Opposite Role of H_2SO_4 Formation Pathway on Secondary Organic Aerosol Formation Derived from Ethyl Ethacrylate Ozonolysis

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Stressed plants and polymer production can emit many unsaturated volatile organic esters (UVOEs). However, few studies attempt to explore secondary organic aerosol (SOA) formation of unsaturated esters under complex ambient conditions. In this study, we employed ethyl methacrylate (EM) as a UVOEs proxy to investigate SOA formation resulting from EM ozonolysis with or without seed particles in the presence of SO_2. Results showed that, in the absence of seed particles, a substantial increase in homogeneous formation of H_2SO_4 particles and enhanced acid-catalyzed oligomerization of carbonyl species promoted the increase of SOA with increasing SO_2. In contrast, increased particle acidity enhanced EM uptake and the chemical conversion of SOA but reduced SOA formation in the presence of seed particles. This was mainly ascribed to the fact that the ozonolysis of more adsorbed EM was hampered due to the formation of surface H_2SO_4 with increasing particle acidity. This study demonstrated that the opposite roles of SO_2 and seed particle addition on SOA formation and composition were closely related to the H_2SO_4 formation pathway. This research will not only help to advance our understanding of the complex chemical processes involved in UVOE-derived SOA but also of the complicated role of H_2SO_4 in SOA formation.

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