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## A REVIEW ON ACID RAIN AND ENVIRONMENTAL DISASTERS

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### ABSTRACT

A close relationship is observed between pollution and acid rain. Components responsible for acid rain are carbonic acid, sulphurous acid and nitric acid. Acid rain has proved to be dangerous on various elements of environment. Water bodies are affected the most by acid rain due to the process called water cycle. The soil present near the water bodies are directly affected by the polluted water. Leaching of minerals and nutrients takes place due to acid rain affecting both soil and trees. Vegetation is also affected due to polluted soil which leads to attack of fungi, bacteria and insects. Animals, especially aquatic animals, suffer health problems like reproductive and birth defects caused by acid rain. Human health degenerates too as there are several references of cardiac and respiratory



problems caused by acid rain.

**KEYWORDS:** Acid rain, leaching, chemical pollutants, environment.

### INTRODUCTION:

Any kind of precipitation which is a mixture of chemicals like nitric and sulphuric acid is termed as acid rain. The term was first coined by Robert Angus Smith in 1872. Human activities like working of industries, increase in transportation and working of variety of power plants contribute to this phenomenon. The amount of nitrogen, sulphur dioxide, pollutants and chemicals released by burning of fossil fuels causes a drastic increase

relationship of acid rain with environmental catastrophe was shown by Robert Angus Smith in 1852 in Manchester, England (Wondyfraw, 2014).

Acid rain can be any acidic deposition which is wet or dry. Wet acid rain appears in the form of fog, snow or rainfall. As the water touches ground, it flows through the soil and harms many plants and animals. Dry acid deposition is through gases and particles. Half of the total acidity present in the atmosphere falls back on the earth through dry deposition. Wind acts as a major factor that blows the dry particles and gases towards infrastructure like buildings, cars, homes and also trees. The chemical reactions of pollutants that cause acid rain are carbonic acid, sulphurous acid and nitric acid. Effects of acid rain are numerous.

### 1. Effect on Water bodies

There is a direct

connection between acid rain and water bodies. Water bodies like lakes, streams, rivers, seas as well as ground water are affected by acid rain. Acid rain gets collected in the aquatic system and this water gets evaporated and forms clouds; thereafter the same water pours down as rain.

### **The particles of these chemicals exist in two forms-**

a) Dry particles : present in air

b) Wet particles : present in the form of snow, rain, sleet and fog

Acid rain washes various mineral nutrients present in soil into the water bodies. Due to increase in the amount of acid in water the pH of the water changes. This ultimately harms different organism of different species. Not only are the organisms harmed, but the eggs laid by them in water causes perilous birth defects due to change in pH of water (Butnariu and Samfira, 2013).

Birds which feed on fishes that are already affected by harmful chemicals due to acid rain get these chemicals accumulated in their system. Subsequently the chemicals get passed on to other animals and climb up the trophic level. This causes an increase in the concentration of chemicals (bioaccumulations) leading to biomagnifications (Bhargava and Bhargava, 2013).

## **II .Effect on Soil**

Every plant is dependent on soil for the supply of water and nutrients. Therefore, the important ecological factor which needs mention in relation to the present study is soil. The acidification of soil takes place as a result of acid rain. This acidification is caused due to increased amount of exchange between the nutrient cations like calcium, magnesium and potassium with hydrogen ions present in the soil. Leaching takes place as a result of acidification which leads to deficiency of nutrients; ultimately affecting the soil wherein the soil loses its fertility. After losing its fertility there is decrease in the growing capacity of vegetation. It is known that the quality of soil plays an important role in maintaining the structural diversity (Singh and Agrawal, 2006).

Several contents of the soil are harmful though elements like aluminum and mercury which cannot be absorbed by plants and trees are harmless. But when these metals come into contact with acid rain, they form various compounds which then become harmful to vegetation. These newly formed compounds can be easily absorbed by the trees and plants; ultimately harming animals and humans via the entry of these compounds into food chain. Due to changes in the soil, the level of pH reduces which kills some of the microbes due to their reduced tolerance in low pH. Again, as the important minerals and nutrients trickle down the deeper layers of soil without providing nutrition to the upper layer as a result of the same acid rain, indirectly the entire food chain is affected (Bhargava and Bhargava, 2013).

## **III.Effect on Vegetation**

The most vital part in trees and plants are leaves. As they are the most sensitive part, the pollutant damages it first. If the leaves are exposed to low pH (pH 3.0 approx.) of acid rain, the leaf blade shows presence of necrotic spots. Many plants accumulate phenol compounds in these necrotic spots which lead to injury and fungal diseases in such vegetation (Singh and Agrawal, 2006). The important minerals present on plants get washed off by acid rain. The small pores present on the leaves get blocked due to the same. These small pores happen to be responsible for taking in carbon dioxide to carry out photosynthesis. If the plants are not able to use the carbon dioxide, their functioning gets affected which hampers their growth. The effect of acid rain results in loss of leaves, damaged bark and stunted growth. Later, these plants and trees become prone to fungi and insect attacks, ultimately resulting into death (Bhargava and Bhargava, 2013).

Trees also die indirectly by acid rain. They get weak as their leaves get damaged, the nutrients get washed away and the soil gets exposed to the toxic compounds (Dubey, 2013). Photosynthesis does not take place which leads to reduced vegetation due to acid precipitation. This leads to diseases and drought which is known as dieback. In the process of dieback, the leaf starts getting brown and fall off, causing reduction in the annual growth and also reduction in the biomass because of reduced growth of vegetation. The fine root system gets affected by mycorrhiza and there is reduction in the number of lichens as potassium and phosphorous are

leached out from the soil. This hampers the fertility of soil (Sivaramanan, 2015).

#### IV. Effect on Animals

There is no direct effect of acid rain on land animals (Ferenbaug, 1975). The animals present in the aquatic system face several health hazards. Various reports have shown that metabolic activities of diverse animals get affected by acid rain (Singh and Agrawal, 2006). The soil gets leached because of this rain and several microbes are washed out or they die due to low pH. As has already been discussed, the fishes in the water get affected by the acid rain and these chemicals subsequently enter into the food chain (Bhargava and Bhargava, 2013). Not only the fishes, many amphibians and insects are also affected by acid rain. (Butnariu and Samfira, 2013).

Acidification causes several effects on the molluscs as they face problems in the formation of shells. Coral reefs, shellfish, sea grass bed are also affected by acid rain. Even the organisms at juvenile stage face several adverse effects due to acid rain. The shell or skeleton of the corals and shellfish get dissolved due to acidic nature of water. These acidic bodies give rise to acid tolerant forms. Protozoan and bacteria are the acid tolerant forms which is the major cause for killing of swamp and marshes. An example that can be cited here is of the fishes that were killed in Virginia surface of Pennsylvania, West Virginia. This happened due to the formation of swamps and marshes on the surface of water bodies which resulted in depletion of oxygen content leading to death of fishes (Sivaramanan, 2015).

#### V. Effect on Human Health

Acid rain does not have direct adverse effect on human health. It is similar to clean rain. But large amounts of acid particles in atmosphere causes heart and lung problems. Though sulphur dioxide and nitrogen oxide cause acid rain, sulphur dioxide and nitrogen oxide particles do not cause any damage to human health. However, interaction of these gases with the atmosphere leads to transportation of fine acid particles by wind which then is inhaled by humans entering their lungs. Generally these particles are in liquid state. But when they are present in the atmosphere, they directly enter into lungs of individuals. Concentration more than 1.6ppm causes breathing problems and eye irritation (Bhargava and Bhargava, 2013). Many scientific researches and studies have reported about the relationship between increased premature deaths, illness and these acidic fine particles. Heart and lung disorders are reported to be the causes of premature death. Lung disorders include asthma and bronchitis (Bhargava and Bhargava, 2013). Very common health problems which are observed are eye, nose, and throat irritation, cough, asthma and headache. Sulphur dioxide is used in various factories which have caused chronic bronchitis to the workers who work with this chemical (Butnariu and Samfira, 2013).

#### CONCLUSION

Acid rain takes a huge toll on human and animal health (animals included are terrestrial, aquatic and amphibian) leading to numerous diseases and disorders. It also shows its effects on plants, water and soil. An increase in the number of industries has lead to increased occurrences of acid rain. Industries contribute to acid rain by releasing harmful chemicals in the air and water. This pollution needs to be curbed or the concentration of these chemicals and methods of releasing these chemicals should be brought under control. Acid rain can be controlled by adopting the following suggestions -

- 1) As chemicals like carbonic acid, sulphurous acid and nitric acid are the main causes of acid rain, these chemicals should be treated before they are released from the factories into the atmosphere.
- 2) Fuels should be washed before using the same; the substitute that can be used is natural gas which does not contribute to acid rain.
- 3) Fuels and gases should be desulphurised i.e. sulphur dioxide should be removed from the fuels and gases.
- 4) Lime water or lime stone can be added to the soil and water which would reduce the acid content and neutralize the water and soil; a process termed as liming.

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