



Fig. 23 Data from Table 5 treated by the BET equation.

This can be converted to moles (n) and then to molecules (N);

$$\begin{aligned} n_m &= \frac{20PV}{RT} = 1 \times \frac{20}{82 \times 298} = 12.9 \cdot 10^{-4} \text{ moles} \\ &= 6 \times 10^{23} \times 12.9 \times 10^{-4} = 77 \times 10^{19} \text{ molecules} \end{aligned} \quad (8.35)$$

Water molecules in a monolayer will position themselves so that their cross-sectional area is $10 \text{ \AA}^2 = 10 \times 10^{-16} \text{ cm}^2$, so that in this case the entire surface area would be the number of molecules times the area of each molecule, i.e.,

$$77 \times 10^{19} \times (10 \times 10^{-16}) = 77 \times 10^4 \text{ cm}^2 = 77 \text{ m}^2$$

Most substances are not “hygroscopic” below 20% RH.

If a bag of silica is placed in a bottle with a dosage form, then, if there is a critical moisture content beyond which the dosage form becomes unstable, it is possible to calculate, from the isotherm of the dosage form, at which relative humidity this occurs. From the silica isotherm one can then calculate how much moisture is taken up by the silica bag at this point, and dividing this figure by the moisture penetration of the package, it is possible to calculate the length of time the product is good.

Moisture isotherms are of great significance in pharmaceuticals. Cases in point are the moisture isotherms of PVP and of the complex of misoprostol and hydroxypropyl methylcellulose.

14. HYDROUS AMORPHATES

As mentioned, solids that are not crystalline are called amorphous. An important category of these are lyophilized cakes (for intravenous reconstitution). These are formed by freezing aqueous solutions. Upon such freezing (when part of the solid comes out as an atmosphere), ice will first freeze out, and then the remaining solution (which usually crystallizes as a eutectic) will supercool and will become