

Effects and Control Measure of Acid Rain

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ABSTRACT: *The air pollution levels are steadily rising in the metropolitan cities like Kolkata, Delhi, and Mumbai. Acid rain problem in Bihar, West Bengal, Orissa and southern coastal India has been predicted to lead to infertile soil. Acid rain makes the water bodies acidic. The amphibians are also affected by acidification of water bodies. At low pH; many species of amphibians including frogs, toads and salamanders are particularly sensitive. Indirect effect of acid rain on human health involves toxic heavy metals because these are liberated from soil when soil gets acidified. The most common heavy metals are Al, Cd, Zn, Pb, Hg, Mn and Fe. These mobilized contaminants are dissolved in soil and water make their way to groundwater that is drunk by humans and contaminate the food (Fish, meat, and vegetables) eaten by humans. These heavy metals get accumulated in the body and resulted into various health problems like dry coughs, asthma, headache, eye, nose and throat irritations. Acid rain problem has been tackled to some extent in the developed world by reducing the emission of the gases causing acid rain.*

KEYWORDS: *Acid, Decomposition, Harmful, Rain, Pollution.*

INTRODUCTION

Dictionary description - Due to carbonic acid from carbon dioxide in the atmosphere, most precipitation is usually slightly acidic. But when sulphur (sulphur) dioxide and nitrogen oxides (from car exhausts and industrial emissions) are washed out of the atmosphere by rain as poor sulfuric (sulfuric) and nitric acid, 'acid rain' is caused. Acid rain can cause significant crop damage, creating an ionic imbalance and leaching calcium ions from the soil and plant leaves. Human beings have used diverse natural resources for their gain since the beginning of civilization. They have built facilities that use many of the Earth's energy resources in order to make their lives easier. Energy is produced primarily through the combustion of fuels such as coal, oil and natural gases. On the one hand, this kind of growth makes our lives simpler, but on the other hand, it results in contamination by the release into the atmosphere of toxic substances[1]. Industrial and transport combustion of fossil fuels, industrialization and urbanisation have contributed to a rise in ambient concentrations of gaseous and particulate emissions, contributing to air pollution. One of the most severe environmental issues caused by air pollution is acid rain. Acid rain is a general term describing a variety of ways in which acid falls out of the atmosphere. Acid weather entails acidic rain, hail, snow, and fog. This term was first used by Robert Angus Smith in 1872 to describe the acidic quality of rain in the industrial city of Manchester, UK. "In a paper entitled "The beginning of chemical climatology in air and rain"[2]. As a more precise word for acid rain, scientists sometimes refer to "acid deposition". There are also dry depositions of acids in addition to wet deposition, which can be converted into salts in the soil and cause the same environmental harm as wet deposits. Dry deposition typically occurs near to the emission stage. However, wet deposition can occur thousands of kilometres away from the original emission source[3]. It is commonly accepted that the issue of acid rain stems from the washing out of sulphur oxides, nitrogen and other components found in the atmosphere. Coal fired power plants, smelters and motor vehicle exhausts are the primary sources of these oxides (producing NO_x). These oxides can react with other chemicals and create corrosive substances that are washed out by rain as acid deposition, either in wet or dry form. Initially, acidic rainfall events were only common around industrial areas. Yet atmospheric emissions are being transported regionally and also internationally with the increased usage of tall stacks for power plants and industries. Acid rain has an impact on the quality of human life and threatens the security of the ecosystem and the protection of food and timber supplies, causing an economic crisis. Acid rain has large economic, social and medical ramifications and has been called the industrial age's invisible plague[4].

Wet Deposition

Wet deposition refers to rain, fog, and snow that are acidic. If acid chemicals in the air are blown into places where the weather is wet, in the form of rain, snow, fog, or mist, the acids may fall to the ground. It affects a number of plants and animals as this acidic water flows over and through the field. Several factors depend on the strength of the results, including how acidic the water is; the chemical and buffering ability of the soils involved; and the types of fish, plants, and other living things that depend on the water. The process of wet deposition of acidic compounds in particular, acidic deposition has adverse effects on vegetation. This is

mainly due to soil acidification and the uptake of substances, which disturb the pH levels within plant cells that may lead to the evolution of reactive radicals[5].

Dry Deposition

The acid chemicals may be incorporated into dust or smoke in places where the weather is dry, and fall to the ground by dry deposition, sticking to the soil, houses, homes, vehicles, and trees. Rainstorms will wash dry deposited gases and particles from these surfaces, leading to increased runoff. This water from the runoff makes the resulting mixture more acidic. Via dry deposition, about half of the acidity in the atmosphere drops down to earth. In the absence of precipitation, acid deposition also occurs through dry deposition. For as much as 20 to 60 percent of overall acid deposition, this may be responsible. This occurs when particles and gases stick to the ground, plants or other surfaces. The results suggested that approximately 30% of erosion by dissolution could be attributed to the wet deposition of hydrogen ions and the dry deposition of SO₂ and HNO₃[6].

Acid rain has many ecological impacts in areas where the weather is dry, but none is greater than its effect on lakes, streams, wetlands, and other aquatic ecosystems. Acid rain renders water acidic and allows the aluminium that makes its way from soil into lakes and streams to be consumed by them. This mixture makes crayfish, clams, fish, and other marine animals poisonous to the water. Some species, better than others, can tolerate acidic waters. In an integrated ecosystem, however, what impacts certain species ultimately affects many others, including non-aquatic species such as birds, throughout the food chain[7]. Forests are also affected by acid rain, especially those at higher elevations. It robs the soil of vital nutrients and introduces aluminium into the soil, making water difficult for trees to absorb. Acids also affect the leaves and needles of trees. Combined with other environmental stressors, the effects of acid rain make trees and plants less capable of surviving cold weather, insects, and disease. Pollutants can also impair the capacity of trees to reproduce. Some soils are capable of neutralizing acids better than others. The harmful effects of acid rain are far greater in areas where the soil's "buffering capacity" is limited[8].

Effects on Environment and Human

Buildings and monuments:

Significant damage to buildings and marble sculptures is caused by acid rain. Calcium bicarbonate is a powdery material that is quickly washed away with water or, more precisely, rainwater. Acid rain combines with calcium carbonate (CaCO₃) to form soluble calcium hydrogen carbonate or calcium bicarbonate. This is how many world-famous temples and structures, such as the Taj Mahal in India, St. Paul's Cathedral in London and the Statue of Liberty in New York, have been partially eroded by acid rain. Due to exposure to cloud water with high acidity for a long time, high concrete buildings in urban areas were affected. The cement and concrete were affected by acid precipitation with pH levels between 3.0 and 5.0. Also showing signs of damage from sulphur emissions are Delhi Red Fort and Jama Masjid. Acid rain in churches, bridges made of steel, and railway tracks will ruin stained glass windows. It corrodes metal, destroys the colour of the paint, weakens leather and creates a crust on the surfaces of glass[9].

Acid Rain Effects on Taj Mahal

Severe levels of sulphur and nitrogen oxides are found in the air in that location. This is due to the large number of factories set up by the nearby Taj Mahal and the Yamuna River pollution. The wind direction is normally shifted in the direction where Taj is located as per metrological studies. Many of these culminated in acid rain. The marble (calcium carbonate) of Taj Mahal reacted with acid rain and this caused damage to the heritage structure. A government of India institute named NEERI aims at clearing the air in 'Taj Trapezium' to secure Taj Mahal. Taj Trapezium refers to an area that includes towns of Agra, Mathura, Bharatpur and Firozabad. As a result of this plan, over 2000 industries situated inside the trapezium had transferred. Still the current situation is critical because of nearby leather industry[10].

CONCLUSION & DISCUSSION

In marine, or water, habitats, such as streams, lakes, and marshes, the ecological effects of acid rain are most clearly seen. After landing on trees, fields, homes, and highways, acid rain flows into streams, lakes, and marshes. Acid rain often falls directly on marine ecosystems. Each and every part of the environment is impacted by acid rain. Acid rain also destroys man-made products and structures. Acid rain is one of the most severe environmental issues caused by air pollution. Sulphur dioxide (SO₂) and to some degree the main sources of acid rain are oxides of nitrogen and ozone. These emissions come from human activities, such as the burning of burnable waste, thermal and automotive fossil fuels. These components interact with atmospheric reactants which result in acid deposition. Due to the interaction of these acids with other atmospheric components, protons are released causing soil acidity to increase, and soil pH mobilizes and leaches away nutrient cations and increases the supply of toxic heavy metals as acid rain flows through water sheet soils.

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