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Atmospheric chemistry of methylbutenol : ozone and acetone production in the troposphere

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Biogenic volatile organic compounds (BVOCs) account for around 90% of hydrocarbon emissions into the Earth's atmosphere ([1], [2]). Several thousand different BVOCs have been identified, the most well known being unsaturated hydrocarbons. However, over the last ten years an increasing number of oxygenated BVOCs, such as methylbutenol (MBO), have also been detected in field measurement campaigns and plant emission studies ([3], [4]).

In order to determine the environmental impact of BVOCs, a thorough knowledge of the rates and mechanisms for their atmospheric degradation is required.

Very few studies are available concerning the reactivity of MBO and almost none about one of its oxidation products, the 2-hydroxy-2-methylpropanal (HMPR). This study presents a complete overview of their diurnal reactivity, which means both a kinetic and a mechanistic approach of all their possible reactions in the troposphere (photolysis, reactions with OH radicals and with ozone). Experiments were carried in three European complementary simulation chambers : in LISA (Paris, France), in CRAC (Cork, Ireland) and in EUPHORE (Valencia, Spain) using FTIR spectroscopy, PFBHA derivatization with GC-MS detection and a particle sizer and counter.

The ozone production during the atmospheric oxidation processes of MBO have been studied and the speciation of its products have been obtained. Results of this study showed in particular that MBO degradation leads to acetone and to HMPR through two complementary pathways and that HMPR is completely converted into acetone. This implicates that the very abundant biogenic compound MBO is totally transformed into acetone in the troposphere.

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