Gas–particle partitioning of gaseous elemental mercury

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Mercury models are used to assess the benefit of changes in anthropogenic mercury emissions such as expected under the Minamata Convention on mercury levels in environmental ecosystems; however, lack of understanding of gas-particle partitioning and heterogeneous chemistry of mercury in the atmosphere remain significant sources of uncertainties in mercury models. Based on observations and theoretical analysis, adsorption of Hg^0 onto atmospheric particulate matter has been suggested; however, knowledge on the fundamental interactions of Hg^0 on atmospheric aerosol surfaces is limited. In this study, uptake and reaction kinetics of Hg^0 on the surfaces of anthropogenic particles of fly ash from three major coal-fired power plants in North America, two in USA (TVA-Shawnee, Kentucky; TVA-Cumberland, Tennessee) and one in Canada (Nanticoke, Ontario), and on the surfaces of nanoparticles of iron oxides, ubiquitous components of mineral dust aerosols, was studied using SMPS, OPS, NTA, GC-MS, HR-TEM and BET analysis. Size distributions of fly-ash were measured. The surface reactions rates of Hg^0 uptake on these and iron oxides particles under various environmental conditions (i.e., molecular oxygen, humidity and irradiation) were determined. We will present our experimental kinetic and mechanistic data set and discuss the impact of humidity and O_2 on Hg^0 capture on fly-ash. The long-range transport of mercury and its impact on global ecosystems are largely determined by the physicochemical processes involved in the removal of Hg^0 from the atmosphere. We will discuss the implications of our experimental data to atmospheric mercury models. A manuscript on this study has been submitted to a peer reviewed journal; therefore, the results of the study are not submitted in the abstract in accordance with the journal policy.