Supporting Information

We note that in order to obtain the sub-cooled liquid vapor pressures used in Figure 9, the solid vapor pressure of a compound, found in the literature, can be converted to that of the sub-cooled liquid from the following equation (*39*).

$$\ln\frac{P^\circ{}_s}{P^\circ{}_L} = -\frac{\Delta S_{fus}(T_M)}{R}\left[\frac{T_M}{T}-1\right] \tag{11}$$

where $P°_s$ is the solid vapor pressure, $P°_L$ sub-cooled liquid vapor pressure, T_m is the melting point, T is the temperature of interest and $\Delta_{fus}S$ is the entropy of fusion.

The derivation of equation (8) from equation (6), when $P<<P°$ and $C_{BET}>>1$, is as follows

$$\frac{n}{n_m} = \frac{C_{BET}x}{(1-x)(1+(C_{BET}-1)x)}, x = \frac{P}{P^\circ} \tag{6}$$

Equation (6) simplifies to the following

$$\frac{n}{n_m} \cong \frac{C_{BET}x}{1+C_{BET}x} \tag{12}$$

since $1\text{-}x \approx 1$ and $C_{BET} -1 \approx C_{BET}$. Equation (12) can be reformulated as follows

$$\frac{n}{n_m} \cong \frac{C_{BET}\frac{P}{P^\circ}}{1+C_{BET}\frac{P}{P^\circ}} \times \frac{P^\circ}{P^\circ} \cong \frac{C_{BET}P}{P^\circ + C_{BET}P} \tag{13}$$

and since $\frac{n}{n_m} = \frac{\theta}{\theta_m}$ we can equate (13) to the Langmuir isotherm (1) as follows

$$\frac{C_{BET}P}{P^\circ + C_{BET}P} \cong \frac{KP}{1+KP} \tag{14}$$

which simplifies to

$$K \cong \frac{C_{BET}}{P^{\circ}} \tag{8}$$

(39) Schwarzenbach, R. P.; Gschwend, P. M.; Imboden, D. M. *Environmental Organic Chemistry*; 2 ed.; Wiley-Interscience: Hoboken, 2003.