Acid Rain

Acid rain is precipitation that has unusually high levels of hydrogen ions (low pH). The water droplets are acidic because of atmospheric pollution. It is known to have harmful effects on aquatic animals, plants and infrastructure. The term “acid rain” was coined in 1872 by Robert Angus Smith.

Acid rain is an important topic for the UPSC exam environment and ecology segments. In this article, you can read all about acid rain, its causes, effects and a previous year UPSC question on acid rain.

What Causes Acid Rain?

Acid rain is the rain that has been acidified, with a pH less than 5.6.

- Excessive amounts of sulfur and nitrogen released by cars and industrial processes get mixed with rain and result in precipitation that is highly acidic.
- These pollutants react with water vapours present in the atmosphere to form sulfuric acid and nitric acid respectively.
- Sulfur and Nitrogen particles may be released in the atmosphere due to anthropogenic causes or by natural causes.
    - Anthropogenic causes include industrial emissions, burning of fossil fuels such as diesel and coal, incineration of garbage, production of paper.
    - Natural causes could be release of sulfur during volcanic eruptions or nitrogen ions released in the atmosphere during a lightning strike. The chemical reaction occurs in the presence of lightning to form the nitric oxide. This further reacts with oxygen to form nitrogen dioxide.
- Furthermore, ozone, some other organic acids like formic and acetic acids also contribute to 5-20% acidity in total acid rain.

Effects of Acid Rain

In this section, we talk about the impact of acid rain on the environment as well as infrastructure.

- Acid rains damage standing crops and forests.
- It has adverse impact on freshwater life, other aquatic life forms, insects etc.
- Acid rain can cause the ocean’s pH to fall. This phenomenon is known as ‘ocean acidification’. Though acid rain does not have huge impacts on oceans, they significantly affect shallower coastal waters.
- Excess nitrogen inputs from the atmosphere in the oceans promote increased growth of marine plants and phytoplankton which may result in more frequent harmful algal blooms and eutrophication.
- Limestone skeleton in Corals is sensitive to decrease in pH levels, as calcium carbonate – the core component of the limestone skeleton – dissolves in low pH/acidic solutions.
- Some microbes in the soil cannot tolerate changes to low pH and get killed. The enzymes of these microbes are denatured by the acid.

- It corrodes structures as well as buildings. Example: Acid rains have turned the Taj Mahal's marble yellow.
- Acid rain also causes the corrosion of water pipes which further results in leaching of heavy metals such as iron, lead and copper into drinking water.
- Acid rain does not harm humans immediately. The sulfur dioxide creates various health problems. It can cause lung inflammation including asthma, bronchitis and emphysema.

Controlling the anthropogenic causes of acid rain by keeping a check on industrial and vehicular emissions is one of the most significant steps in reducing acid rains. Policy interventions to reduce such emissions is the need of the hour. Additionally, renewable sources of energy through fewer emissions can help reduce acid rain.

Previous Year Question on Acid Rain [UPSC 2011]

Acid rain is caused by the pollution of the environment by:

a. Carbon dioxide and nitrogen
b. Carbon monoxide and carbon dioxide
c. Ozone and carbon dioxide
d. Nitrous oxide and Sulphur dioxide

Answer: - d