

# Dosing For Effect

## Getting It Right The First Time

Dosing is that critical step in producing a consumer product where manufacturing wants things to go as smoothly as possible. Two issues that affect acceptance are volume of material in the dose and proper proportions for constituent ingredients. This application note addresses the situation for both liquid and powder-based products.

R&D has the responsibility to get it right for Manufacturing. Scale up from bench tests in the lab need to be based on realistic simulation of process conditions.

Liquid products can be assessed using a texture analyzer with an extrusion cell which simulates the effect of squirting material out an opening of known diameter. (See Figure 1) The test objective is to measure the amount of force required to expel the product and the amount of material that extrudes during that time interval. The test apparatus utilizes a selection of discs with different diameter openings placed in the bottom of the cell to mimic the effect of fill lines with nozzles of varying diameter. This is one test technique that provides data on extrusion rates for the product in question.

Viscosity measurement is another approach that is widely used. The material can be sheared with a cone/plate rheometer (See Figure 2) at variable rates to determine the viscosity profile. (See Figure 3) This technique produces viscosity data that can be correlated with the size opening in the nozzle required to produce a desired volume flow rate. Since this is an analytical approach, it may be useful to compare results with the experimental information resulting from tests with a texture analyzer. Both techniques can reinforce the final conclusions that are drawn about the flow behavior of the liquid.

Powders require a different approach. The common device that is most widely used is the Flodex Cup. (See Figure 4) The cup is filled with powder and allowed to flow out a hole in the bottom. At best, this can only give a go or no-go indication on flow behavior. More practical, but also more expensive, is the shear cell method. The powder is compressed to a specific pressure, then sheared against itself to measure the internal friction of particles sliding against each other. The data output is a flow function which predicts flowability based on the fill level of the powder in the bin.

For powders comprised of blended materials, it's important that they do not desegregate in the process of discharging through a hopper. The best way to preclude this problem from occurring is to design the equipment to achieve mass flow behavior. Shear cells provide the capability to design conservatively for hopper opening size and hopper half angle with conventional engineering calculations built into the software.

**Figure 1:** Brookfield Extrusion Cell with CT3 Texture Analyzer

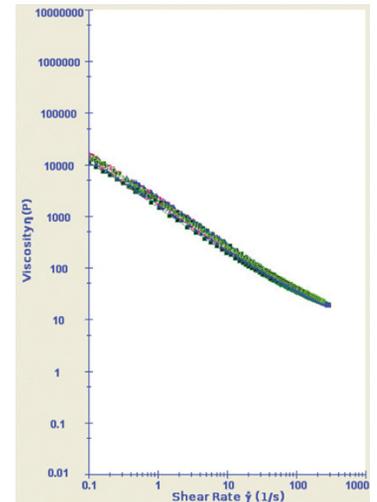


**Figure 2:** Brookfield RS Cone/Plate Rheometer



This is a quick overview of some technical approaches taken by companies that pursue dosing for effect. More in-depth analysis is available from instrument and equipment manufacturers who specialize in these methods for evaluating flow behavior in the dosing process.

**Figure 3:** Viscosity vs Shear Rate Profile for Cream Ointment



**Figure 4:** Flodex Cup for Measuring Powder Flow



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