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Laboratory studies on the atmospheric photochemistry of acetone and methyl-ethyl-ketone

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Acetone and methyl-ethyl-ketone (MEK) basically affect the $HO_x$and NO_x chemistry of the atmosphere, in particular in the upper part of the troposphere (UT).

Quantum yields for the photodissociation of acetone and MEK have been determined in the gas phase by using 308 nm exciplex laser photolysis coupled with gas-chromatographic analysis. Following are the main results:

1. The temperature and pressure dependence of the quantum yield of acetone loss (QYA) has been measured between 233 and 323 K in 13–998 mbar synthetic air. QYA has been found to decrease with decreasing temperature, e. g., QYA is 0.37, 0.32, 0.23, 0.18 and 0.12 at 323, 298, 273, 253 and 233 K, respectively (P= 133 mbar). These results agree very well with those obtained very recently at the Leeds University by applying laser spectroscopic method. The temperature dependent quantum yields imply a significantly less important role of acetone photolysis in UT than thought before.

2. QYA has been found to decrease with pressure depending on the quenching efficiency of the buffer gases (He, Xe, air, and O_2). The pressure dependence is non-linear in Stern-Volmer plots, which indicate that reaction and quenching occur from at least two different excited states of the acetone molecule.

3. Photodissociation quantum yields of methyl-ethyl-ketone (QYM) have been determined in synthetic air at room temperature (T= 298 K). QYM has been found to be significantly larger than that of acetone showing also a pressure dependence, e. g., QYM (67 mbar air) $\approx$ 1 and QYM (1000 mbar air) $\approx$ 0.3.