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# A Review of Acid Rain

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***ABSTRACT:*** ***Often known as acid drainage or acid precipitation, acid rain has a pH rating of about 5.2 or less. Emissions of Sulphur dioxide (So2) as well as nitrogen oxides (NoX: mixture of NO and NO2) from human activities such as fossil fuel burning are the source of acid rain. The presence of these acids along with other components of the environment emits protons that increases the soil acidity and further not only mobilizes but also leaches away nutrient positive ions and increases radioactive metals. This improvement in the chemical properties of the soil decreases fertility and has a detrimental effect on the production and growth of crops and forest trees.Acid accumulation lowers the pH of sea water and results in water sources becoming acidified, creating harmful effects on marine species. Somehow, acid rain impacts each and every part of the environment and also has any tortuous impact on human health. Acid rain also adds to the deterioration of air-polluted soils and deteriorates man-built objects such as houses and temples made of limestone and marble. Acid rain has attracted widespread science and public attention due to its destructive large-scale effect on habitats.***

***KEYWORDS:*** ***Acid rain, acidity, Oxidants, pH readings, germinate, ecosystem, environmental concern.***

## INTRODUCTION

Scottish chemist Robert Angus Smith first invented the term acid rain in 1852 while studying rainwater near industrial areas in England and Scotland. In his book Air and Rain: The Origins of Chemical Climatology, the inquiry became an important subject. In the late 1960s and early 1970s, acid rain was recognized as a significant environmental issue. As a global environmental concern, it is most frequently overshadowed by climate change. Acid rain is a major challenge that the world is facing and is caused by both natural and human means of development[1]. Industrial emissions are human-generating sources, and volcanic eruptions are an example of a natural cause.Aquatic habitats suffer the most direct consequences of acid rain. Due to the effects of several gases which dissolve in rainwater in order to form different acids, the acidity of rain is increased. Any greenhouse compounds, such as carbon dioxide, Sulphur dioxide and nitrogen oxides, which come into contact with water in the atmosphere and are converted into acidic liquids, are responsible for the production of acid rain. In several of these acid forming systems, oxidants play a crucial role[2].

In rain water, carbon dioxide dissolves and is converted into a weak acid, that is, carbonic acid.Some gases are converted into heavy acids, i.e. Sulphuric and nitric acids respectively, such as Sulphur and nitrogen oxides[3]. Owing to the presence of carbon dioxide, rainwater is

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naturally little acidic, and natural releases of nitrogen and Sulphur oxides as well as some organic acids due to human activity make it more acidic in nature. In certain cases, near industrial areas, pH readings below 2.4 have been recorded. Emissions from biological activities and from volcanic eruptions happening on the planet are the primary natural events that lead to acid-producing gases in the atmosphere.The gases in the atmosphere reach hundreds of miles and are then converted into acids and stored later[4]. Fossil fuels such as coal are consumed from electricity generation sources, resulting in higher releases of Sulphur and nitrogen oxides into the atmosphere. The main contributors to elevated nitrogen oxides in the atmosphere are these causes, along with the transport industry. With economic growth and population expansion, the issue of acid rain has grown rapidly; it has become a more prevalent area of concern[5].The brick processing industry uses tall smokestacks to mitigate local emissions, dumping poisonous gases into the regional environment and leading to the spread of acid rain.

## EFFECTS OF ACID RAIN

All the elements of habitats and human beings are threatened by acid rain. Nitrogen oxide and Sulphur dioxide pollution from acid rain cause skin, nose, and throat irritation. Not only this, respiratory problems such as asthma, dry cough, headaches and bronchitis are also caused. In farming areas, the heavy application of urea and animal waste induces the accumulation of acid in the environment[6]. Acid rain has a large effect on fiscal, social and medical issues and, owing to the exponential development of manufacturing as well as vehicles, is considered one of the serious problems.

- *Consequences of acid rain on soil:*

The soil system is very complex and is considered to be one of the main ecological factors that provide every plant and tree with nutrients and water for its growth. Because of acid rain, soil acidification occurs, which increases the interaction of ions in the soil between hydrogen and nutrient cations such as calcium, magnesium and potassium. Such cations are released into soil that leaches the soil solution and sulphate out of the acid input rapidly. Nutrient deficiency occurs in soils affected by acid rain due to acid-induced leaching, which deteriorates soil fertility and further inhibits plant and tree growth.Because of soil acidification, there is a detrimental effect on nutrient cycling and decomposition. It has also been shown that heavy acidification lowers the soil's nutrient content to a greater degree.

- *Consequences on Plants and Trees*

For the growth of plants, the optimal pH value range is between 5 and 8, and plants grown in soil with a pH value other than this range face trouble germinating and no plants can thrive if the pH is less than 3.7. Acid rain lowers the necessary soil nutrients provided by calcium, magnesium, nitrogen and potassium, etc., and decreases the growth and yield of plants. Initially, aluminum, mercury, cadmium, manganese and lead are non-toxic in nature and exist

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in ample concentrations in the soil, but these elements are turned to toxic form after the addition of acid rain, which not only kills but also results in the death of plants and trees.Because of the wood's calcium deficiency, trees become less cold resistant and go through winter damage or can become dead. The composition of leaf surfaces is influenced by acid rain, which contributes to a decline in fertilization, pollen germination, fruit formation and seed growth[7]. It contributes to the soil positive hydrogen ions that react together with calcium, magnesium and potassium compounds from soil particles. Because of acidification, the micro-organisms that are beneficial in releasing vital nutrient components from rotting organic matter into the soil are destroyed which contribute to the depletion of nutrients from plants and trees.Acid rain damages and thus destroys the seeds of plants and trees. The impacts of acid rain plants are very weak despite surviving and cannot face natural calamities such as high winds, excessive rainfall and drought. It is experimentally found that, relative to trees, plants with soft stems are more susceptible to damage from acid rain. Acid rain kills the components of cells such as chlorophyll. Both living organisms are interdependent on each other, but if a lower food chain species is affected, it also affects the other dependent species.

- *Consequences of acid rain on aquatic ecosystem*

It is rendered acidic by the adding of acid rain to the water sources. In streams and lakes, the evident symptoms of acidification can be observed as these water sources have little ability to process the acid supplies relative to soils and plants. All the aspects of the marine environment are influenced by acid rain. More than 20 percent of the water bodies in southern Norway lost their fish during the 1970s. The declines of the sport fish population are witnessed in the acidified water sources in Canada. Fishes adapted to acidic precipitation and increased their mortality rate, heavy metal uptake and decreased skeletal deformities and reproductive failure growth rate.Lakes and rivers are also impaired by the acidification of amphibians[8]. At low pH, several amphibian species such as toads, frogs and salamanders are very vulnerable. The number of snails and phytoplankton dropped at pH below 5.5 and disappears more when pH was less than 5.2 and zooplankton vanished at pH 5.0, as this acidity level made it impossible for the embryos to mature. The fish species quickly declined below pH 4.0. Any species, however, can face and develop in the adverse state of acid rain. Initially, Swedish lakes were inhabited by the genus Lobella and later by Juncuabulbosus or Sphagnum sp, which are more acid-tolerant.

- *Consequences of acid rain on human health*

Acid rain has little indirect effects on human health and is a source of pollution that is invisible. The indirect effects of acid rain include disruption to humans by interaction with acidification-affected materials such as food and water sources[9]. SO2 is very harmful in gaseous and aerosol types and causes more serious human health effects. Breathing is very difficult and eye irritation at concentrations above 1.6 ppm improves to a greater

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degree.When SO2 is mixed with aerosols, mist and suspended smoke, leading to the creation of finer suspensions from these chemical mixtures, it becomes even more volatile and dangerous, resulting in more penetration of the lungs than gas alone could. In Tokyo, the contaminated rain droplets resulted in inflammation of the skin and eyes[10]. As the soil is acidified, poisonous heavy metals are emitted from the soil, which impacts human health indirectly. The most common heavy metals are aluminium (Al), Cadmium (Cd), Zinc (Zn), Lead (Pb), Mercury (Hg), Magnesium (Mn) and Iron (Fe).

## CONCLUSION

The foundation for the effective management of acid rain, which has been recognized as one of the serious and destructive environmental issues of this century, is created by technology, industry, policy and public works hand in hand. Past practice has given us a lesson that science-based policy guidance works best where the information available is applied to the fullest and to examine the real issues and find the right solution. It is important to produce and review the available policy choices and track the effects of policy enforcement, as well as to make any amendments.There must be a shared trust between science advisors and politicians and both communities should be frank with each other regarding their beliefs and priorities. This way, a constructive dialogue about important issues will exist within society and multiple mitigation steps can be taken to overcome the problem of acid rain. While having so many serious effects, there are still some of the positives of acid rain that have been addressed in this article. All has its boon and curse, so does the acid rain. In order to monitor the impacts of acid rain, such as liming, pollution control and policy interference, the different approaches were addressed.The future problems related to the acid rain on the ecosystem are examined and criteria of new methods are addressed. At the end some recommendations are given to cope with the acid rain.

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