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Light induced conversion of nitrogen dioxide into nitrous acid on submicron humic acid aerosol

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Abstract. The interactions of aerosols consisting of humic acids with gaseous nitrogen dioxide (NO_2) were investigated under different light conditions in aerosol flow tube experiments at ambient pressure and temperature. The results show that NO_2 is converted on the humic acid aerosol into nitrous acid (HONO), which is released from the aerosol and can be detected in the gas phase at the reactor exit. The formation of HONO on the humic acid aerosol is strongly activated by light: In the dark, the HONO-formation was below the detection limit, but it was increasing with the intensity of the irradiation with visible light. Under simulated atmospheric conditions with respect to the actinic flux, relative humidity and NO_2-concentration, reactive uptake coefficients γ_{rxn} for the $NO_2 \rightarrow$HONO conversion on the aerosol between $\gamma_{rxn} < 10^{-7}$ (in the dark) and $\gamma_{rxn} = 6 \times 10^{-6}$ were observed. The observed uptake coefficients decreased with increasing NO_2-concentration in the range from 2.7 to 280 ppb and were dependent on the relative humidity (RH) with slightly reduced values at low humidity (<20% RH) and high humidity (>60% RH). The measured uptake coefficients for the $NO_2 \rightarrow$HONO conversion are too low to explain the HONO-formation rates observed near the ground in rural and urban environments by the conversion of $NO_2 \rightarrow$HONO on organic aerosol surfaces, even if one would assume that all aerosols consist of humic acid only. It is concluded that the processes leading to HONO formation on the Earth surface will have a much larger impact on the HONO-formation in the lowermost layer of the troposphere than humic materials potentially occurring in airborne particles.

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