RECENT RESEARCH ACTIVITIES

Dry Deposition and Oligomerization of Gaseous Isoprene on Atmospheric Water's Surfaces

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It is estimated that ~0.6 petagrams (10^{15} g) of gaseous isoprene (ISO, 2-methyl 1,3-butadiene) are emitted by the biosphere annually, representing half of volatile organic compound (VOC) emissions. In spite of the magnitude of the number and the anticipated response to global climate change, it is unclear how and how much it is converted to atmospheric aerosols. Current atmospheric chemistry models predict that ISO emissions atop forest canopies would deplete the oxidizing capacity of the overhead atmosphere, at variance with field observations. Here we address this key issue in novel laboratory experiments where we apply electrospray mass spectrometry [1-3] to detect online the products of the reactive uptake of gaseous ISO on the surface of water jets. We found that ISO is already protonated to $ISOH^+$ and undergoes cationic oligomerization to $(ISO)_2H^+$ and $(ISO)_3H^+$ on the surface of pH < 4 water jets. We estimate uptake coefficients, $\gamma_{ISO} = (0.5 – 2.0) \times 10^{-6}$ on pH = 3 water, which translate into the significant reuptake of leaf-level ISO emissions in typical (surface-to-volume ~5 m^{-1}) forests during realistic (a few minutes) in-canopy residence times (Fig. 1). Our findings also account for the rapid decay of ISO in forests after sunset and help bring the global budget of VOC closer to balance [4].

References

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[4] Enami, S., *et al.*, "Protonation and oligomerization of isoprene on weakly acidic water – Implications for atmospheric chemistry" *J. Phys. Chem. A*, *116*, 6027-6032, **2012**.

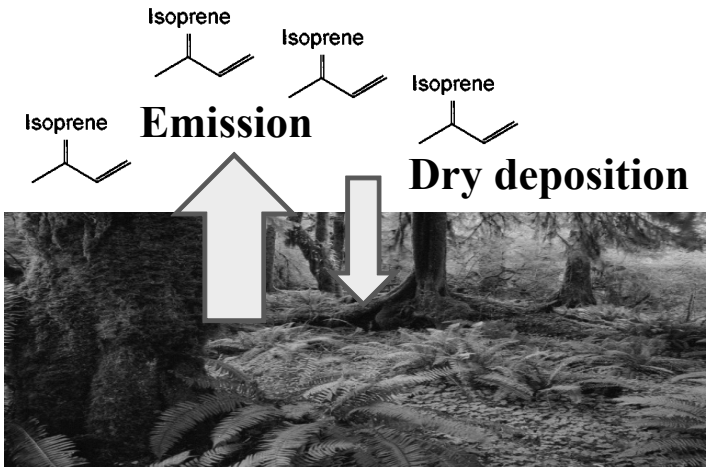

Figure 1. Schematic diagram of the emission and dry deposition of isoprene in the biosphere.