W4155

Comparison of Flow Properties of Granules Prepared by Top-drive and Bottom-drive High-shear Granulators

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Introduction

Powder flow is critical to mixing and tableting, which may significantly affect dosage uniformity of weight and content. Powder flowability can be assessed via direct shear testing, which is a test method that yields results that assist in bin, hopper, and chute design and evaluation. Additional information about the powder's particle size, compressibility (change in bulk density) and granule robustness (change in size as a result of handling) can be useful to the formulator in optimizing a granulation process.

Purpose

To compare the flow properties of granules prepared by top-drive and bottom-drive high-shear granulators.

Materials

Ingredients of Granulation

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

Water added to 2 kg powder, kg

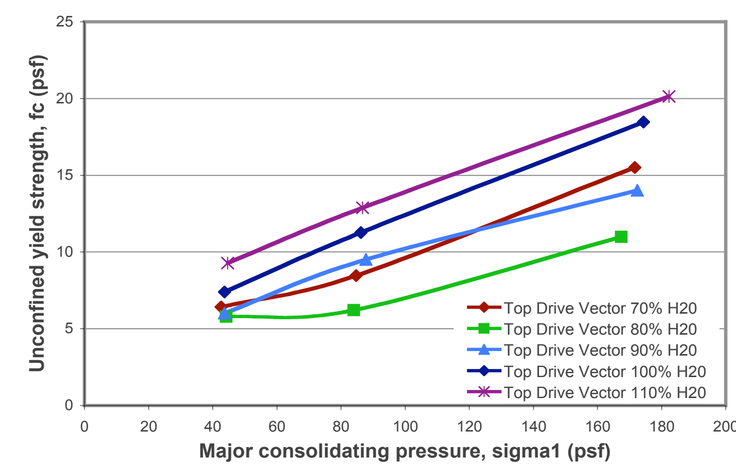
Top Drive	Bottom Drive	% of Water Added
1.4	1.4	70%
1.6	1.6	80%
1.8	1.8	90%
2.0	2.0	100%
2.2		110%

Methods

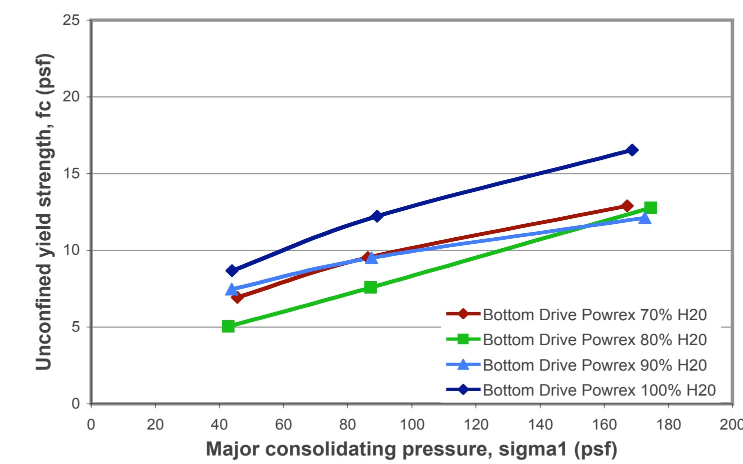
Blends of starch, microcrystalline cellulose, and lactose were granulated with increasing amounts of water using a 25-liter top-drive granulator (Vector GMX-25) and a same sized bottom-drive granulator (Powrex FM-VG-25). The granulation parameters were optimized. Granulates were fluid-bed dried and milled with a Fitzmill. Each material was tested for cohesive strength using a ring shear tester (Jenike-Schulze RST-XS). Bulk density as a function of consolidating pressure was determined using ASTM standard D-6683. Particle size distributions were determined using a Malvern Mastersizer 2000. The degradation/ deagglomeration potential of the granules was assessed by measuring the decrease in D_{90} on increasing the Mastersizer conveying pressure from 0.5 to 3.0 bar. An increased conveying pressure increases the likelihood of breaking up agglomerates, removing fine particles that were loosely bound to coarse particles, or attrition of weak particles.

Results and Discussion

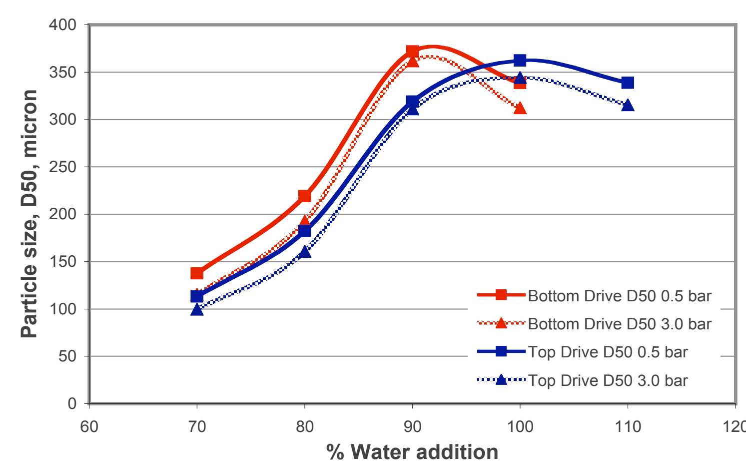
Flow Functions: Top Drive Granulations



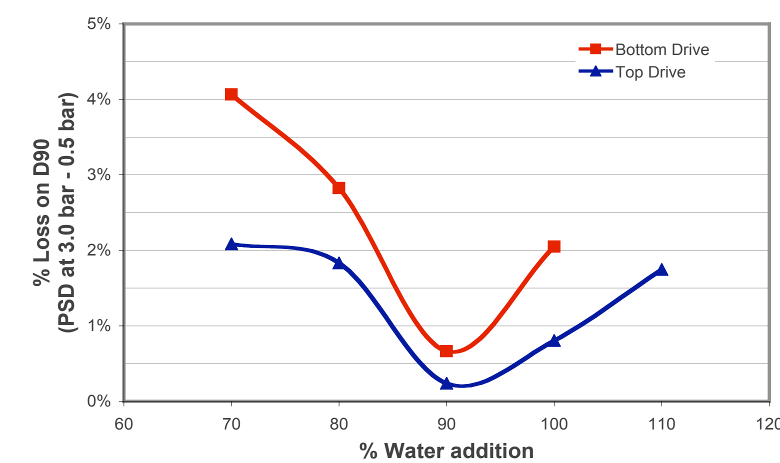
Flow Functions: Bottom Drive Granulations



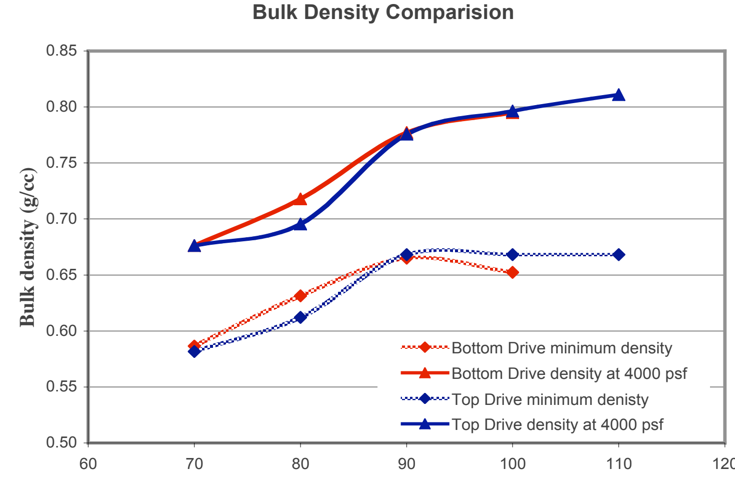
Particle Size Comparison: D50 at Two Feed Pressures



Particle Degredation Potential



Bulk Density Comparision



Conclusions

Top-drive and bottom-drive granulators produced granulations that are substantially similar. The enlargement of particle size was maximized at 90% water addition for the bottom drive, and at 100% for the top drive. The granulations from each granulator have minimized cohesive strength at 80% water addition. However, the granules are least prone to attrition when produced using 90% water. Bulk density is generally increasing with increased water addition, but begins to level off at higher water addition.

Acknowledgements

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