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Relationships between Carbonyl Sulfide (COS) and CO_2 during leaf gas exchange

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Partitioning net CO_2 fluxes between plants and the atmosphere are important to understand plants and ecosystem response to climate changes. COS was recently proposed as a potential tracer of gross CO_2 uptake by terrestrial vegetation. This is based in part on the assumption of COS uptake by leaves associated with photosynthesis in leaves. Yet, detail quantitative information at the physiological scale, needed for accurately modeling and predicting COS uptake by leaves, is still missing.

We carried out controlled leaf-scale gas exchange measurements of COS and CO_2 exchange in C3 plants *(Salvia officinalis; Capsicum annuum; Rosa sinesis)* under a range of light intensities, CO_2 and COS concentrations, and after abscisic acid (ABA) treatments. Gas exchange experiments were performed using a dynamic leaf chamber and CO_2 and H_2O measurements of air entering and exiting the chamber using infra red gas analyzer. COS was measured on concentrated air samples taken from the inlet and outlet of the chamber using a GC-MS and automated cryogenic trap. The ratio of deposition velocities (Vd) of COS and CO_2 showed ranged between 0.50 to 2.86 during the light response curves, with uptake of both gases saturating at high light. A-Ci (CO_2 response) experiments showed different patterns for different species, with either increasing COS uptake with CO_2, or constant COS uptake. The COS/CO_2 Vd ratios had a narrow range of 1.2-2.3. Increasing COS concentrations had little effect on CO_2 assimilation rates, but COS uptake increased linearly in the COS range used (0.6 to 2.7 ppb). Vd increased for COS but not for CO_2 in these experiments. Our results show tightly linked leaf exchange of COS and CO_2 and indicate strong, but not

exclusive, stomatal control over both CO_2 and COS exchange.