Research Paper CHEMISTRY

Impact of Acid Rain on Human Health

AMIT PARIHAR | PG IN CHEMISTRY FROM BARKATULLA UNIVERSITY

ABSTRACT

Acid rain is mainly a mixture of sulphuric and nitric acids depending upon the relative quantities of oxides of sulphur and nitrogen emissions. Its basic components includes mainly SO2, NOx, VOC's. As these gases interact with the atmosphere to form fine sulfate and nitrate particles that are transported long distances by winds and inhaled deep into people's lungs thus creating various chronic as well as acute diseases among the health of the human being.

KEYWORDS Acid rain and human health

Acid rain is a broad term used to describe several ways that acids fall out of the atmosphere. A more precise term is acid deposition, which has two parts: wet and dry. Wet deposition refers to acidic rain, fog, and snow. As this acidic water flows over and through the ground, it affects a variety of plants and animals. The strength of the effects depend on many factors, including how acidic the water is, the chemistry and buffering capacity of the soils involved, and the types of fish, trees, and other living things that rely on the water. Dry deposition refers to acidic gases and particles. About half of the acidity in the atmosphere falls back to Earth through dry deposition. The wind blows these acidic particles and gases onto buildings, cars, homes, and trees. Dry deposited gases and particles can also be washed from trees and other surfaces by rainstorms. When that happens, the runoff water adds those acids to the acid rain, making the combination more acidic than the falling rain alone. Acid rain is measured using a scale called pH. The lower a substance's pH, the more acidic it is. Pure water has a pH of 7.0, which is neutral. Normal rain is slightly acidic because carbon dioxide dissolves into it, so it has a pH of about 5.5. In the year 2000, the most acidic rain falling in North America had a pH of about 4.3.

Components of acid rain

The basic components of acid rain are SO_2 NO_x, VOC's (volatile organic compounds) and several others. Most of the sulphur present in the atmosphere of the Northern Hemisphere is from anthropogenic sources. Coal and lignite power stations contribute to a large amount of this pollution. The United States emits almost 20 million tons of sulfur dioxide every year, with three-quarters coming from the burning of fossil fuels by electric utilities.[1]

Coal burned in most parts of the world is high in sulphur. Transportation, residential combustion, smelters and other industrial processes are the other man-made contributions to SO_2 emissions. During smelting, ores containing sulphur are roasted at high temperatures and the sulphur is driven off as SO_2. Natural resources such as volcanoes and marsh gases contribute to a small percentage of this concentration through gases such as hydrogen sulphide and dimethyl sulphide which are produced by the action of soil bacteria on rotting vegetation and on inorganic sulphate. When they enter the air, these sulphur compounds are rapidly oxidized to acid sulphate. Virtually all the sulphur deposited in precipitation is in the form of acid sulphate. Typically, less than 5% of the sulphur is dissolved SO_2, and this remnant is rapidly oxidized to acid after falling to earth.

Sources of acid rain

There are several natural sources of NO_x. These come from denitrification of the soil. 78% of the atmosphere is made up of nitrogen and 80% of this is from anthropogenic sources. Therefore, the other factor that affects the formation of NO_x is temperature. Other pollutants include particulates, hydrocarbons and carbon monoxide. Trifluoroacetic acid is an atmospheric breakdown product of the chlorofluorocarbon replacements HCFC-123, HCFC-124, and HFC-134a.

Impact on health

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. Acid rain looks, feels, and tastes just like clean rain. The harm to people from acid rain is not direct. Walking in acid rain, or even swimming in an acid lake, is no more dangerous than walking or swimming in clean water. However, the pollutants that cause acid rain sulfur dioxide (SO2) and nitrogen oxides (NOx) do damage human health. These gases interact in the atmosphere to form fine sulfate and nitrate particles that can be transported long distances by winds and inhaled deep into people's lungs. Fine particles can also penetrate indoors. Many scientific studies have identified a relationship between elevated levels of fine particles and increased illness and premature death from heart and lung disorders, such as asthma and bronchitis. Decreases in NOx emissions are also expected to have a beneficial impact on human health by reducing the nitrogen oxides available to react with volatile organic compounds and form ozone. Ozone impacts on human health include a number of morbidity and mortality risks associated with lung inflammation, including asthma and emphysema (Dubey 2013). 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 (Singh and Agarwal 2008).

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