Metal-organic frameworks for the adsorption of gaseous toluene under ambient temperature and pressure

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Metal-organic frameworks for the adsorption of gaseous toluene under ambient temperature and pressure

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Abstract

Enormous efforts have been put to effectively treat or eliminate toluene, one of the most well-known volatile organic compounds (VOCs). Herein, we report its sorptive removal mechanism against metal-organic frameworks (MOFs: UiO-66, UiO-66(NH_2), ZIF-67, MOF-199, MOF-5, and MIL-101(Fe)) under ambient conditions. Their interactions were assessed by the Henry's law constant (K_H) and the heat of adsorption (ΔH_{ads}). Although the equilibrated adsorption capacities of all MOFs were measured from 159 (MOF-199) to 252 mg g^{-1} (UiO-66(NH_2), those values were reduced considerably with increases in humidity and temperature. Among them, the sorption pattern of UiO-66(NH_2) was the most reproducible when tested over a three cycle (147 (1^{st}) and 133 mg g^{-1} (3^{rd} cycle)). The behavior of -NH terminated MOFs (UiO-66(NH_2) and ZIF-67) was distinguished with those of –COOH as explained by a scheme of hypothetical potential energy profiles using mass transfer resistance and surface barrier phenomena.

Keywords: *Toluene, Hydrogen bonding, Surface barrier, Physisorption, UiO-66(NH_2)*

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