Experimental study on the capture/desorption of gaseous methyl iodide on sea salt aerosols

Hanaa Houjeij[1,2], Anne-Cécile Gregoire[2], Gwenaelle Le Bourdon [1], Laurent Cantrel[2] and Sophie Sobanska[1]

[1]*Institut des Sciences Moléculaires, Université de Bordeaux, 33405, Talence, France*
[2]*Institut de Radioprotection et de Sûreté Nucléaire, PSN-RES, 13115, Saint Paul lés Durance cedex, France*

Iodine-131, when released into the environment during severe nuclear power plant accident can have a high radiological impact on the population at short term [1]. Interaction between gaseous Iodine compounds and aerosols was not considered by the current post-accident management. In this context, this work was focused on investigating the influence of sea salt aerosols on the transport of gaseous methyl iodide (CH_3I). The identification of uptake processes as well as the formation of new products at the particle surfaces was the main objectives.
We have studied the interaction between NaCl particles as surrogate of sea salt particles and CH_3I in various humidity conditions to reproduce the atmospheric conditions.

The nature of this interaction was investigated by Infrared Spectroscopy (DRIFTS, Diffuse Reflectance Infrared Fourier Spectroscopy). Solid NaCl was exposed to CH_3I (1000 and 500 ppm) with a relative humidity (RH) ranging between 0 and 80%.

DRIFTS results clearly evidenced adsorbed CH_3I on NaCl particles surface under both dry and humid conditions. The kinetic results exhibited very low uptake coefficients in the order of 10^{-14} in all the experimental conditions. The adsorption process follows three regimes that can be fitted with First-order Langmuir adsorption isotherm models.

Additionally, to the CH_3I absorption bands, the DRIFT spectrum evidenced typical absorption bands that could be assigned either to the CH_2 deformation of CH_2I_2 or to CH_3 degenerate rocking of CH_3Cl. The formation of new bands appears only when CH_3I is in presence of halogenated salts [2]. However, at RH=80%, the water layer at the particle surface inhibits the interaction between gaseous CH_3I and NaCl surface due to the low solubility of CH_3I in water.

Although the uptake coefficients of CH_3I are quite low, a coverage of particle surface with CH_3I-derived compounds may affect the reactivity of the particles and in term the cycling life of Iodine in the atmosphere.

Références :

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