"Normal" rainfall is slightly acidic because of the presence of dissolved carbonic acid. Carbonic acid is the same as that found in soda pop.

**Introduction**

The pH of "normal" rain has traditionally been given a value of 5.6. However scientists now believe that the pH of rain may vary from 5.6 to a low of 4.5 with the average value of 5.0. Acid rain or acid snow is a direct result of the method that the atmosphere cleans itself. The tiny droplets of water that make up clouds, continuously capture suspended solid particles and gases in the atmosphere. The gases of sulfur oxides and nitrogen oxides are chemically converted into sulfurous and nitric acids. The non-metal oxide gases react with water to produce acids (ammonia produces a base).

\[
\text{SO}_2 + \text{HOH} \rightarrow \text{H}_2\text{SO}_3 \tag{1}
\]

\[
2 \text{NO}_2 + \text{HOH} \rightarrow \text{HNO}_2 + \text{HNO}_3 \tag{2}
\]

When enough of the tiny cloud droplets clump together to form a larger water drop it may fall to the earth as "wet" acid precipitation including rain, snow, ice, sleet, or fog. See [*Acids and Bases*](#) for more details.

**Formation**

The sulfuric and nitric acids formed from gaseous pollutants can easily make their way into the tiny cloud water droplets. These sulfuric acid droplets are one component of the [*summertime haze*](#) in the eastern United States. Some sulfuric acid is formed directly in the water droplets from the reaction of sulfur dioxide and hydrogen peroxide. Some of these sulfuric acid particles drop to the earth as "dry" acid deposition. The tiny water droplets containing sulfuric acid provide a ready surface to attract more molecules of water to form a larger droplet of dilute sulfuric acid.
Water droplets collected from the base of clouds in the Eastern U.S. during the summer have an average pH of 3.6, with some values as low as pH 2.6. The pH in the upper portion of a cloud is much higher. The final rain droplet has an average pH of 4.2 in the Northeast U.S. In Los Angeles, the pH of fog has been measured at 2.0 - about the acidity of lemon juice.

**Contrary View**

The benchmark of "natural rain" is 5.6. Acid precipitation in the range of 4.2-5.0 has been recorded in most of the Eastern United States and Canada. EPRI (Electric Power Research Institute) likes to compare these values to familiar objects to give the impression that these pH values are not harmful. Examples: Carrots = 5.0, Bananas = 4.6, Tomatoes = 4.2, Apples and soft drinks = 3.0, Lemon juice = 2.0. EPRI also contends that pH 5.6 may or may not be a valid reference point. It should not be considered the "background" or "natural" acidity of precipitation.

Even without man-made influences, there are natural sources of sulfur oxides, nitrogen oxides, and other species important to determining the precipitation acidity at any given time. Hence, trying to quantify man's contribution to the natural condition will never be possible, since the "natural background" condition cannot be known.

In the forest areas of Brazil at the headlands of the Amazon River, an area remote from civilization, the monthly average of 100 rain events in the 1960s ranged from pH 4.3 to pH 5.2, with the median value of pH 4.6 and one reading as low as pH 3.6. On the island of Hawaii, remote from all industrial activity, the weighted average of precipitation over a 4 year
period was pH 5.3, with a minimum value of pH 3.8.

Outside Links

- www.epa.gov/acidrain/what/index.html

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