Journal of Pollution and effects and control

OPEN ACCESS Freely available online

Perspective

Causes of Acid Rain and its Environmental Impact

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DESCRIPTION

Acid precursors and nitrogen oxides as well as nutrients are examples of anthropogenic emissions (especially nitrogen). The acids formed from the acid precursors can release nutrients such as Ca, Mg, and K from the solid phases into the solution *via* reactions with dust particles (e.g. soil dust). The reaction can occur in the air or with particles deposited on plant surfaces. Because of the emission of acid precursors, this implies an increase in the input of dissolved nutrient cations into ecosystems. The effects of acidity and nutrient input and output of fluxes in the forest canopy, the ecosystem as a whole, and the soil provide insight into which ecosystem processes are affected. Based on our prior knowledge we can then conclude how the processes are affected. Proton and acid-base budgets are the instruments. The macronutrients are an essential component of these budgets because they can exist as bases (K^+, Mg^{2+}, and Ca^{2+}) or acids (NO_3 SO_4, and PO_4). Some cations (NH^{4+}, Al^{3+}, Fe and Mn ions, and trace metals) can react as bases, while others can react as acids. Only major ions that contribute significantly to the cation-anion budget are considered. The effects of transboundary transport of acidifying pollutants from increased fossil fuel combustion. A large number of lakes and streams in Scandinavia showed a significant change in pH, and rain was found to be significantly more abundant across much in world. In addition to other causes such as drought and frost, forest degradation has been linked to exposure to added substances and associated changes in soils. Because of national and international concerns, scientific research was established to investigate the causes of the observed changes and how they could be controlled and reversed. This included, in particular, the OECD-initiated Cooperative Programme for Monitoring and Evaluation of Long-Range Transboundary Air Pollution (EMEP), which is now an important part of the overall structure under the United Nations Economic Commission for Europe (UN/ECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP).

Initially, sulphur dioxide (SO_2) was emphasised as the main pollutant causing damage, but later, the significant contribution of nitrogen species, including both oxides of nitrogen (NO) generated by the transportation sector and stationary sources of combustion, and reduced nitrogen (NH_3), primarily from agriculture, was recognised to simulate the transport of SO_2 and other acidic species as well as the contributions of different countries to the overall pattern of deposition. Simultaneously, a monitoring program with several 'EMEP stations' taking comparable measurements of the concentrations of the same range of species in air and precipitation was established. The First Sulphur Protocol was established in response to the clear trends in acidification and growing concern about the effects on fish and forests. This was the so-called "30% club," in which signatory countries agreed to reduce their SO_2 emissions by 30% levels by the end. A second protocol was established to stabilize NOx emissions, which were also steadily increasing, particularly with the growth of road transport. These measures, however, were insufficient to combat rising acidification in sensitive areas. Additional measures were required, and the UN/ECE began the process of developing new international agreements to reduce acidification. Scientific questions arise regarding how to avoid further acidification low deposition of acidifying species was required. Furthermore, because some areas are more sensitive than others and suffer from acidification far more severely, it was critical to place a greater emphasis on reducing emissions that resulted in a deposition in these areas. It was clear that a further uniform reduction in emissions across all countries would not be the most effective strategy for the next sulfur emissions protocol to replace the 30-percent club, but that it would be important to reduce emissions more in some countries than in others.

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Received: 02-Sep-2022, Manuscript No. JPE-22-19838; **Editor assigned:** 06- Sep-2022, PreQC No. JPE-22-19838 (PQ); **Reviewed:** 20-Sep-2022, QC No. JPE-22-19838; **Revised:** 27-Sep-2022, Manuscript No. JPE-22-19838; **Published:** 04-Oct -2022, DOI: 10.35248/2375-4397.22.10.348.

Citation: Safar Y (2022) Causes of Acid Rain and its Environmental Impact. J Pollut Eff Cont.10:348