Water Pollution in Developing Countries

Saroj Kumar Singh

Deptt. Of Rural Economics, S. N. S. R. K. S. College, Saharsa,
(A Constituent Unit of B. N. M. U., Madhepura, Bihar)
E-mail: drsaroj999@gmail.com

Abstract—*Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 580 people in India die of water pollution related illness every day. About 90 percent of the water in the cities of China is polluted. As of 2007, half a billion Chinese had no access to safe drinking water. In addition to the acute problems of water pollution in developing, developed countries also continue to struggle with pollution problems. The objective of this research is to study the Challenges of water pollution in developing countries. Water pollution is the contamination of water bodies Water pollution affects the entire biosphere–plants and organisms living in these bodies of water. In almost all cases, the effect is damaging not only to individual species and population, but also to the natural biological communities. In this paper, an attempt has been made to review the main water pollutants, sources and cause, effects, types and its possible remedies to improve the situations.*

1. INTRODUCTION

It is defined as the presence of materials in the water, which are harmful to the living beings when they cross their threshold concentration levels. It includes the heat, organic, inorganic, and biological along with the radiological compounds. The surface water is not fit for drinking. It has organic, inorganic components along with the presence of bacteria, fungi, viruses, algae, protozoa's and the other organisms. The water gets polluted when these organisms are present in the higher concentration. It makes the water unfit to drink. The degree of pollution depends upon the concentration of substances. There are some substances, which can cause the pollution even at the low concentration. It includes the poisons, toxins, chemicals and few pathogens. The water pollution is not natural and is mainly man made. The natural water pollution consists of clay, animal wastes, minerals, etc.

2. TYPES OF WATER POLLUTANTS

2.1 Sediments and Suspended Solids

Sediments consist of fine particles of mostly inorganic material such as mud and silt washed into a stream because of land cultivation and construction. They may also arise from demolition and mining operations where these activities take place. The presence of solid particulate material suspended in the flowing water is the reason why many rivers look brown in color, especially in the rainy season. The particles are called suspended solids while they are carried (suspended) in flowing water. When they settle to the bottom, they are called sediments.

Organic matter means anything that is derived from living organisms, i.e. all plants and animals. Inorganic matter has a mineral, rather than biological, origin meaning it comes from rocks and other non-living sources.

Large quantities of inorganic matter, in the form of suspended solids, may reduce light penetration into the water, which can affect the growth of plants. Sediments may even suffocate organisms on the riverbed. River water may also contain organic matter, such as human and animal wastes, which can deplete (reduce) the oxygen in the water if the river is slow flowing. This can lead to anaerobic conditions, which may create unsightly conditions and cause unpleasant odors.

2.2 Nutrients

Phosphorus and nitrogen are common pollutants generated from residential areas and agricultural runoff, and are usually associated with human and animal wastes or fertilizer. Nitrogen and phosphorus are plant nutrients required by plants to grow. They are spread on farmland in the form of fertilizers. Rain-washes these nutrients into rivers, streams, and lakes.

2.3 Biological Pollutants

Biological pollutants are microorganisms (bacteria, viruses, protozoa, and helminthes) that are harmful to humans and other forms of life. Infectious diseases caused by biological pollutants, such as typhoid and cholera, are the most common and widespread public health risks associated with drinking water.

2.3.1. Bacteria. Many different types of bacteria are found in fresh water. They are not all pollutants because many are not harmful in any way and play a valuable role in the natural breakdown of organic matter and the cycling of nutrients. Other bacteria, however, as you have learnt in other sessions, are pathogens, and are the cause of many waterborne diseases. The presence of faecal coliform bacteria in drinking water,

and E.coli in particular, can indicate a possible presence of harmful, disease-causing organisms.

2.3.2. Viruses. Viral contamination may come from sewage effluent discharged into a river or from open defecation by an infected person which may be washed by rainwater to a river or stream. Some enteric viruses are resistant to chlorination. The common waterborne viruses are polio, hepatitis A and rotavirus. The presence of any enteric virus in water bodies can be taken as an indication of the possible presence of other harmful viruses.

2.3.3. Protozoa. There are several protozoa that can be discharged into water bodies from infected persons.For example Criptosporidium and Giardia are common problems in rural parts of Ethiopia. A home sand filter is appropriate for removing protozoa from drinking water. The layers of sand and gravel will trap the protozoa.

2.3.4. Helminthes. Helminthes or parasitic worms can also cause ill health in humans. Infection occurs through ingestion of the helminthes eggs, which may be present in food. For example, helminthes eggs may be present in the meat of cattle grazing on land contaminated by faces. Guinea worm (dracunculiasis) is transmitted by drinking water that contains copepods infected by the larvae of the worm.

2.4 Chemical Pollutants

2.4.1. Heavy Metals. Arsenic, copper, lead, mercury and cadmium are chemical pollutants that may be found in lakes, rivers and groundwater. Fortunately these are not common problems in rural Ethiopia. These heavy metals can harm aquatic organisms and humans. Farmers who use river water polluted by urban wastes for irrigation of fruits and vegetables may find their crops affected by the accumulation of these chemicals

2.4.2. Pesticides. Pesticides include insecticides, herbicides and fungicides. There are several thousand different types in use and almost all of them are possible causes of water pollution. For example, DDT, malathion, parathion, delthametrine and others have been sprayed in the environment for long periods of time for the control of disease vectors such as mosquitoes, and to control the growth of weeds and other pests.

3. CAUSES OF WATER POLLUTION

Most water pollution doesn't begin in the water itself. Take the oceans: around 80 percent of ocean pollution enters our seas from the land. Virtually any human activity can have an effect on the quality of our water environment. When farmers fertilize the fields, the chemicals they use are gradually washed by rain into the groundwater or surface waters nearby. Sometimes the causes of water pollution are quite surprising. Chemicals released by smokestacks (chimneys) can enter the atmosphere and then fall back to earth as rain, entering seas, rivers, and lakes and causing water pollution.

3.1. Sewage

With billions of people on the planet, disposing of sewage waste is a major problem. According to 2013 figures from the World Health Organization, some 780 million people (11 percent of the world's population) don't have access to safe drinking water, while 2.5 billion (40 percent of the world's population) don't have proper sanitation (hygienic toilet facilities); although there have been great improvements in securing access to clean water, relatively little progress has been made on improving global sanitation in the last decade. Sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhea that kills 760,000 children under five each year. (Back in 2002, the World Health Organization estimated that water-related diseases could kill as many as 135 million people by 2020.) Yet the problem of sewage disposal does not end there. When you flush the toilet, the waste has to go somewhere and, even after it leaves the sewage treatment works, there is still waste to dispose of. Sometimes sewage waste is pumped untreated into the sea. Until the early 1990s, around 5 million tons of sewage was dumped by barge from New York City each year. According to 2002 figures from the UK government's Department for the Environment, Food, and Rural Affairs (DEFRA), the sewers of Britain collect around 11 billion liters of wastewater every day, some of it still pumped untreated into the sea through long pipes. The New River that crosses the border from Mexico into California once carried with it 20–25 million gallons (76–95 million liters) of raw sewage each day; a new waste water plant on the US-Mexico border, completed in 2007, substantially solved that problem. Unfortunately, even in some of the richest nations, the practice of dumping sewage into the sea continues. In early 2012, it was reported that the tiny island of Guernsey (between Britain and France) has decided to continue dumping 16,000 tons of raw sewage into the sea each day.

3.2. Nutrients

Suitably treated and used in moderate quantities, sewage can be a fertilizer: it returns important nutrients to the environment, such as nitrogen and phosphorus, which plants and animals need for growth. The trouble is, sewage is often released in much greater quantities than the natural environment can cope with. Chemical fertilizers used by farmers also add nutrients to the soil, which drain into rivers and seas and add to the fertilizing effect of the sewage. Together, sewage and fertilizers can cause a massive increase in the growth of algae or plankton that overwhelms huge areas of oceans, lakes, or rivers. This is known as a harmful algal bloom (also known as an HAB or red tide, because it can turn the water red). It is harmful because it removes oxygen from the water that kills other forms of life, leading to what is known as a dead zone. The Gulf of Mexico has one of the world's most spectacular dead zones. Each summer, according to studies by the NOAA, it grows to an area of around 5500

square miles (14,000 square kilometers), which is about the same size as the state of Connecticut.

3.3. Waste Water

A few statistics illustrate the scale of the problem that wastewater (chemicals washed down drains and discharged from factories) can cause. Around half of all ocean pollution is caused by sewage and wastewater. Each year, the world generates perhaps 5–10 billion tons of industrial waste, much of which is pumped untreated into rivers, oceans, and other waterways. In the United States alone, around 400,000 factories take clean water from rivers, and many pump polluted waters back in their place. However, there have been major improvements in wastewater treatment recently. Since 1970, in the United States, the Environmental Protection Agency (EPA) has invested about $70 billion in improving water treatment plants that, as of 2015, serve around 88 percent of the US population (compared to just 69 percent in 1972).

Factories are point sources of water pollution, but ordinary people from nonpoint sources pollute quite a lot of water; this is how ordinary water becomes wastewater in the first place. Virtually everyone pours chemicals of one sort or another down their drains or toilets. Even detergents used in washing machines and dishwashers eventually end up in our rivers and oceans. So do the pesticides we use on our gardens. A lot of toxic pollution also enters wastewater from highway runoff. Highways are typically covered with a cocktail of toxic chemicals—everything from spilled fuel and brake fluids to bits of worn tires (themselves made from chemical additives) and exhaust emissions. When it rains, these chemicals wash into drains and rivers. It is not unusual for heavy summer rainstorms to wash toxic chemicals into rivers in such concentrations that they kill large numbers of fish overnight. It has been estimated that, in one year, the highway runoff from a single large city leaks as much oil into our water environment as a typical tanker spill. Some highway runoff runs away into drains; others can pollute groundwater or accumulate in the land next to a road, making it increasingly toxic as the years go by.

3.4. Chemical Waste

Detergents are relatively mild substances. At the opposite end of the spectrum are highly toxic chemicals such as polychlorinated biphenyls (PCBs). They were once widely used to manufacture electronic circuit boards, but their harmful effects have now been recognized and their use is highly restricted in many countries. Nevertheless, an estimated half million tons of PCBs were discharged into the environment during the 20th century. In a classic example of trans boundary pollution, traces of PCBs have even been found in birds and fish in the Arctic. They were carried there through the oceans, thousands of miles from where they originally entered the environment. Although PCBs are widely banned, their effects will be felt for many decades because they last a long time in the environment without breaking down.

Another kind of toxic pollution comes from heavy metals, such as lead, cadmium, and mercury. Lead was once commonly used in gasoline (petrol), though its use is now restricted in some countries. Mercury and cadmium are still used in batteries (though some brands now use other metals instead). Until recently, a highly toxic chemical called tributyltin (TBT) was used in paints to protect boats from the ravaging effects of the oceans. Ironically, however, TBT was gradually recognized as a pollutant: boats painted with it were doing as much damage to the oceans as the oceans were doing to the boats.

3.5. Radioactive Waste

People view radioactive waste with great alarm—and for good reason. At high enough concentrations, it can kill; in lower concentrations, it can cause cancers and other illnesses. The biggest sources of radioactive pollution in Europe are two factories that reprocess waste fuel from nuclear power plants: Sell afield on the north-west coast of Britain and Cap La Hague on the north coast of France. Both discharge radioactive wastewater into the sea, which ocean currents then carry around the world. Countries such as Norway, which lie downstream from Britain, receive significant doses of radioactive pollution from Sell afield. The Norwegian government has repeatedly complained that Sell afield has increased radiation levels along its coast by 6–10 times. Both the Irish and Norwegian governments continue to press for the plant's closure.

3.6. Oil Pollution

When we think of ocean pollution, huge black oil slicks often spring to mind, yet these spectacular accidents represent only a tiny fraction of all the pollution entering our oceans. Even considering oil by itself, tanker spills are not as significant as they might seem: only 12 percent of the oil that enters the oceans comes from tanker accidents; over 70 percent of oil pollution at sea comes from routine shipping and from the oil people pour down drains on land.

3.7. Plastics

If you've ever taken part in a community beach clean, you'll know that plastic is far and away the most common substance that washes up with the waves. There are three reasons for this: plastic is one of the most common materials, used for making virtually every kind of manufactured object from clothing to automobile parts; plastic is light and floats easily so it can travel enormous distances across the oceans; most plastics are not biodegradable (they do not break down naturally in the environment), which means that things like plastic bottle tops can survive in the marine environment for a long time.

3.8. Alien Species

Most people's idea of water pollution involves things like sewage, toxic metals, or oil slicks, but pollution can be biological as well as chemical. In some parts of the world, alien species are a major problem. Alien species (sometimes known as invasive species) are animals or plants from one region that have been introduced into a different ecosystem where they do not belong. Outside their normal environment, they have no natural predators, so they rapidly run wild, crowding out the usual animals or plants that thrive there. Common examples of alien species include zebra mussels in the Great Lakes of the USA, which were carried there from Europe by ballast water (waste water flushed from ships). The Mediterranean Sea has been invaded by a kind of alien algae called Caulerpa taxifolia. In the Black Sea, an alien jellyfish called Mnemiopsis Leidy reduced fish stocks by 90 percent after arriving in ballast water. In San Francisco Bay, Asian clams called Potamocorbula amurensis, also introduced by ballast water, have dramatically altered the ecosystem. In 1999, Cornell University's David Pimentel estimated that alien invaders like this cost the US economy $123 billion a year.

4. EFFECTS OF WATER POLLUTION

Contaminants in irrigation water may accumulate in the soil and, after a period of years, render the soil unfit for agriculture. Even when the presence of pesticides or pathogenic organisms in irrigation water does not directly affect plant growth, it may potentially affect the acceptability of the agricultural product for sale or consumption.

Poor quality water can affect livestock by causing death, sickness or impaired growth. Some substances, or their degradation products, present in water used for livestock may occasionally be transmitted to humans. The purpose of good quality water used for livestock watering is, therefore, to help protect both the livestock and the consumer.

Contaminated water also has health problems for those who swim in it. They may become ill if the water is contaminated with faucal material or with microorganisms that could cause gastrointestinal illness or ear, eye, or skin infections.

Some people believe pollution is an inescapable result of human activity: they argue that if we want to have factories, cities, ships, cars, oil, and coastal resorts, some degree of pollution is almost certain to result.

Pollution matters because it harms the environment on which people depend. The environment is not something distant and separate from our lives. The environment is everything that surrounds us that gives us life and health. Destroying the environment ultimately reduces the quality of our own lives—and that, most selfishly, is why pollution should matter to all of us.

5. CONTROL OF WATER POLLUTION

Decisions on the type and degree of treatment and control of wastes, and the disposal and use of adequately treated wastewater, must be based on a consideration all the technical factors of each drainage basin, in order to prevent any further contamination or harm to the environment.

5.1 Sewage Treatment

In urban areas of developed countries, centralized sewage treatment plants typically treat domestic sewage. Well-designed and operated systems (i.e., secondary treatment or better) can remove 90 percent or more of the pollutant load in sewage. Some plants have additional systems to remove nutrients and pathogens.

5.2 Industrial Wastewater Treatment

Some industrial facilities generate ordinary domestic sewage that can be treated by municipal facilities. Industries that generate wastewater with high concentrations of conventional pollutants (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or other non-conventional pollutants such as ammonia, need specialized treatment systems. Some of these facilities can install a pre-treatment system to remove the toxic components, and then send the partially treated wastewater to the municipal system. Industries generating large volumes of wastewater typically operate their own complete on-site treatment systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

6.3 Agricultural Wastewater Treatment

6.3.1. Non-point Source Controls

Sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States. Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian.

Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer, animal manure, or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residues, irrigation, water, wildlife, and atmospheric disposition. Farmers can develop and implement nutrient management plans to reduce excess application of nutrients and reduce the potential for nutrients.

To minimize pesticide impacts, farmers may use integrated pest management (IPM) techniques to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.

6.3.2. How to Control Radioactive Pollution

Number of ways can control the radioactive pollution. It includes the stoppage of leakage from the radioactive materials including the nuclear reactors, industries, and laboratories. The disposal of radioactive material must be safe and secure. They must be stored in the safe places and must be changed into harmless form. The wastes with a very low radiation must be put into the sewage. The nuclear power plants must follow all the safe instructions. The workers who work in the nuclear plants must wear the protective garments. The natural radiation must be at the permissible limits and they must not cross it.

6. SUGGESTIONS

There is no easy way to solve water pollution; if there were, it wouldn't be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

6.1. Education

Making people aware of the problem is the first step to solving it. In the early 1990s, when surfers in Britain grew tired of catching illnesses from water polluted with sewage, they formed a group called Surfers. Against Sewage to force governments and water companies to clean up their act. People who've grown tired of walking the world's polluted beaches often band together to organize community beach-cleaning sessions. Anglers who no longer catch so many fish have campaigned for tougher penalties against factories that pour pollution into our rivers. Greater public awareness can make a positive difference.

6.2 Laws

One of the biggest problems with water pollution is its trans boundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighboring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be effective they have to operate across national and international borders. The European Union has water-protection laws (known as directives) that apply to all of its member states. They include the 1976 Bathing Water Directive (updated 2006), which seeks to ensure the quality of the waters that people use for recreation. Most countries also have their own water pollution laws. In the United States, for example, there is the 1972 Clean Water Act and the 1974 safe drinking water.

6.3. Economics

Most environmental experts agree that the best way to tackle pollution is through something called the polluter pays principle. This means that whoever causes pollution should have to pay to clean it up, one way or another. Polluter pays can operate in all kinds of ways. It could mean that tanker owners should have to take out insurance that covers the cost of oil spill cleanups, for example. It could also mean that shoppers should have to pay for their plastic grocery bags, as is now common in Ireland, to encourage recycling and minimize waste. Or it could mean that factories that use rivers must have their water inlet pipes downstream of their effluent outflow pipes, so if they cause pollution they themselves are the first people to suffer. Ultimately, the polluter pays principle is designed to deter people from polluting by making it less expensive for them to behave in an environmentally responsible way.

REFERENCES

[1] "An overview of diarrhea, symptoms, diagnosis and the costs of morbidity" (PDF). CHNRI. 2010. *Archived from the original* (PDF) on May 12, 2013.

[2] "China says water pollution so severe that cities could lack safe supplies". *Chinadaily .com.cn.* June 7, 2005.

[3] Wachman, Richard (2007-12-09). "Water becomes the new oil as world runs dry". *The Guardian (London).* Retrieved 2015-09-23.

[4] *United States Geological Survey* (USGS), Denver, CO (1998). "Ground Water and Surface Water: A Single Resource." Circular 1139.

[5] EPA.(2005) *Protecting Water Quality from Agricultural Runoff."* Fact Sheet No. EPA-841-F-05-001. .

[6] EPA (2006). Water Pollution - Causes, Effects and Control. New Delhi: *New Age International*. p. 179.ISBN 978-81-224-1839-2.

[7] Kennish, Michael J. (1992). *Ecology of Estuaries: Anthropogenic Effects. Marine Science Series.* Boca Raton, FL: CRC Press. pp. 415–17. ISBN 978-0-8493-8041-9.