Formation of iodine oxide particles from the photooxidation of CH_3I in the presence of O_3, under the conditions of a major nuclear power plant accident

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The potential importance of iodine in tropospheric chemistry was suggested by Chameides and Davis (1) and there is now increasing evidence that chain processes involving reactive halogen radicals, namely I and IO radicals, play an important role in the formation of new particles (2). In addition to atmospheric interest, the reactivity of iodoalkanes, such as CH_3I, has recently gained increased health and safety interest in the nuclear industry in order to better understand chemical processes responsible for the formation of iodine oxides resulting from a major nuclear power plant accident type Fukushima. Among all of the possible released fission products, volatile iodine has the highest radiological health impact, *i.e.*, the isotope ^{131}I is known to bind to the thyroid gland. The quantity of volatile iodine containing compounds that would be released into the environment is, therefore, a major security and public health issue.
We have investigated the photooxidation of CH_3I using UV-C radiation in the presence of ozone and humidity at 30°C in a smog chamber, *i.e*; conditions that are representative of a major nuclear power plant accident in the containement building of the reactor. The size distributions and compositions of the particles were monitored with a SMPS, and a HR-ToF-AMS. The results show that important amounts of particles were formed as soon as CH_3I was injected into the chamber. The particles contained different forms of iodine oxides ($H_xI_yO_z$), and their time profiles were monitored. The influence of irradiation, concentrations of O_3, CH_3I and relative humidity were tested and are discussed. The evolution of the size and composition of the formed particles is of particular interest for the prediction of filtration efficiency in the case of a major nuclear power plant accident.

References

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(2) Saunder R.W. and Plane J.M.C., *Environ. Chem.*, **2005**, 2, 299-303.