COMPARISON OF METHODS FOR DETERMINING PARTICLE SIZE DISTRIBUTION AND POWDER FLOWABILITY.

Jian-Xin Li[1], James K. Prescott[2], Timothy J. Smith[3], Brian Carlin[1], Sharon Ray[1], Paul Sheskey[4], Lirong Liu[5]
[1]FMC BioPolymer: Princeton, NJ; [2]Jenike & Johanson, Inc.: Westford, MA; [3]Vector Corporation: Marion, LA; [4]Dow: Midland, MI; [5]Pfizer: Brooklyn, NY

Introduction

Powder flow is critical to mixing and tableting, which may significantly affect content and dose uniformity. Although various techniques have been used to characterize powder flow, there is neither consensus on the correlation between the results obtained from different methods, nor recognition of the best flow test method.

In addition to many factors, powder flow is affected by particle size. Correlation between different test methods and conditions needs to be established experimentally.

Purpose

To compare the results of particle size distribution and powder flowability determined by different methods.

Materials and Method

Ingredients of Granulation

Avicel® PH-101 (MCC)	30%
Lactose	55%
Starch 1500	15%

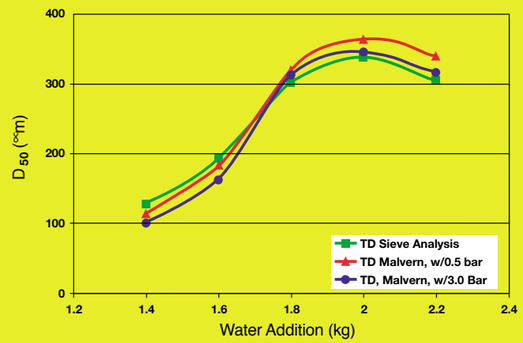
Water Added to 2 kg Powder, kg

Top Drive	Bottom Drive	% of Water Added
1.4	1.4	70%
1.6	1.6	80%
1.8	1.8	90%
2.0	2.0	100%
2.2		110%

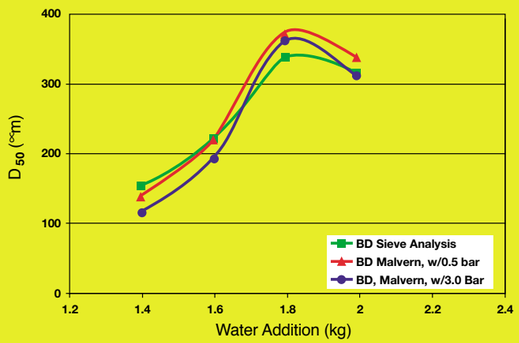
A series of milled granules was prepared using high shear granulation (top drive and bottom drive). The granulations had the same formulation except for varying amounts of water addition during granulation. The particle size distribution of the milled granules was determined by both sieve analysis and a Malvern® Mastersizer 2000 with dry dispersion, at 0.5 and 3.0 bar conveying pressure. The flowability of the powder was determined by Carr Index and Flodex. The cohesive strength and effective internal friction angle for each material were determined by a ring shear tester (Jenike-Schulze RST-XS). The compaction coefficients were determined by an instrumented rotary press (Stokes® 512).

Results and Discussion

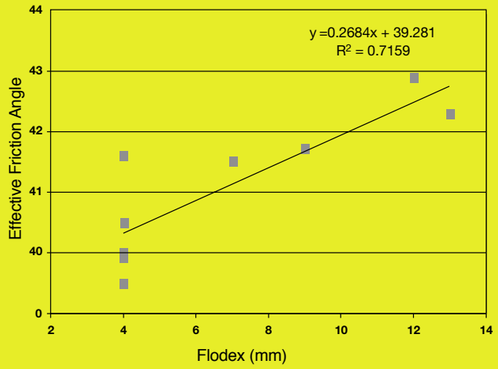
Methods of Particle Size Determination, Top Drive



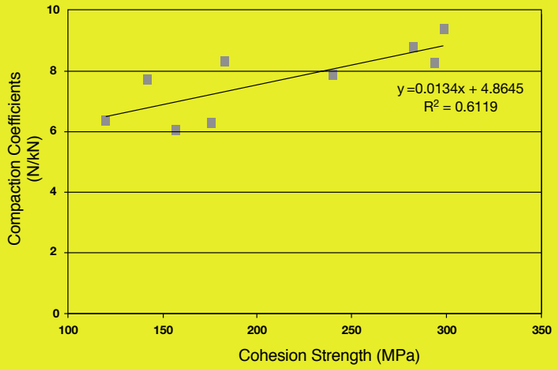
Methods of Particle Size Determination, Bottom Drive



Correlation Between Flodex and Effective Friction Angle at 4.1 kPa



Correlation Between Compaction Coefficients and Cohesion Strength



Conclusions

D_{50} determined by sieve analysis is close to that by Malvern Mastersizer. The ranking of powder flowability by internal friction is more discriminative than that of Flodex for fast flowing powder, with a trend generally similar to that of Flodex. The ranking of powder flowability by Carr Index is not discriminative. Differences in powder cohesion strength may explain the differences in flowability for powders with similar particle size, as well as the slightly higher compaction coefficient for milled granules from the bottom drive granulator.

Acknowledgements

The authors extend their thanks to FMC BioPolymer, Mutchler Inc. Pharmaceutical Ingredients, and Colorcon, Global Technical Support for their contributions of materials for this study.

FMC | FMC BioPolymer
THE SCIENCE OF FORMULATION

vector corporation
A FREUND GROUP COMPANY