes and land run-off into various water bodies. Nutrients are released from organic waste by aerobic (oxygen requiring) bacteria which start decomposing it. Dissolved oxygen is consumed in this process. As more and more organic matter enters a water body, more is the deoxygenation of the water body and larger is the production of nutrients. These nutrients fertilize an abnormal growth of algae and other large water plants such as duckweed. As more plants grow, some of them die also due to larger oxygen demand and therefore oxygen deficiency in the water body (i.e., deoxygenation of the water body). Such a water body is said to be eutrophied and the process is called eutrophication.

Biological Oxygen Demand (BOD)

The quality of oxygen used up by microorganisms at 27ºC and in darkness during 3 days in breaking down organic wastes in a water body is called its biological oxygen demand (BOD). It can be explained in the following manner. You know that there are many organic compounds or waste present in a water body. The microorganisms present in the system act upon this waste for their own consumption and growth. In the process the metabolic activity requires oxygen which is met by the dissolved oxygen present in water. It is this amount of oxygen which is defined as biological oxygen demand (BOD). The BOD value of an aquatic system depends upon:

- The type and amount of organic waste
- The organisms acting on it
- Temperature and pH

The greater the amount of organic waste in the water body, the greater is the amount of oxygen required to break it down biologically and therefore higher is the BOD value of water. This value is a good measure in evaluating the degree of pollution in a water body. The less polluted water shows comparatively low value of BOD. Its value is used as a criterion for managing water pollution of a water body. An evaluation is made by determining oxygen concentration in water before and after incubation at 20ºC in dark for 5 days.

Control

To maintain the quality of water effluents must be treated before its discharge. Pretreatment includes removal of larger aggregates of floating and suspended solid matter. Passing the waste effluent through the screens consisting of spaced metal bars to grind the solids into small pieces which subsequently settles out in pr sedimentation tanks. Secondary treatment is a biological process. Activated sludge process consists of maintaining an active flow in a tank. Supplied with oxygen so that proper contact can be established between incoming waste water and microorganism in floe. Tertiary treatment consist of processes like coagulation, filtration, co-precipation and adsorption etc. using water pollution control devices like Drug disposal, fog collectors, weed booms, etc. Waste water generated by household activity, industries or garbage landfills is called sewage which is classified as the municipal water pollution. Sewage contains solid matters in the form of suspended colloidal and dissolved organic matter, detergent, mineral matter, nutrients and gases. Now the disposal of the solid residue from sewage has been improved by applying municipal treatment processes. The treatment of this waste water is carried out in three stages: Primary treatment, Secondary treatment, and Tertiary treatment.

Primary Treatment

When the waste water is to be dumped off into a river or flowing steam, the treatment is carried out by sedimentation, coagulation and filtration. This is known as primary treatment. If the water is required for drinking purposes, it has to undergo further treatment called secondary and tertiary treatments. The following steps are performed to do primary treatment of water.

Sedimentation

This step is carried out in large tanks specially built for this purpose in sewage treatment plant. The polluted water is allowed to settle so that silt, clay and other matter settle to be bottom and water is slowly allowed to move out. Fine particles do not settle and are thus required to be removed in the next step.

Coagulation

Fine particles and colloidal suspension are combined into large particles by a process called coagulation. This step is carried out by the addition of special chemicals called coagulants (flocculants) such as potash alum. The large

particles either settle to the bottom or are moved in the next step.

Filtration

Suspended particles, flocculants, bacteria and other organisms are filtered by passing the water through a bed of sand or finely divided coal or through some fibrous materials. The total impurities collected in these steps are called sludge. It is used as a valuable fertilizer. On composting (i.e. the action of anaerobic bacteria), it releases sludge gas. It consists mainly of methane gas which is used for cooking purposes.

- **Secondary or Biological Treatment:** The water after primary treatment is not fit for drinking purposes and has to undergo further treatment. This is done through secondary or biological treatment. A commonly used method is to allow polluted water to spread over a large bed of stones and gravel so that the growth of different microorganisms needing nutrients and oxygen is encouraged. Over a period of time a fast moving food chain is set up. For example, bacteria consume organic matter from the polluted water; protozoa live on bacteria. Every form of life including algae and fungi help in the cleaning up process. This is called secondary treatment of water. It involves the following processes

Conclusion

Water pollution is an environmental problem that is of major concern to us. Human contribution to water pollution is enormous by way of defecating; dumping of refuse, industrial wastes and washing of clothes etc. practicing the habits of cleanliness, efforts for prevention of water pollution, controlling and monitoring, using water pollution control equipments may play a great role in providing pure water and keeping water for future. environmental education may be of immense importance. In this way they will be less inclined to pollute our waters.

Recommendation

It is pertinent that environmental education is introduced in schools and be made compulsory. Federal, State and Local Government should establish agencies to monitor our environment and equally to be sure that our environment is kept clean and free from refuge dumps. Industrial homes or family should equally inculcate a hygienic environment particularly in their vicinity, according to be adage that says charity beings at home. Our industries should go advance in trying to recycle these wastes instead of dumping them for rain water to sweep these refuse into our rivers and streams making them undrinkable.

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