(as judged by x-ray powder diffraction). It did cause a reduction in the acid neutralization rate, and the rate of sedimentation increased. The effect was pronounced after the first cycle (and indeed most of the effect occurred at this point). The duration of freezing was not important, but the aggregate size grew inversely with the rate of freezing. The use of polymers in the suspensions reduced the effects of the freeze–thaw cycle.

Freeze–thaw cycles (aside from being a stability monitoring tool) can be used to screen products as well, the best of a series of suspensions or emulsions being the one that stands up best to the test. This on the surface may be logical, but without a theoretical basis it is difficult to judge the generality of such a statement.

3.2 Sedimentation Volumes

If a suspension is particulate, then the particles will (approximately) settle by a Stokes law relation, i.e., the terminal velocity, v, is given by

$$v = d^2 \cdot g \frac{\Delta\rho}{18\eta} \tag{10.11}$$

where the constant g is gravitational acceleration, $\Delta\rho$ is the difference in density between solid and liquid, η is the viscosity of the liquid, and d is the diameter of the particle. The final apparent volume of the sediment, provided it is monodisperse, would be given by the fact that in cubical loose packing a sphere of diameter d will occupy the space of its confining cube, i.e., the sedimentation volume will be

$$V = n \cdot d^3 \tag{10.12}$$

where n is the number of particles per cm^3 of suspension. Since their density is ρ g/cm^3, then (denoting the dosage level Q g/cm^3) the following holds:

$$Q = \frac{\rho \cdot n \cdot \pi d^3}{6} \tag{10.13}$$

so that, solving for n,

$$n = \frac{Q \cdot 6}{\rho \pi d^3} \tag{10.14}$$

which inserted in Eq. (10.12) gives

$$V = \frac{6Q}{\rho\pi} \tag{10.15}$$

In this view, each particle touches its neighbors. The potential diagram from two particles is as shown in Fig. 4.

When the particles touch, the potential energy becomes exceedingly large ($x = 0$), and from an equilibrium point of view they will be trapped in the primary minimum, which is the deep minimum at short distance in Fig. 4. Hence it becomes difficult to separate them, and the precipitate becomes a cake. This would prevent redispersion by shaking and would make proper dispensing impossible. It is a formulation goal to prevent this from happening, and this is done by adjusting the