

Formation of nitrate in aqueous aerosol microdroplets exposed to gaseous NO₂

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The generation of nitrate in aqueous microdroplets over the pH range from 3 to 12 traversing dilute NO₂ gas plumes has been studied via online electrospray mass spectrometry within ~ 1 ms time frame. Most studies have reported that absorption of NO₂ into the aqueous phase in the form of aerosols in the atmosphere and their subsequent oxidation are not significant under typical atmospheric conditions. The major reasons for this are that NO₂ are not highly soluble and, in addition, the reactions of NO₂ hydrolysis leading to the formation of nitrate and nitrite are kinetically rather slow due to the dependence of rates on the square of the reactant concentration. In our experiment, when aqueous microdroplets with different pH value were exposed to gaseous NO₂, an interesting phenomena was observed that nitrate was formed in the case of the high (11 and 12) and low (3) pH microdroplets. In the presence of bisulfate in aqueous microdroplets, nitrate was formed even in neutral media. The relative efficiencies of chloride, bromide and iodide in acid media for the formation of nitrate were also studied.