

# **An individual particle perspective for the atmospheric Processing of Particulate Imidazole Compounds**

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As a potential fraction of brown carbon, particulate imidazole compounds may initiate photosensitive reactions and have substantial radiative effects. However, our knowledge of the atmospheric processing of imidazole compounds is still in its nascent stage. On the basis of a single-particle aerosol mass spectrometer measurement, the mixing state of imidazole-containing particles and high-time-resolved variations of imidazole compounds were investigated in Qingdao, China. Five imidazole compounds (methylimidazole, ethylimidazole, dimethylimidazole, imidazole-2-carboxaldehyde, and 2,2'-biimidazole) were identified, overall accounting for ~10% of all of the detected particles. They are tightly correlated and internally mixed with enhanced carbonyls, amines, and ammonium, supporting their secondary formation from these precursors. The number fraction of imidazole-containing particles exhibited predominant diurnal variations, especially on sunny days. A sharp decrease in the number fraction from morning to noon is most likely attributed to photochemical degradation. This is also confirmed by the reverse correlation ( $r = -0.77$ ;  $p < 0.01$ ) with photochemical indicators (temperature and O<sub>3</sub>) and our laboratory experiment by exposure of imidazole compounds to sunlight. Multiple linear regression and random forest analysis further support the hypothesis, with precursors (i.e., carbonyls and amines/ammonium) and O<sub>3</sub> being the most important factors (~70%) regulating the variations of imidazole compounds.