



Iron Catalysis of SO₂ Oxidation in Cloud Droplets

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What can happen to solution of a sulfite saturated by oxygen if a small amount of Fe(III/II) is introduced? The normally slow autoxidation is specifically accelerated by these ions. That is why iron-catalyzed oxidation of sulfite is of great interest for atmospheric chemistry. In general, the kinetics of the reaction is characterized by bad a reproducibility. The reaction orders vary unpredictably between zero – second order both in sulfite and in iron. None of the data support the half-order dependence on iron ion concentration expected for radical-radical recombination. All these “anomalies” receive a naturally explanation assuming a conjugation between the branching reaction, $\text{HSO}_5^- + \text{Fe}^{2+} \rightarrow \text{FeOH}^{2+} + \text{SO}_4^-$ and those producing HSO_5^- in the chain-carriers cycles $\text{SO}_5^- + \text{HSO}_3^-/\text{SO}_3^{2-}$ and the metal cycle $\text{SO}_5^- + \text{Fe}_{aq}^{2+}$. Being coupled these steps are able to accelerate or to slow down significantly the production of chain-carriers at certain concentration conditions or exposures to any additives. Perhaps most importantly is also that the radical-radical recombination $\text{SO}_5^- + \text{SO}_5^-$ represents a gross but not a net loss of the chain-carriers, because nearly all of them are reformed through the branching step $\text{HSO}_5^- + \text{Fe(II)} \rightarrow \text{FeOH}^{2+} + \text{H}_2\text{O} + \text{SO}_4^-$ and $\text{SO}_4^- + \text{HSO}_3^- + \text{O}_2 \rightarrow \text{SO}_5^-$. In the report the result of the modeling of the gas-phase/aqueous-phase reactions of SO₂ removal from the gas are given.

This work was supported by Russian Fund of Basic Research (## 08-05-00818- [U+FFFD] 9-05-00270- [U+FFFD] nd by the Presidium of the Russian Academy of Sciences through program no. 4, "Changes in the Environment and Climate—Natural Disasters." which are gratefully acknowledgement