

Table S1. Raman bands and band assignments.

Bands	Assignments
166 cm^{-1}	Hg_2Cl_2
185 cm^{-1}	O-H \cdots O stretching vibrations
206 cm^{-1}	hydrogen bond stretch
279 cm^{-1}	liberational (rotational) modes of H_2O
314 cm^{-1}	HgCl_2
380 cm^{-1}	HgCl_2
482 cm^{-1}	$\nu_4 (\text{ClO}_3^-)$
621 cm^{-1}	$\nu_2 (\text{ClO}_3^-)$
979 cm^{-1}	$\nu_1 (\text{ClO}_3^-)$
1023 cm^{-1}	$\nu_3 (\text{ClO}_3^-)$
1124 cm^{-1}	ClO_4^-
1550 cm^{-1}	O_2
1630 cm^{-1}	OH-bending vibrations
2330 cm^{-1}	N_2
2930 cm^{-1}	H_2O_2
2900-3600 cm^{-1}	OH-stretching mode

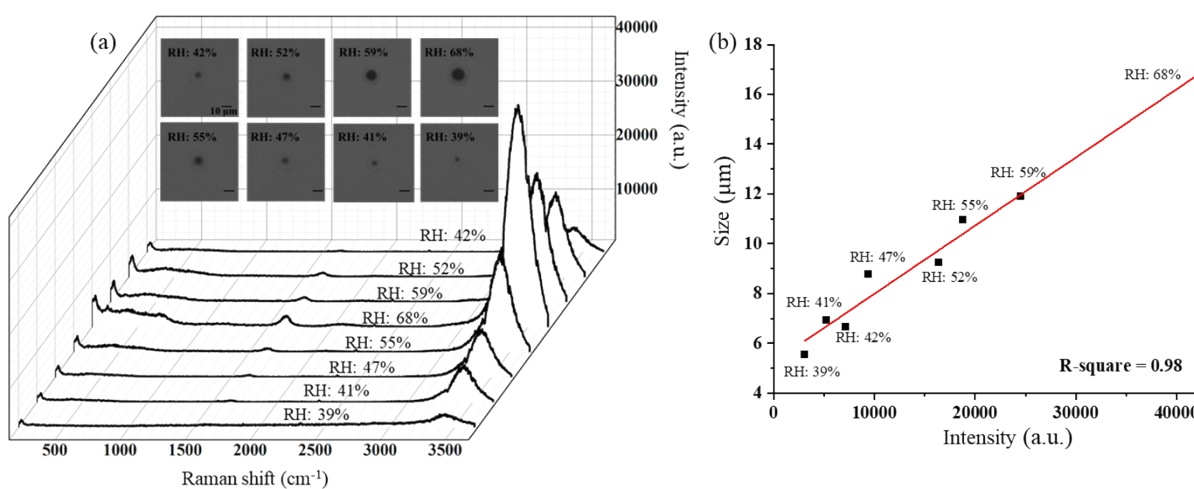


Figure S1. (a) Single-particle Raman spectra of the sea spray aerosol trapped in air under the RH of 39% - 68%. (b) A relationship between the intensity of the Raman band at 3430 cm^{-1} and the size of the trapped droplet.

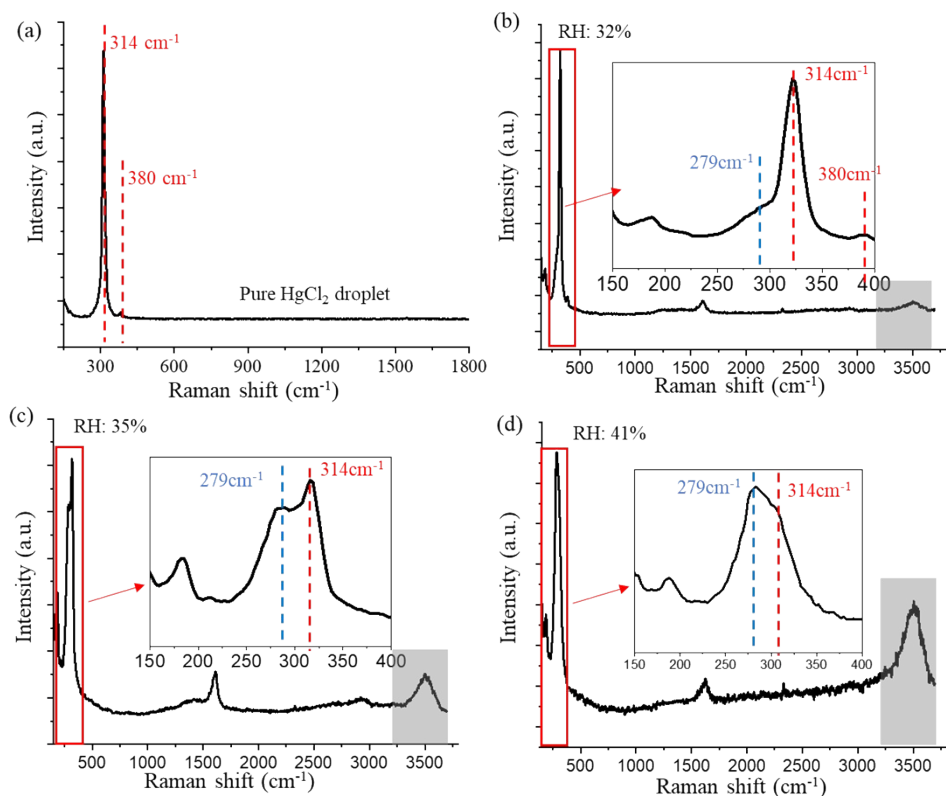


Figure S2. Single-particle Raman spectra of (a) pure HgCl_2 droplet; (b), (c), and (d) spectra of SSAs containing Hg(II) trapped in a dry environment under different RH. The inset figure shows the Raman spectra with high resolution in the region of $150 - 400\text{ cm}^{-1}$.

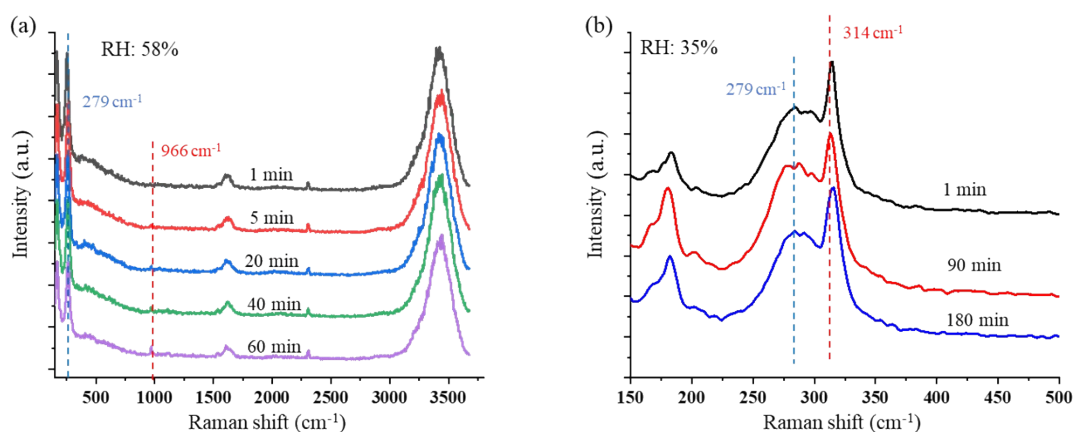


Figure S3. Raman band variations are shown by the time-resolved Raman spectra as a SSA particle exposed to O_3 of 1000 ppm (a) with RH of 58%, (b) with RH of 35%.

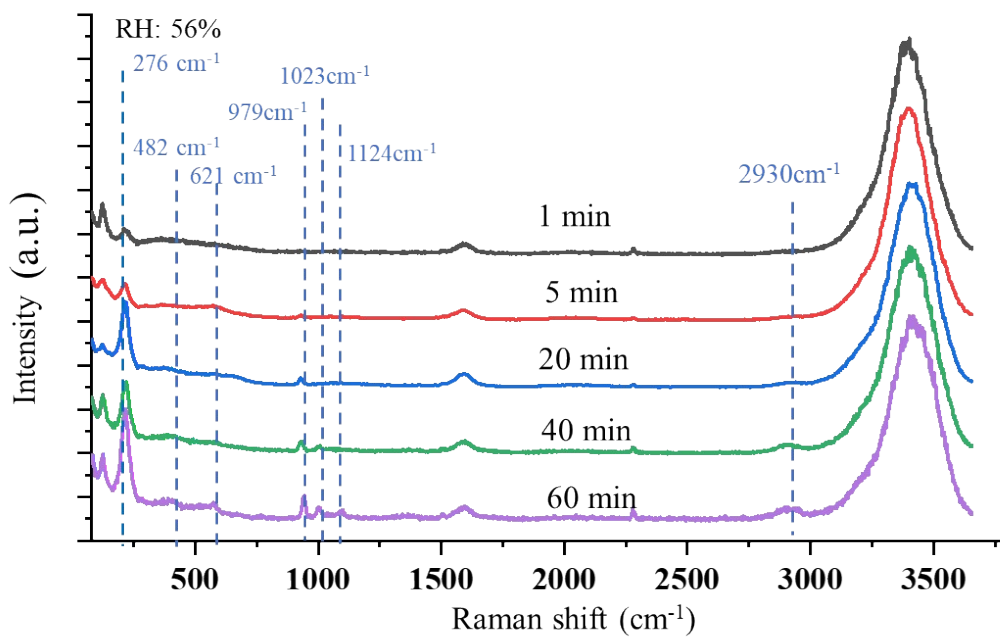


Figure S4. Raman band variation shown by the time-resolved Raman spectra indicates the formation of ClO_3^- and ClO_4^- as the SSA containing Hg(II) trapped under UVC radiation with RH of 56%.