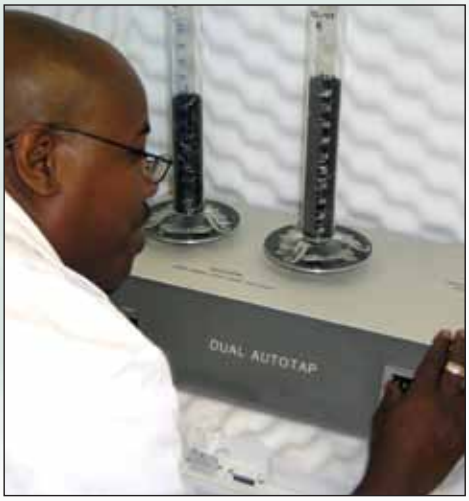

Quantachrome Instruments Dual Autotap.

Tablets & Capsules

Powder Density in Solid Dosage Forms

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Both active and inactive (excipient) compounds are used in the manufacture of solid dosage formulations, i.e. tablets and capsules. These powders possess many properties or characteristics and exhibit certain behaviors as a result.

Tapped Density

One important characteristic is tapped bulk density, or simply tapped (tap) density: that is, the maximum packing density of a powder (or blend of powders) achieved under the influence of well-defined, externally applied forces. The minimum packed volume thus achieved depends on a number of factors including particle size distribution, true density, particle shape and cohesiveness due to surface forces including moisture. Therefore, the tap density of a material can be used to predict both its flow properties and its compressibility (see right sidebar as to how). These are just two of the many parameters which are important in the overall tabletting process - which requires that loose powders be compacted into a durable solid form with the correct mechanical strength, porosity and dissolution characteristics – and in capsule-filling performance.

Compressibility Index & Hausner Ratio

The two most commonly used measures of the relative importance of interparticulate interactions are the compressibility index (often referred to as Carr's Index [1]) and the Hausner ratio [2] (see right sidebar). "V" and "D" represent powder volume and density respectively, subscript "o" denotes the initial or untapped state and "f" the final or tapped state. In free-flowing powders the initial bulk and tapped densities will be more similar than in poor flowing powders which yield greater differences between the two values.

Autotap & Dual Autotap

The Autotap and two-sample Dual Autotap conform to USP ‹616›, for Tapped Density (Method II). The measuring cylinder containing the powder sample is dropped a height of 3mm (1/8") at a rate of approximately 250 drops per minute. Both Autotaps feature a drop counter which can be set to any value from 1 to 9999. An optional lock-out mechanism is available to prevent tampering with a preset number of counts. Quantachrome's Autotaps therefore can contribute a vital role in the development and assurance of solid dosage formulations in the pharmaceutical industry. ■

References

[1] R.L. Carr, (1965) *Chem Eng*. **72,** 163-168
[2] H.H. Hausner, (1967) *Int J Powder Metall*. **3,** 7-13
[3] F. Podczeck, (1998) in *"Particle-particle Adhesion in Pharmaceutical Powder Handling"* Imperial College Press, London, p108
[4] K.H. Lüdde and K. Kawakita, (1966) *Pharmazie* **21**, 393-403

For more information about measurement capabilities and how to submit an evaluation sample, contact Quantachrome Instruments by phone: (561) 731.4999, fax: (561) 732.9888, email: qc.sales@quantachrome.com or visit www.quantachrome.com.

Quantachrome INSTRUMENTS

Powder Density Equations

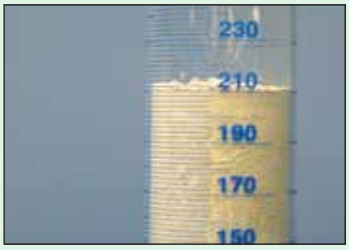
The usefulness of the two simple ratios below, both based on the decrease in powder volume during tapping, is in their ability to predict flowability. The lower the number, the more free-flowing the powder. An increase in the value is proportional to adhesion and friction properties of a powder [3], including (attractive) triboelectric charge.

Carr's Index (Compressibility Index)

$$= \frac{100*(V_o - V_f)}{V_o} \equiv \frac{100*(D_f - D_o)}{D_f}$$

Hausner Ratio

$$= \frac{V_o}{V_f} \equiv \frac{D_f}{D_o}$$



The dynamics of the compression of the powder mass can be further evaluated by using the:

Kawakita Equation [4]

$$\frac{N}{c} = \frac{N}{a} + \frac{1}{ab}$$

N = number of taps

$$c = \left(\frac{V_o - V}{V_o}\right)$$

a = Carr's Index *(Compressibility Index)*
b = constant related to cohesiveness and shear strength

By plotting $\frac{N}{c}$ vs N, the parameters a and b can be evaluated graphically.

For More Information:

Please avail yourself of the easy access to our experts regarding powder and porous materials characterization. Quantachrome specializes not only in tap density apparatus but also true density pycnometers plus surface area, pore size and water sorption analyzers.

Contact us at:
QC.sales@quantachrome.com or visit us on our website at www.quantachrome.com.