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# Impacts of Air Pollution & Acid Rain on Environment

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**Abstract**

Rain is very important for life . All living things need water to line even people .Rain beings use the water we need. But in many places in the world even where we live, rain has become menace. Acid rain is result of air pollution when any type of fuel is burnt lots of different chemicals are produced In Polluted cities internal combustion engines of automobile amitt pollutants such as Co, Co2 hydrocarbones in air. In industrial areas various industries exit pollutants like CO, CO2, SO2, SO3, NO, NO2in the atmosphere air are absorbed by moisture, present in air Resulting in the formation of various acids burning of fossil fuels in industries and transport sector, industrialization and urbanization on have led to increase the concentrations of gaseous and particulate pollutants in the atmospheric leading to air pollution. Acid rain is one of the most serious environmental problems emerged due to air pollution.

The problems of acid rain are result from the washout of oxides of sulfur nitrogen and other constituents present in the atmosphere. Main source of these oxides coal fined power station motor vehicle exhausts. Power station factories and cars all burns fuels and therefore they all produce polluting gases. Some of these gases (especially Nitrogen Oxides and sulfur dioxides) react with the tiny droplets of water in clouds to from sulfuric and nitric acids. Atmospheric acid deposition in form of rain, fog or snow was indentified as major environmental problems in all over world and many countries are now taking steps to reduce the amount of sulphur and Nitrogen emissions. Government also needs to spend more money on pollution Control.

**Keywords:** Acid Rain, Environmental Problems, Pollutants, Power Station

**Introduction**

Human beings have used various natural resources for their benefit. To Make Their life easier, they have produced facilities that use money of the earth energy resources. Energy is mainly produced by burning fuels such as coal and natural gases. One side this kind at development makes our life easier but on other hand it results in to pollution by release of harmful substance in to environment. Burning of fossils, fuels in industries and transport sector industrialization and urbanization have led to in concentration of gaseous and particulate pollutants in the atmospheric leading to air pollution. Acid Rain is one of the most serious environmental problems emerged due to other pollution.

The Problems of Acid Rain is widely believed to result from the washout of oxides of sulfur nitrogen and other constituents present in the atmospheric. These oxides may react with other chemical and produce corrosive substance that are washed out either in wet or dry from by rain as acid depositions or snow was indentified as major environmental problems for the various countries.

**How acidic is acid rain?**

Acidity is measured using a scale called the pH scale. This scale goes from 0 to 14. 0 is the most acidic and 14 is the most alkaline (opposite of acidic). Something with a pH value of 7, we call neutral, this means that it is neither acidic nor alkaline. Very strong acids will burn if they touch our skin and can even destroy metals. Acid rain is much, much weaker than this, never acidic enough to burn our skin. Rain is always slightly acidic because it mixes with naturally occurring oxides in the air. Unpolluted rain would have a pH value of between 5 and 6. When the air becomes more polluted with nitrogen oxides and sulphur dioxide the acidity can increase to a pH value of 4. Some rain has even been recorded as being pH2.

**Causes of Acidification**

Sulphur dioxide (SO2) and oxides of nitrogen and ozone to some extent are the primary causes of acid rain. These pollutants originate from human activities such as combustion of burnable waste, fossil fuels in thermal power plants and automobiles. These constituents interact with reactants present in the atmosphere and result into acid deposition. The natural sources of sulphur pollutants are oceans and to much smaller extent from volcanic eruptions. The man-made sources of SO2 emissions are the burning of coal and petroleum and various industrial processes. Other sources include the smelting of iron and other metallic (Zn and Cu) ores, manufacture of sulphuric acids, and the operation of acid concentrators in the petroleum industry. The levels of NOx are small in comparison to $SO_2$, but its contribution in the production of acid rain is increasing. Main natural sources of NOx include lightening, volcanic eruptions and biological processes (especially microbial activity). Man-made sources are power stations, vehicle exhausts and industrial emission. The degree of acidity is measured by pH value; it is shorthand version of potential hydrogen. The pH of normal rainwater is also acidic; the reason is that water reacts to a slight extent with atmospheric carbon dioxide ($CO_2$) to produce carbonic acid. Small amount of nitric acid is also responsible for the acidity of normal rainwater, which is produced by the oxidation of nitrogen in presence of water during lightening storms. Rain that presents a concentration of H+ ion greater than 2.5 Ieq-1 and pH value is less than 5.6 is considered acid.

**Chemical Reactions during Acid Rain Formation**

The chemical reaction that results in the formation of acid rain involves the interaction of SO2, NOx and O3. When the pollutants are vented into the atmosphere by tall smoke stakes, molecules of SO2 and NOx are caught up in the prevailing winds, where they interact in the presence of sunlight with vapours to form sulphuric acid and nitric acid mists. These acids remain in vapour state under the prevalent high temperature conditions. When the temperature falls, condensation takes the form of aerosol droplets, which owing to the presence of unburnt carbon particles will be black, acidic and carbonaceous in nature. This matter is called “acid smut”. The presence of oxidizing agents and the characteristics of the reaction affects the rate of acid generation.

**Acid reactions involving $O_3$**

O3 ---------- O2 + O
O+H2O ---------- OH• (hydroxy radical)
OH•+SO2 ---------- HSO3
HSO3 - + OH• ---------- H2SO4
OH+NO2 ---------- HNO3
HSO3 + O2 ---------- SO3 2-+ HO•2 (peroxy radical)

Peroxy radicals react with formaldehyde, acetaldehyde and form formic and acetic acids and some other organic acids, contributing to 5-20% acidity in total acid rain load.

**Acid reactions involving sulphur**

Coal is especially rich in sulphur. As coal is burned, its component get oxidized

S + O2 ---------- SO2

The oxidation of sulphur to SO2 occurs directly in the flame; therefore SO2 is discharged to the atmosphere from the smoke stacks. As SO2 is swept along by the prevailing wind, it is slowly oxidized at ordinary temperature to $SO3^{2-}$

2 SO2 + O2 ---------- 2 $SO3^{2-}$
$SO3^{2-}$ + H2O ---------- H2SO4
SO2 + H2O ---------- H2 SO3
H+ HSO3-
HSO3- + O3 ---------- $SO4^{2-}$ + H+ + O2

Oxidant property of atmosphere plays an important role in conversion of $SO_3$ 2- to $SO_4$. Sulphur dioxide oxidation is most common in clouds and especially in heavily polluted air where compounds such as ammonia and O3 are in abundance. These catalysts help to convert more SO2 into sulphuric acid.

H2 O2 + HSO3 ---------- HSO4- + H2O

**Acid reactions involving Nitrogen**

N2 + O2 ---------- 2NO
2NO + O2 ---------- 2NO2
4NO2 + O2 + 2H2O---------- 4HNO3
O3 + NO2 ---------- NO3 + O2
NO3 + NO2 ---------- N2O5
N2O5 + H2O ---------- 2 HNO3

**Effects of acid rain on Soil**

Soil is one of the most important ecological factors. Every plant depends on it for their nutrient and water supply. Soil system is very complex and dynamic. Acid rain results into acidification of soil, which increases the exchange between hydrogen ion and nutrient cations like potassium (K), magnesium (Mg) and calcium (Ca) in the soil. These cations are liberated into soil and can be rapidly leached out i4n soil solution along with sulphate from acid input. Acid induced leaching leads to nutrient deficiency in the affected soils, and this loss of soil fertility results into decrease in the growth of plants including trees on acidified soil. Nutrient cycling and decomposition rate is also negatively affected by acidification of soil.

**Effects of acid rains on Lakes and Rivers**

It is in aquatic habitats that the effects of acid rain are most obvious. Acid rain runs off the land and ends up in streams, lakes and marshes - the rain also falls directly on these areas. As the acidity of a lake increases, the water becomes clearer and the numbers of fish and other water animals decline. Some species of plant and animal are better able to survive in acidic water than others. Freshwater shrimps, snails, mussels are the most quickly affected by acidification followed by fish such as minnows, salmon and roach. The roe and fry (eggs and young) of the fish are the worst affected, the acidity of the water can cause deformity in young fish and can prevent eggs from hatching properly.

The acidity of the water does not just affect species directly; it also causes toxic substances like aluminium to be released into the water from the soil, harming fish and other aquatic animals.

**Effects of acid rain on materials and buildings**

The impact of acid deposition on stone monuments made of marble and limestone and on building materials containing large amounts of carbonate have been recognized for over a century and many studies have addressed the effect of acid wet deposition on stone materials of historic buildings and monuments. High buildings made of concrete in urban areas have damaged due to exposure to cloud water with high acidity for a long time. Acid precipitations with pH level ranging between 3.0 and 5.0 have affected the cement and concrete. Acid rain causes chemical deterioration on carbonate stones and formation of soluble Ca2+, HCO3 - , SO4 2-. Dry deposition of SOx and NOx on the surfaces of stones contributes to salt enrichment on carbonate stones and plays a major role in the deposition of acid substances on buildings.

Power stations around Agra and oil refinery at Mathura have brought many problems to the Taj mahal. Delhi Red fort and Jama Masjid are also showing signs of damage from sulphur pollution.

**Effects of Acid Rain on Human Beings**

Acid rain is the invisible form of pollution, but has some indirect effects on human health. Indirect effects involve damage to humans by contact with materials that have themselves been affected by acidification like food and water supplies. SO2 causes more adverse impact to human health in gas and aerosol forms. Concentrations above 1.6 ppm breathing becomes detectable more difficult and eye irritation increases SO2 is much more toxic and damaging when combined with aerosols, and mists, and suspended smoke because these mixture of chemicals form finer suspensions that penetrate the lungs further than the gas alone. In Tokyo the polluted drizzle droplets were resulted into eye and skin irritations. Indirect effect of acid rain on human health involves toxic heavy metals because these are liberated from soil when soil gets acidified.

**Effects of acid rain on Plants**

Acid rain does not usually kill trees directly. Instead, it is more likely to weaken the trees by damaging their leaves, limiting the nutrients available to them, or poisoning them with toxic substances slowly released from the soil. The main atmospheric pollutants that affect trees are nitrates and sulphates. Forest decline is often the first sign that trees are in trouble due to air pollution. Scientists believe that acidic water dissolves the nutrients and helpful minerals in the soil and then washes them away before the trees and other plants can use them to grow. At the same time, the acid rain causes the release of toxic substances such as aluminium into the soil. These are very harmful to trees and plants.

**Aim of Study**

We all know very well that there are many problems arises due to environmental pollutants, so this paper is useful to aware the people about environmental pollution and to solve the problems which are related to environment.

**Conclusion**

The most important solution for acid rain problem is reduction of So2 and NO2 emissions. Oxides of nitrogen can also be reduced through reduction or better control of combustion temperature.

1. Acid Rain has deleterious effects of eco system which includes decline in growth of trees as well as other plants including crops reduction in aquatic flora and fauna. Marble, limestone and sand stone can be easily destroyed by acid rain. Acid rain can also directly or identify affects the human health. Soil fertility is affected by acid rain.
2. Acid rain problem has been tackled to some external in the developed world by reducing the emission of the gases causing acid rain.
3. Burning fossils fuels is still one of the cheapest ways to produce electricity so people are now researching new ways to burn fuel which do not produce so much pollution.
4. Walking, cycling and sharing cars all reduce the pollution from Vehicles.
5. Greater subsidies of public transport by the government to encourage people to use public transport rather than always travelling by car.
6. Lakes and rivers can have powdered limestone added to them to neutralize. this is called liming. Liming eliminates some of the symptoms of acidification.

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