



RESEARCH ARTICLE

A Study on Water Pollution: Causes and Remedies

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Received: 30th March 2018, Revised: 20th May 2018, Accepted: 26th May 2018

ABSTRACT

Any substance which causes its adverse effect on the environment is called as pollutant. Pollutants are the materials or energies which make the environment foul. They may also be defined as the undesirable substances or energies which make environment foul. They may also be defined as the undesirable substances or energies present in the environment in toxic concentrations. These may be the residues of the materials we make, use or throw away. When undesirable substances are found in water which make the water less fit or unfit for humans, for other living organisms and for cultural assets, called water pollutions. Water pollution may also be defined as an addition of foreign substances like organic, inorganic, biological or radiological to water, or a change in the physical property of water that constitute a health hazards. The presence of undesirable substances in the water makes it foul. This type of water is contaminated and is unfit for use. Many diseases are spread out due to the use of this type of water. Sometimes it kills the consumers. Those organisms suffer due to contamination who resides in the water and whose activities totally depend upon water for example fishes is such type of creatures.

Key words: Water Pollution, Cause, Remedy

INTRODUCTION

Water is one of the most important natural resource. 2/3 part of our earth is occupied by water. Water pollution is the contamination of water bodies like rivers, lakes, oceans, ponds etc. Water is necessary for life. Without the water, life is impossible on the earth. Every organism gets water by any resource. For the activities of body of living organisms water is compulsory. When water from industries and from other sources is discharged in the rivers etc without adequate treatment, it becomes polluted. If water is treated adequately before discharging in the water bodies, it will not be harmful for those organisms use this. According to a survey 6 billion of garbage is dumped every year in oceans. One third of our earth is occupied by land, a habitat for flora and fauna. Pollution of water is a problem of the whole world. Water pollution occurs due to pollutants which are of several types. Biological pollutions are pathogens, like Virus, Bacteria, Protozoans and Helminthes etc. Heat and oil spills come under the category of physical pollutants while DDT, BHC, polychlorinated biphenyls, arsenic, Cd, Hg, Pb, Nickel, Phosphates nitrates and fluorides etc. are chemical pollutants. Among them, the chemical pollutants presently pollute the water in high quantity. These have more important role in polluting water because they are using in most of the fields. Today in every place of life chemical become a part of any object.

SOURCES

Water pollution affects the entire biosphere of plants and organisms living in the water bodies. In all cases the effect of water pollution is damaging not only to individual species and populations but also to the natural biological communities. Due to contamination the water becomes unfit for drinking and other use. There are so many types of sources which are responsible for water pollution. Flow of pollutants through regular channels or pipes of municipal board or industries are come under the category of point source of water pollution.

The U.S. Clean Water Act (CWA) defines point source for regulatory enforcement purposes. The CWA definition of point source was amended in 1987 including municipal storm sewer systems, as well as industrial storm water, such as from construction sites. Decaying of organic matter, entrance of soil particle into the water through soil erosion, entrance of minerals from rocks and soil in to water, falling of dead leaves and animal waste in to the water also pollutes water. These are natural sources. In the whole world man is important cause of water pollution. Human activities are so harmful for any type of pollution. Different man made sources of water pollution including domestic wastes, sewage, effluents of industries, water from animal shed and from slaughter houses, soaps and detergents, surface run offs from agricultural fields having several pesticides and fertilizers, oil spills and radioactive wastes are come in the category of anthropogenic. It is also called anthropogenic pollution. These types of water which are man- made have enormous quantity of material for water pollution. It has very serious danger for flora and fauna.

Non-point source or NPS is another type which refers to diffuse contamination. It does not originate from a single discrete course. It is often the cumulative effect of small quantity of contaminants, gathered from a large area. It is also known as diffusion source of water pollution. In this source the pollution can not be readily identified. Diffusion source of water pollution is very slow process to contaminate water bodies, hence it is less harmful. Agricultural run off, fertilizers and pesticides are the common example of non-point source. Water pollutants are of many types as organic wastes are contributed by domestic and commercial sewage and effluents from paper mills, petroleum refineries, food processing plants, dairy farms, piggeries, poultry farms, slaughter houses, breweries, tanneries, etc. These wastes have polluted rivers including sacred Ganges. Animal excreta discharged in to the fields or dumped in pits reach to water by run off and leaching, particularly during rainy season. In water, organic matter provides nutrition for decomposers namely bacteria and fungi. Discharge of domestic wastes like sewage etc. into a water body, it will result rise in BOD (Biochemical Oxygen Demand) where sewage water mixes with flowing water because decomposers are already present in the flowing water consume lot of oxygen during degradation of organic matter. If in water body, sewage is in the large quantity, than whole of the oxygen is consumed by the decomposers. Ultimately it may result in mortality of fishes and other aquatic organisms. Deoxygenating of water produce anaerobic bacteria which produce foul smelling gasses like H_2S and CH_4 etc. These are called secondary pollutants. Due to this habitat of animals, disruption of food chains, befouling air, pollution of water with organic wastes become unfit for drinking, bathing and recreation purposes. Mere 01% impurities turn water into waste water. The composition of waste water includes sand, slit, clay faecal matter, bacteria, cloth, paper fibers, nitrates, ammonia, phosphates, sodium and calcium etc.

BOD (Biochemical Oxygen Demand) indicates the quality of waste water. BOD refers to the amount of dissolved oxygen needed by bacteria in decomposing the organic wastes present in water. It is expressed in milligrams of oxygen per liter of water. For example a weak organic waste has BOD less than 1500 mg/- liter while a strong one has higher than this. A survey of river Yamuna recorded different ranges of BOD at Mathura, Agra, Delhi, Nizamuddin and other places. The survey shows that BOD and TDS of water are so high that is water totally unfit for drinking and irrigation also. CWC (Central Water Commission) declared that the Yamuna is now polluting ground water also. The Oxygen used up in BOD reduces the amount of dissolved oxygen.

Sewage disposal is also critical problem. Billions of people on the planet dispose sewage waste create a major problem. According to survey of World Health organization, 9% of the world population does not have access to safe drinking water while 40% of the world population does not have proper sanitation. Although there have greater improvements in securing access to clean water, in the last decade, a little progress has been made on improving global sanitation. WHO also estimated that water related diseases could kill as many as 135 million people by 2020. Most of the people of developed countries have flush toilets that take away sewage waste quickly and hygienically from their homes. In India today's Biotoilets also have been developed which change the faecal matter in to water with the help of bacteria.

Factories are point sources of water pollution. A lot of water is polluted by ordinary people from non-point sources. Every-one pours chemicals to their drains or toilets. Even detergents used in washing machines and dishwashers make their way in our rivers and oceans through channels. A lot of toxic pollution takes place due to highway run off because these are typically covered with cocktail of toxic chemicals. When it rains, these chemicals wash into rivers or drains. It has been estimated that, in one year, the highway runoff from a single large city takes as much oil into our water environment as a typical tanker spill. It was repeated that the tiny island of Guensey has decided to continue dumping of 16000 tons of raw sewage into sea every year. 90% of sewage is water. Lead and Mercury like heavy metals cause another type of toxic pollution. To form gasoline, lead was used but presently its use is restricted in some countries. Hg and Cd are used to form batteries. Tributyltin (TBT) which is a highly toxic chemical used in paints to protect boats from ravaging effect of oceans, gradually, it was recognized as a pollutant. In 1938, a Japanese factory discharged a significant amount of mercury metal into Minimata Bay, contaminating the fish stock there. By that time, many local people had eaten the fish and around 2000 were poisoned. Hundreds of people were died or disabled. So it was a poisonous element.

Rapid urbanization and industrialization in developing countries have had huge impact on the natural resource base, especially water. There are various determinants of water pollution; one of the major causes is increasing pollution. Kemp also states that population growth and change of life style and technology bring worse sewage because the nature can not keep up with the treatment of the pollution. Domestic waste water comes from residential sources including toilets, sinks, bathing and laundries etc. India is the 2nd largest country having population after China. Due to enormous increasing population all the needs are increasing in the same ratio. First of all any person settles himself, its needs through the arrangement of water and others. After that other, hence urbanization plays a vital role in polluting water because all the activities come in ratio by increasing population.

EFFECT

Phosphours and nitrates dissolved in water act as nutrients and accelerate the growth of algae that may form a mat on the water surface. This increased productivity is called Eutrophication. The algae use oxygen at night and may deoxygenate the water enough to kill the fish and other animals. This algal mat at the water surface may block light to the submerged plants. The algae may die and sink, and feed the oxygen consuming bacteria. They may be pushed on to the shore by wind and decompose releasing foul gases such as H₂S. Slit and decaying matter may accumulate and finally fill the lake or pond. This process is called senescence. It is a natural stage of in the change of a lake into the dry land. Depending upon the climate, size of the lake and other factors, the natural ageing of a lake may span thousands of years. However, pollutants from man activities can radically accelerate the ageing process. This phenomenon is called cultural or accelerated eutrophication. In many parts of the world, lakes have been atrophied by sewage, agricultural and industrial wastes in the last century/ Nitrates from fertilizers and detergents contaminate drinking water. It is reduced in the stomach to nitrite which combines with hemoglobin. It reduces the oxygen carrying capacity of the blood. Nitrite poisoning may prove fatal in children. Hence Nitrogenous fertilizers should use carefully. Industrial wastes released into water contain toxic substances, such as Arsenic, Cd, Pb, Zn, Cu, and cyanides, besides some salts, acids and alkalis. All these materials can prove harmful for health.

They may reach human body directly with contaminated food or indirectly by way of plants and other animals. The toxic substances like arsenic, cadmium, lead, zinc, Cu, Hg and cyanides, some acids and alkalis with large no. of pesticides are non biodegradable. Therefore concentration of toxic materials at each toxic level of a food chain increases. This phenomenon is called Biological magnification or Biomagnifications. The water of a river has a low concentration of DDT, but the carnivorous fish in that river may contain high concentration of DDT and be unfit for eating by man or birds. The agricultural fields are sprayed with pesticides; the latter are carried by runoff water into nearby aquatic bodies. The concentration of DDT in water is low (0.003PPM). These pesticides accumulated into ZOO planktons (0.04 PPM) and its concentration

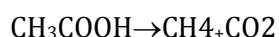
goes of increasing at different trophic levels in a food chain. A kingfisher has 5 PPM of concentration. This increased concentration in birds affects the calcium metabolism. As a result the egg shell becomes thin and breaks before maturity. Oil from oil spills and washing of automobiles find way into river water through sewers. Layer of oil prevents oxygenation of water. It uses water's oxygen in its own degradation. Oil pollution checks growth of phytoplankton and other aquatic plants. It finally destroys the animal life. Due to this sea birds become sick and die.

Disposal of radioactive wastes from atomic power plants is a great problem. They are stored in underground tanks and will take hundred of yeas to degrade completely into harmless non-radioactive materials. The radioactive wastes are so deadly that any leakage would cause a large scale human tragedy. Radioactive dust from mining and processing of uranium finds its way into rivers, lakes and thence into crops, livestock and man via food chain.

As we know that without water life is impossible hence water is needed by all living organisms for metabolic activities. Some use water as habitat as well but man use water in different purposes. Pollutants affect the life by different ways directly or indirectly. Pollutants make water unfit for domestic and agricultural use very fine, solid suspended particles or colloidal substances make water turbid. Dyes and compounds of chromium and iron change the water colour. Addition of free chlorine, phenol, manganese, detergents and hydrocarbons change the taste of water. Nitrates and phosphates promote the growth of oxygen consuming algae which deoxygenate water killing fishes and other animals. Due to cadmium pollution itai-itai disease is caused. It is a painful disease of bones and joints. It also causes cancer of liver and lung in children excess nirate reach with hemoglobin to form nonfunctional methaemoglobin. This condition is termed as methaemoglobinemia or blue baby syndrome. In west Bengal and Bangladesh, ground water is contaminated with arsenic. Chronic exposure to arsenic causes black food disease. It also results in skin cancer. It is estimated that 1000 children in India die every day due to water pollution. Humans aren't the only once facing issues related to water pollution. There are many terrestrial animals that have faced extinction due to water shortage and contamination and the extinction rate of aquatic animals is five times worse than those of land animals.

CONTROL

Water is one of the most important natural resources. Man has polluted the water by different ways. Due to this non polluted water is demand of today's nation. Every organism is suffering everywhere by the pollution of water wherever it lives and water is compulsory for the life. Anyhow we too have control the water pollution. Government is also making efforts to clean water at any cost. Sewage treatment consists of three steps i.e primary, secondary and tertiary. In the primary process it includes physical processing like sedimentations, churning, floatation and screening. These processes remove most of the suspended wastes. After primary treatment, the waste water still contains high-level of organic matter and other nutrients. Hence, secondary treatment is essential for microbiological treatment. During anoxic secondary water treatment, a series of digestive and fermentative reactions carried out by a number of bacterial species. This process is carried out in large enclosed tanks called sludge digesters or bioreactors. Through this action, the macromolecules like polysaccharides lipids and proteins etc. of waste components are first digested by enzymes into soluble components. Latter are then fermented to yield a mixture of fatty acids, H₂ and CO₂. These products are then used as substrates by methanogons as under:



In aerobic secondary treatment, sewage after primary treatment passed through a thick layer of gravel. Bacteria consume the organic matter during its filtration by making small biofilms on the rocky surface. The water that trickles out through the bottom of the gravel bed is much cleaner. It is sent by pipes for further process i.e. for chlorination- Chlorination is a process in which microbes are killed. Sewage, after primary treatment, is pumped into an aeration tank. Here it is

mixed with air and sludge containing algae and bacteria. Bacteria consume the organic matter. Algae produce oxygen for the bacteria. The components are then shifted to the settling tank.

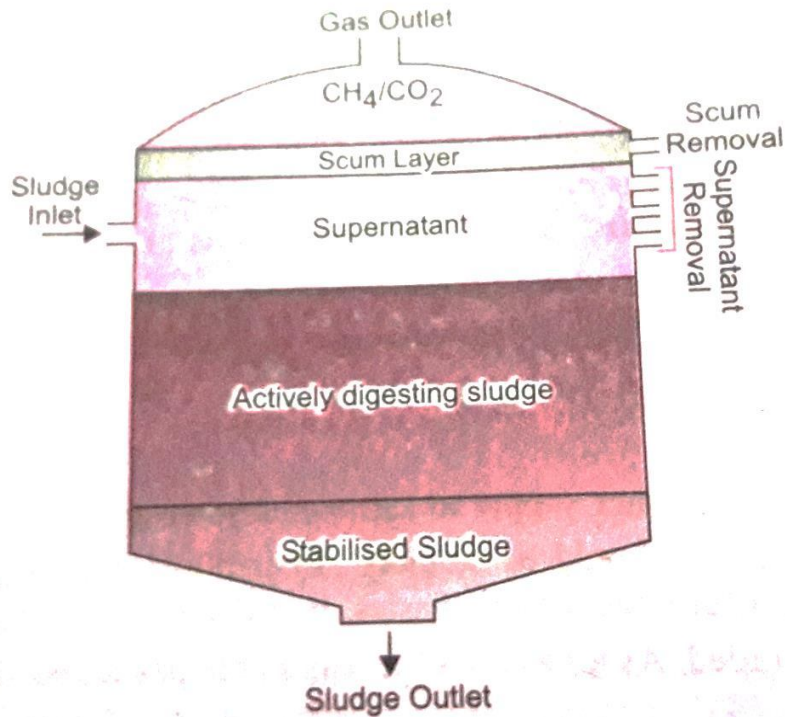


Fig. 1: Liner working of a sludge digester

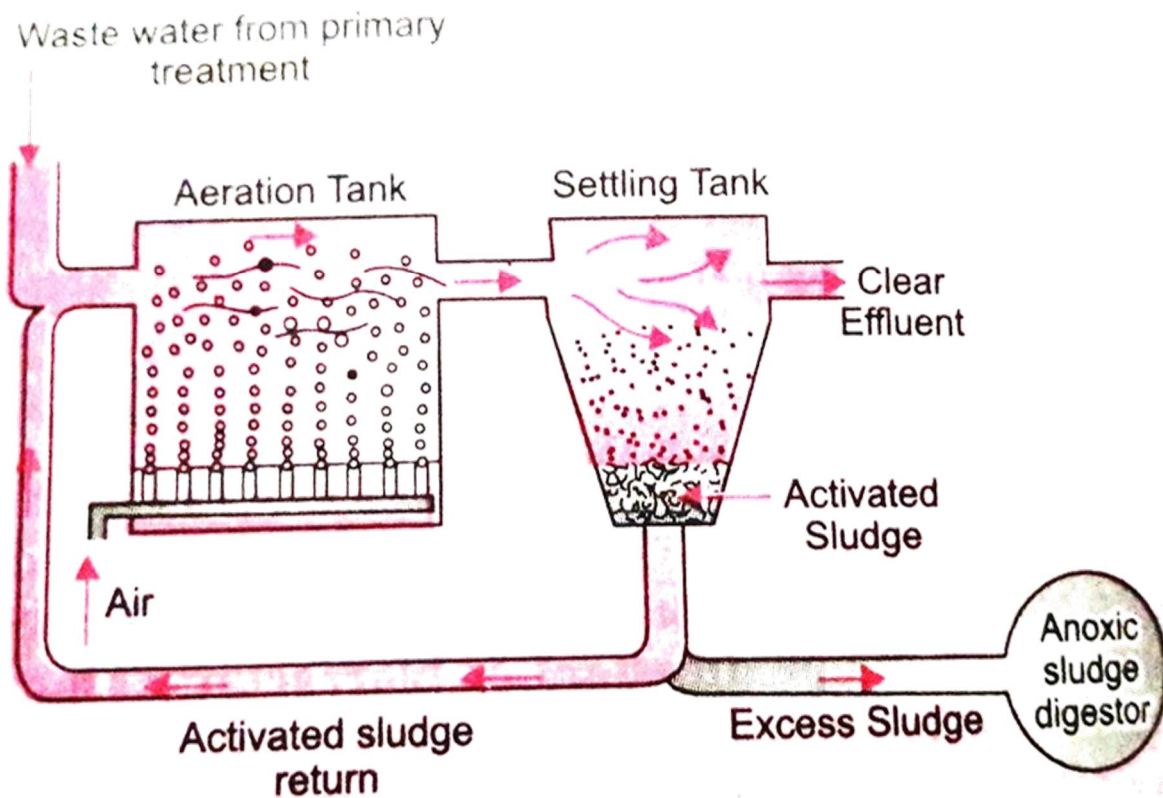


Fig. 2: Waste water flow through an activated sludge installation. Recirculation of activated sludge to the aeration tank introduces microorganisms responsible for aerobic digestion of the organic components of the waste water

The effluent which is almost now clean and chlorinated to kill microbes. The sewage treatment is quite expensive and only the first two steps are followed in many developing countries. After secondary treatment, the clear effluent is either chlorinated or ozonized with ultraviolet radiations to kill pathogens. After secondary treatment, the clear effluent still contains lot of salts such as nitrates, phosphates and suspended solids. The tertiary treatment involves removal of salts and suspended solids. The clear effluent mixed with Alum, Ferric chloride and lime to precipitate upto 90% of suspended solids and 90% of phosphates. It is then further treated for removal of salts and nitrates. This water can now be recycled for irrigation. Facilities are now available to remove DDT and other specialized compounds from the effluents. The treated water now passed to rivers, lakes, streams, reservoirs or in the industries. Treatment for industrial effluents has neutralization of acids, alkalis, removal of toxic compounds by chemical oxidation, coagulation of colloidal impurities, precipitation of metabolic compounds and cooling of waste water. Industries should be made legally bounded to treat the waste water before discharge. There are some after duties to control water pollution. Hot water should be cooled before release from factories. Low level of radioactive wastes can be eliminated in oxidation ponds.

CONCLUSION

Overuse of fertilizers and pesticides should be avoided. As far as possible, stable pesticides should be used. Taking baths and washing clothes directly in ponds, tanks and streams, which supply drinking water for humans should be prohibited.

Water pollution is a critical problem of the world. Govt. is taking steps against water pollution. Many rivers are polluted by pollutants. The sewage and garbage from metropolitan cities is dumped or thrown into nearby pond and other water-body. Water pollution is indeed a very serious concern because it not only has a poor impact on health but also can have negative effects on various industries. Water pollution has the capabilities to disrupt life on our planet to a great extent. Early govt. has passed laws to try to combat water pollution. Presently our holy river Ganga is being polluted also. The effluents of Kanpur industries and other cities are thrown in to Ganga regularly. Govt. also trying to clean Ganga by making a rule also provided fund for it. Thousands of people go to bed due to contamination and face many diseases. The vegetables grown nearby cities, where the sewage making its way, the farmers irrigate the crop with that water which is very harmful for health.

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