Prof.
KAWAMOTO Katsuya

Assessing the fate of chemicals in the environment and engineered processes

Concentration changes and dynamics of environmental chemicals are predicted and evaluated based on partition equilibrium properties of chemical compounds and their conversion/degradation kinetics. The target compounds are organohalogen compounds, PAHs, and other emerging pollutants. The target engineering processes include water treatment and gas cleaning, and solid/liquid waste treatment in such environmental media as water, air, soil, and sediment.

Environmental Characteristics of the Northeast United States and the Boston PMSA

Characteristic	Northeast United States	Boston PMSA
Population	3.3×10^7	3.3×10^6
Area (km^2)	2.84×10^5	5.17×10^3
Air		
Height (m^3)	900×2000(winter) 1000×3000(summer)	900×2000(winter) 1000×3000(summer)
Temperature (°C)	-5to6(winter) 20to4(summer)	-5to6(winter) 20to4(summer)
Wind speed at 10m (m/sec)*	4.0± 1.2	5.6±1.4(winter) 3.5±0.9(summer)
Wind direction	W(winter), SW(summer)	W(winter), SW(summer)
Precipitation (mm/yr)	1100*	200(winter), 470(summer)*
Water		
Fraction of surface area	0.03	0.09
Average depth(m)	3	3
Soil		
Volume fraction water	0.2	0.2
Volume fraction air	0.2	0.2
Fraction organic carbon	0.02	0.02
Sediment		
Volume fraction solids	0.2	0.2
Fraction organic carbon	0.06	0.06

*Reported variability of some values reflects upper bound estimates of uncertainty based on observed diurnal averages; **Ture annual average for the Northeast region; ‡Aunalized values extrapolated from precipitation observed during experiments.

Mass balance equation of MTBE in Boston urban air:

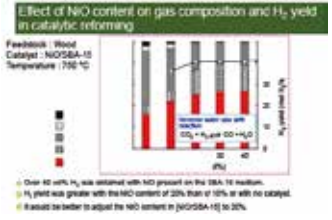
$$\left(\frac{dC_{air}}{dt}\right)_{mixed-air} = 0 = \left(\frac{Emission \cdot rate}{V_{air}}\right) + \left(\frac{C_{air-in}\, dV_{air}}{V_{air}\, dt}\right) - \left(\frac{C_{air}\, dV_{air}}{V_{air}\, dt}\right) - k_{OH}(*OH)C_{air}$$

Safe and appropriate disposal treatment of waste water, flue gas, and solid/liquid waste, and developing further technology for recovering materials/energy from waste

Various exhausts, such as wastewater, flue gas, and other anthropogenic waste emissions should be appropriately and safely disposed. Currently, material and energy recovery is highly desired in the context of establishing a sound material recycling society.

Gasification and reforming experiment apparatus and gas sampling flow

Effect of NiO content on gas composition and H_2 yield in catalytic reforming



Biomass gasification and reforming

Because energy recovery from waste treatment plays a key role in eliminating fossil fuel use and GHG emissions, research and development corresponding to the type and properties of waste are performed. Safety assessments of the systems are also conducted.