Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 5, 2787-2796, 2005
www.atmos-chem-phys.net/5/2787/2005/

Atmospheric methanol measurement using selective catalytic methanol to formaldehyde conversion

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Abstract. A novel atmospheric methanol measurement technique, employing selective gas-phase catalytic conversion of methanol to formaldehyde followed by detection of the formaldehyde product, has been developed and tested. The effects of temperature, gas flow rate, gas composition, reactor-bed length, and reactor-bed composition on the methanol conversion efficiency of a molybdenum-rich, iron-molybdate catalyst [Mo-Fe-O] were studied. Best results were achieved using a 1:4 mixture (w/w) of the catalyst in quartz sand. Optimal methanol to formaldehyde conversion (>95% efficiency) occurred at a catalyst housing temperature of 345°C and an estimated sample-air/catalyst contact time of <0.2 seconds. Potential interferences arising from conversion of methane and a number of common volatile organic compounds (VOC) to formaldehyde were found to be negligible under most atmospheric conditions and catalyst housing temperatures. Using the new technique, atmospheric measurements of methanol were made at the University of Bremen campus from 1 to 15 July 2004. Methanol mixing ratios ranged from 1 to 5 ppb with distinct maxima at night. Formaldehyde mixing ratios, obtained in conjunction with methanol by periodically bypassing the catalytic converter, ranged from 0.2 to 1.6 ppb with maxima during midday. These results suggest that selective, catalytic methanol to formaldehyde conversion, coupled with existing formaldehyde measurement instrumentation, is an inexpensive and effective means for monitoring atmospheric methanol.

Final Revised Paper (PDF, 506 KB) Discussion Paper (ACPD)

Citation: Solomon, S. J., Custer, T., Schade, G., Soares Dias, A. P., and Burrows, J.: Atmospheric methanol measurement using selective catalytic methanol to formaldehyde conversion, Atmos. Chem. Phys., 5, 2787-2796, 2005. Bibtex EndNote Reference Manager