is an entry-level single- and multipoint BET surface area instrument. The FlowSorb measures the surface area by using the flowing gas method, which involves the continuous flow of an adsorptive and inert gas mixture over the sample at atmospheric pressure. It is ruggedly constructed and is ideal for demanding analytical environments.

7.2.6 True Density

Density is the ratio of the mass of an object to its volume, and for solids, this term describes the arrangement of molecules. The study of compaction of powders is described by the Heckel equation:

$$\ln\left[\frac{1}{1-D}\right] = KP + A \tag{7.8}$$

where D is the relative density, which is the ratio of the apparent density to the true density, K is determined from the linear portion of the Heckel plot, and P is the pressure. The densities of molecular crystals can be increased by compression. Information about the true density of a powder can be used to predict whether a compound will cream or sediment in a suspension, such as metered dose inhaler (MDI) formulation. Therefore, suspensions of compounds that have a true density less than these figures will cream (rise to the surface), and those that are denser will sediment. It should be noted, however, that the physical stability of a suspension is not merely a function of the true density of the material. The true density is thus a property of the material and is independent of the method of determination. In this respect, the true density can be determined using three methods: displacement of a liquid, displacement of a gas (pycnometry), and floatation in a liquid. The liquid displacement is tedious and tends to underestimate the true density. Displacement of a gas is more accurate but needs relatively expensive instrumentation. As an alternative, the floatation method is simple to use and inexpensive.

Gas pycnometry is probably the most commonly used method in the pharmaceutical industry for measuring true density. Gas pycnometers rely on the measurement of pressure changes, as a reference volume of gas, typically helium, added to, or deleted, from the test cell.

7.2.7 Flow and Compaction of Powders

The flow properties of a powder will determine the nature and quantity of excipients needed to prepare a compressed or powder dosage form. This refers mainly to factors such as the ability to process the powder through machines. To make a quick evaluation, the compound is compressed using an infrared (IR) press and die under 10 torr of pressure, with variable dwell times, and the resulting tablets are tested with regard to their crushing strength after storing them for about 24 hours. If longer dwell times result in higher crushing strength, then the material is likely to be plastic. Elastic material will show capping at low dwell times, and the brittle material will not show any effect of dwell times. It is recommended that the compressed tablets be subjected to XPRD to record any changes in the polymorphic forms.