**ABSTRACT**

In this work, experimental and theoretical rate coefficients were determined for the first time for the gas-phase reaction of 4-hydroxy-4-methyl-2-pentanone (4H4M2P) with OH radicals as a function of temperature. Experimental studies were carried out over the pressure range of 5–80 Torr and the temperature range of 280–365 K, by using a cryogenically cooled cell coupled to the pulsed laser photolysis-laser induced fluorescence (PLP–LIF) technique. A detailed oxidation mechanism of 4H4M2P with OH radicals was discussed theoretically under three hydrogen abstraction pathways by using density functional theory calculations and wave function based MP2 method. Single-point energy calculations were performed at CCSD(T) level of theory with 6–311++G(d,p) basis set. The H-atom abstraction from the -CH2 group was found to be the dominant channel. The reaction force analysis predicts that the abstraction process is mainly dominated by structural rearrangement. Linear kinetic behavior for all the pathways was found in the range of 278–365 K. An atmospheric lifetime less than 3 days was evaluated for 4H4M2P with respect to its reaction with OH, indicating that the reaction with OH of 4H4M2P may be competitive with losses via photolysis.