SO_2-NH_3-PARTICULATE MATTER-H_2O REACTION SYSTEM AS RELATED TO THE RAINFALL ACIDITY

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ABSTRACT

Acidity of rain water is a major concern due to the progressive acidification of soils, its effect of flora and fauna and its corrosiveness to metals. Sulfur dioxide, through chemical transformations and atmospheric scavenging, is thought to be one of the major contributors to the acidity of rainwater. The straightforward oxidation of SO_2 to $SO_4^=$ in the presence of ammonia and metal oxides should lead to a resulting pH higher than what is usually encountered and also to much faster disappearance of SO_2 during rain. These apparently contradictory conclusions may be reconciled by a more complete analysis of the reaction system.

This paper discusses a recent experimental study of the kinetics of a reaction system containing micromolar quantities of SO_2, NH_3 and particulate matter in the presence of a relatively large amount of water. The results indicate that the rain water acidity through atmospheric scavenging must account for the formation of very strong acids, such as dithionate ion as well as sulfate and bisulfate ions, in a very complex reaction system, if the observed mean pH values of 4 to 5 are to be theoretically justified. Some field measurements downwind from a major power plant are also reported to relate the laboratory measurements to the field measurements.