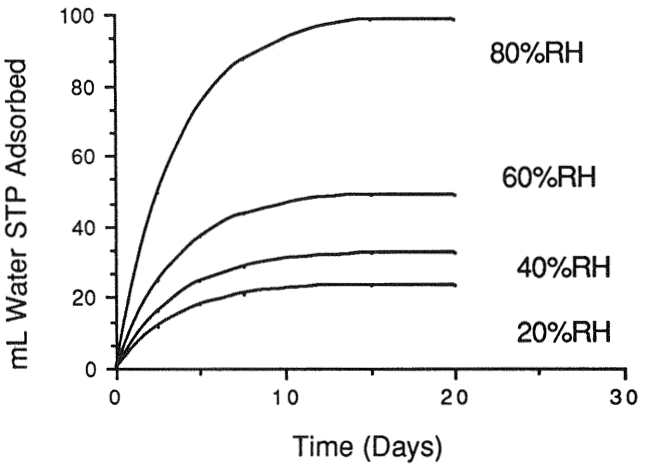

Fig. 21 Moisture uptake curves for a sample of silica gel at 20, 40, 60, and 80% RH.

All quantities are known, so that P [$= P_C = P_D$] can be calculated, i.e., both moisture losses and gains, and the final relative humidity can be calculated. In this latter case, the isotherms should be determined on samples that had been wetted and dried the same way the final mix had been wetted and dried (since the surface area changes).

12. EQUILIBRIUM MOISTURE CONTENTS FOR MACROMOLECULES

For an organic compound such as starch, a smooth equilibrium moisture curve will result. Here again there is a sharp upswing at very high relative humidities.

If experiments such as are exemplified in Table 1 and Fig. 11 are carried out on e.g. cornstarch, then curves of the *type* shown in Fig. 21 result. The figure shows moisture uptake rate curves at four different relative humidities: 20%, 40%, 60%, and 80%. When the moisture contents (x mg water/mg solid) of these levels are plotted as a function of relative vapor pressure, P/P^* (the relative humidity, divided by 100, the so-called water activity), then an isotherm results. This moisture isotherm has the shape shown in Fig. 16.

When $P/[x\{1-P\}]$ is plotted versus P, then a straight line results.

13. ADSORPTION ISOTHERMS OF SILICA

The curve in Fig. 21 eventually levels off. The equilibrium level is a function of the relative humidity at which the experiment is carried out. Table 5 shows an example of moisture uptake curves of a sample of silica, at various relative humidities. These levels are tabulated in the second column. It is customary in isotherm work to convert these adsorbed amounts to the volumes that would have been occupied at 0°C and 1 atm, and this can easily be done, e.g., for the first row. The number of moles is $n = (17.5 \times 10^{-3})/18 = 9.75 \times 10^{-4}$ moles. The volume of this at 25°C and 1 atm would be $V = nRT/P = 9.75 \times 10^{-4} \times 82 \times 298/1 = 23.8$ mL. These figures are shown in the third column and are denoted V.