
Chemical Waste: That Impact on Aquatic Life or Water Quality

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Abstract

Chemical wastes are liquid, semi-solid and solid wastes which are hazardous in nature or constitute a risk of pollution to the environment. Indiscriminate disposal of chemical waste has very serious health, safety and environmental consequences. Undoubtedly, over the last one hundred years, humans have introduced a significant number of chemicals into the environment. While some chemicals are designed to get rid of weeds and pests, a significant amount of chemicals are wastes from industrial and agricultural processes. Wastes discharged from agricultural processes and factories are polluting our rivers and other water bodies. The major victims of water pollution are amphibians and dolphins. A lot of amphibians that hunt insects in our farmlands are dying off. Just because of this, several species of fish and aquatic plants are endangered today. A lot of important plants are dying off due to toxic chemicals in the water. This harms the animals dependent on these plants. Fishes lose their breeding grounds and harm the overall ecosystem. This toxic water is also added on our farmlands by irrigation and because of this, the toxic chemicals are making their way into our food and cause diseases.

It is obvious that with increasing industrialization the pollution will also increase but still, we have to follow the measures to survive alongside. We can also take some small steps on our behalf like reducing the amount of garbage that goes into the dust, reusing & recycling the items so that a number of new items can be decreased. Proper disposal/containment of toxic chemicals/materials before they have an opportunity to reach our oceans and lakes would go a long way towards improving the current condition of our water. So the impact of Chemical waste on aquatic environment is discussed in present paper.

Keywords:

Chemical waste;
Waste water;
Aquatic life.

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1. Introduction

The quality of any body of surface or ground water is a function of either both natural influences and human influences. Without human influences water quality would be determined by the weathering of bedrock minerals, by the atmospheric processes of evapotranspiration and the deposition of dust and salt by wind, by the natural leaching of organic matter and nutrients from soil, by hydrological factors that lead to runoff, and by biological processes within the aquatic environment that can alter the physical and chemical composition of water. Typically, water quality is determined by comparing the physical and chemical characteristics of a water sample with water quality guidelines or standards. Drinking water quality guidelines and standards are designed to enable the provision of clean and safe water for human consumption, thereby protecting human health. These are usually based on scientifically assessed acceptable

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levels of toxicity to either humans or aquatic organisms. Declining water quality has become a global issue of concern as human populations grow, industrial and agricultural activities expand, and climate change threatens to cause major alterations to the hydrological cycle. Undoubtedly, over the last one hundred years, humans have introduced a significant number of chemicals into the environment [1]. During the last century huge amounts of chemical waste water was discharged in to rivers, lakes and coastal areas. The major victims of water pollution are amphibians and dolphins. A lot of amphibians that hunt insects in our farmlands are dying off. Just because of this, several species of fish and aquatic plants are endangered today. A lot of important plants are dying off due to toxic chemicals in the water. This harms the animals dependent on these plants. Fishes lose their breeding grounds and harm the overall ecosystem. This toxic water is also added on our farmlands by irrigation and because of this, the toxic chemicals are making their way into our food and cause diseases. The water we use for domestic purposes ought to be free from contaminants, yet water pollution is a major problem in many countries. According to the World Health Organization (WHO, 2002), about 1.7 million people die each year due to unsafe water, sanitation and hygiene. The careless human intervention has badly affected the aquatic environment, threatening the existence of several other species on earth, including human beings. Accidents such as BP oil spill and Samarco dam collapse are the striking instances to see how badly the human activities can destroy the rich ecosystem of water bodies.

Further water is said to be contaminated when its quality or composition is changed either naturally or as a result of human activities. Nearly 80% of the human diseases in developing countries are due to contaminated water alone. A large number of industrial chemical wastes that come to human body through drinking water threaten the life and health. The famous MINAMATA and ITAI-ITAI diseases took a big toll of human life in Japan due to mercury and cadmium from the industrial effluents in the aquatic ecosystem. Some agrochemicals like chlorinated pesticides disposed in water accumulate in the aquatic food chains and enter the human body causing heavy infection. In coastal Karnataka, several people died by consuming crabs contaminated pesticides. Changes in water quality due to deficiency of iodine lead to goitre which has been found to be endemic in many parts of India. On the other hand many water borne diseases prevalent in the Indian population like cholera, typhoid, gastroenteritis and hepatitis are due contamination of water [2].

Scientists are finding that out of sight, out of mind can no longer be the approach we take to the chemicals in our waters. Substances that we use everyday are turning up in our lakes, rivers and ocean, where they can impact aquatic life and possibly ourselves. Now these contaminants are affecting aquatic environments and may be coming back to haunt us in unanticipated ways. This paper tries to discuss basically the major sources of chemical waste and the effect that chemical waste has on the aquatic environment.

2. What is Chemical Waste?

The term “Chemical Waste” are liquid, semi-solid and solid wastes which includes harmful chemical by-products from manufacturing facilities and laboratories and smaller scale chemicals disposed of from businesses and households. A lot of chemical waste can be classified as hazardous waste depending on the recommended disposal procedure.

Examples of some Chemical Waste (*Including, not Limited to):

- Manufacturing or Laboratory By-Products
- Reagent grade chemicals
- Used oil
- Spent Solvents
- Sulphur
- Asbestos
- Mercury
- Pesticides
- Solutions and Chemicals for Film Processing
- Gas Cylinders
- Chemically Contaminated Objects – Syringes, Needles, Razors
- Chemical Powders
- Electronic Equipment
- Toner / Print Cartridges
- Ethylene Glycol
- Paint
- Fluorescent Light Bulbs
- Lighting Ballasts
- Industrial Cleaning Materials

- Glues and Adhesives
- Resin Including: Epoxy, Styrene
- Dye
- Degreasing Solvent
- Fluids Including: Transmission, Radiator, Brake and Steering Fluids

Household Items:

- Batteries
- Refrigerants
- Cleaning Products
- Aerosol Cans

3. Source of Chemical waste

Chemical waste produces from different sources, are classified as follows

1. Urban or municipal waste
2. Industrial waste
3. Agricultural waste
4. Commercial waste

Urban or municipal waste:

The wastes, collected from the residential houses, markets, streets and other places mostly in the urban areas and disposed of by municipal bodies are called municipal solid wastes. Household cleaning products and pharmaceutical for example laundry detergents, shampoo, toothpaste etc, and medicines likes antibiotics, steroids etc, whenever used goes down the drain in altered or unaltered form into the local water waste.

Industrial waste:

Industrial wastes are released from chemical plants, paint industries, cement factories, power plants, mining operations, textile industries, food processing industries, petroleum industries and thermal power plants. These industries produce different types of waste products. Industrial solid wastes can be classified into two groups.

Non-hazardous wastes:

These wastes are produced from food processing plants, cotton mills, paper mills sugar mills and textiles industries.

Hazardous wastes:

Hazardous wastes are generated by nearly every industry. Metals, chemical, drugs, lather, pulp, electroplating, dye, rubber are some of important example.

Agricultural waste:

Agricultural areas produce this type of chemical wastes. Chemical wastes from agricultural land and agro-industry can expose people to pesticides, fertilizers and hazardous veterinary product wastes. Farms are a major source of these wastes, and agrochemicals can leach into the environment while in storage or can cause damage after their application.

Commercial waste:

With the advancement of modern cities, industries and automobiles, huge amount of wastes are generated daily. These include markets, roads, buildings, hotels, commercial complexes, auto workshops, printing press etc. Hospitals, nursing homes and medical institutes also release tremendous amount of wastes which are hazardous and are much toxic in nature.

4. How chemical waste contaminant the aquatic environment

It is a well-known fact that nearly 70% of the earth is filled with water in the form of different kinds of water bodies such as oceans, lakes and rivers etc. All these water bodies form an indispensable part of our existence as it has key roles to play in our everyday life.-This factor of indispensability has not only helped us tremendously, but has also resulted in the exploitation of the water resources without any second thoughts. There are several ways to contamination of water resources by chemical waste. Some are discussed in given below.

Land Runoff

Industrial sites, construction sites and factories produce toxic chemicals or use them in manufacturing. The chemicals are then exposed to rainwater which causes them to be washed into the soil or directly into rivers, streams or lakes. On the other hand water quality monitoring of rivers and streams has shown that threatened and endangered are widely contaminated with fertilizers, pesticides that have run off from urban areas and

agricultural land. This is one of the main factors leading to an increase in contamination of water bodies.

Groundwater Contamination

This is water that is underneath the ground and cannot be seen unless you dig for it. Chemical wastes get washed into the soil and quickly contaminate the water underneath. This groundwater seeps into lakes, rivers and other important water sources.

Illegal Dumping

Waste from homes or industry which has been illegally dumped causes a significant amount of pollution of aquatic environment. Large amount of chemical wastes of human society are disposed of in river, lakes, ponds and other aquatic bodies making the water polluted which is not fit for drinking and other domestic purpose.

Sewerage and Septic Systems

Human waste can cause dangerous bacteria to spread if it contaminates a water supply. Often these systems are not maintained regularly enough and accidents happen, causing leakage into water supplies. Further the water used by the mining community in domestic and sanitary purpose also becomes a source of pollution if not treated properly before discharge. It may be contaminated with detergents, suspended solids and organic matters.

Leaks and Spills

Human error and negligence can lead to chemical spills and leaks. Leaks and spills can quickly make their way to water streams if not contained and cleared. Workshop effluents contain high amounts of oil and grease which are released during washing of the machineries. Sometimes spillage of oil and other toxic reagents do occur in these areas which ultimately affect the water regime.

Industrial Growth

Large scale growth can lead to a disregard for pollution. A lack of chemical waste disposal sites and services is put aside to continue with a growing economy.

5. Impact of Chemical waste accumulation on aquatic environment

Already two-thirds of aquatic life is considered to be an endangered species because of improperly disposed chemicals and other waste. However, businesses do not have to dump chemicals into water sources for the effects to be seen. Anytime you dump or release chemical waste, it will have an effect. As it rains, those chemicals are washed into rivers, which feed the waterfalls and then go into the ocean. Substances that we use everyday are turning up in our lakes, rivers and ocean, where they can impact aquatic life and possibly ourselves. Chemicals are affecting aquatic environments and may be coming back to haunt us in unanticipated ways. When a toxic waste harms one organism, it can end up destroying an entire food chain of aquatic life. The sewage of cities is often drained into the rivers, which is dangerous to flora, fauna and human life. Chemical wastes from municipalities, sanatoria and tanneries discharged in to rivers, canals and lakes etc. carry many species of bacteria and other microbes which cause disease in human and animals. Due to heavy accumulation of wastes into the canals, lakes and rivers, oxygen concentration is reduced considerably thus affecting the life of fishes and aquatic populations. In extreme deficiency of oxygen most of the fishes die. Some chemical wastes for example heavy metals, cyanides and several other organic and inorganic compounds are harmful to aquatic organisms. Many of them especially non-biodegradable once accumulates in the body of organisms and cause of long-term effects. Similarly some agrochemical waste like DDT and other pesticides present in very low concentrations in water may gather higher concentration within algae, insects and fishes. The birds and people feed on these fishes are then exposed of very high level of hazardous substances. In birds, these substances can affect the egg production and bone formation[3]. In many underdeveloped countries, the harmful and climatic unfriendly effluents from the tanneries are discharged directly into large water bodies even without proper treatment which is a grave and serious issue of concern for the environmental, climatic and public health [4]. Tannery effluents contain both organic and inorganic solids in high concentration in either suspended or dissolved forms which results to high oxygen demand in water including admixture of harmful elements like toxic metal salts and chromium metal ion in the water. Without proper treatment and discharge of untreated wastes in water bodies causes serious harm to both environment and life threatening for the aquatic flora and fauna

One of the least known but most significant uses of the sea is as an enormous dumpsite. Improperly disposed chemicals wastes pollute marine life and kills sea mammals, corals, fish and growth of marine algae is also affected. At the same time, sea birds are affected because they eat the fish. Massive oil spilled in large quantities from tankers of broken oil pipes from oil industries. Oil refinery effluents contain many different chemicals at different concentrations including ammonia, sulphides, phenol and hydrocarbons etc. which kill sea weeds, mollusks, marine birds, crustaceans, fishes and other sea organisms that serve as food for humans. In a matter of fact, any organism that digests affected marine life can have adverse effects[5], [6]. Oil can form a thin film on the water surface and may interfere with the reoxygenation of the water. It can coat the gills of fish and feathers of birds and proves to be dangerous for aquatic ecosystems. The oil also damages

the surface protective activity of skin which keeps the marine mammal warm [7], [8]. Some sewage feed algae that also flow off in the ocean. These algae grow at a rapid rate and have a high nutrient concentration producing red tides. They are called red tides because of the red appearance of the foam of the ocean waves. Red tides kill fishes by releasing toxins [9]. On the other hand 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 bloom and excessive weed growth. This makes water to have odour, taste and sometimes colour. Ultimately, the ecological balance of a body of water is altered. Sulphur dioxide and nitrogen oxides cause acid rain which lowers the PH value of soil and emission of carbon dioxide cause ocean acidification, the ongoing decrease in the PH of the Earth's Oceans as CO₂ becomes dissolved. Mine water quality of some of the mines of coal field's area is found to be acidic and also contains high amount of sulphate, TDS and heavy metals such as Fe and Mn. The pH of mine water is found in the range of 1.53 to 6.65 and may be polluting the nearby water regime. High values of hardness of mine water reduces its utility in domestic purposes [10]

6. Conclusion

Water quality is seriously affected by contamination from chemical waste. Indiscriminate disposal of chemical waste has very serious health, safety and environmental consequences. Release into coastal waters causes damage to local marine life and accumulation of toxins in sea-food generally creates a serious health hazard to the community. The disposal of chemical waste that we use every day is turning up in our lakes, rivers, ocean and other fresh water bodies where they can impact aquatic life and possibly ourselves. Chemical wastes are affecting aquatic environments and may be coming back to haunt us in unanticipated ways. So we can also take some small steps on our behalf like reducing the amount of garbage that goes into the dust, reusing & recycling the items so that a number of new items can be decreased. Therefore the main objective of the scheme of control is to ensure that chemical waste is properly managed by all parties, from the source of production through to the place of final disposal.

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