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Hourly resolution measurement of gaseous oxidized mercury using a membrane-coupled sampling system

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Temporal variation trend of gaseous oxidized mercury (Hg^{2+}) in air is significant to understand global mercury cycling and is urgent to evaluate the effectiveness of the *Minamata Convention on Mercury*. However, Hg^{2+} monitoring is still one of the largest challenges in atmospheric mercury research field, where existing methods cannot simultaneously satisfy the measurement requirements of both accuracy and time precision. Here, we developed a hourly resolution gaseous oxidized mercury sampling system (HGOMS) which coupled a cation exchange membrane (CEM)-based sampling system with the Tekran 2537/1130/1135 equipment. The two stage CEM coupled in our system can capture almost all Hg^{2+} under high $HgBr_2$ exposure (1.45±0.05 ng m^{-3}) in laboratory experiment. During the field observation, the breakthrough percentage of the first stage is approximately 10% and the time resolution of Hg^{2+} concentration measurement is 2 h. The 3-week measurement using HGOMS showed an hour-average Hg^{2+} concentration of 0.46±0.36 ng m^{-3}, which is approximately 23 times higher than the measurement using KCl-coated denuder at urban Beijing. In addition, enhanced Hg^{2+} concentrations was observed during the daytime with diurnal amplitude of 0.37 ng m^{-3}, indicating the strong photochemical production of Hg^{2+}. Given the current prevalent low bias of Hg^{2+} in observation and model simulation, our study indicates the urgency to re-evaluate global Hg^{2+} measurement and air mercury reaction mechanism in the atmospheric mercury transport model.