WHAT ARE THE DETERMINING FACTORS FOR ACHIEVING THE CORRECT PARTICLE SIZE DISTRIBUTION OF A TABLET FORMULATION?

In a recent newsletter, Michael Tousey of Di Pharma Tech identified a few key reasons why particle size distribution is important in tablet formulations.

Flowability: Generally speaking the smaller the particle the worse the flow. Compare powdered sugar with granular sugar. The fine small particles in powdered sugar aid dissolution but not flow.

Feeder clearance: Particle size must be larger than the feeder clearance to prevent leakage.

Die table run-out: If die table run-out increases, feeder clearance and particle size must also increase proportionately. To check run-out, use a dial indicator to determine the variation of the die table.

Die fill: Wide variations in particle sizes can cause inconsistent fill volumes.

Weight control: Final volume is final weight. Larger particles pulled out of the die can reduce the final weight. Fine particles require more precise scrape-off and increase the need for a good scraper blade.

Compressibility: Improves with increased particle size and decreases as particles become smaller and smaller. Small particles have less ability to lock together during compaction.

Hardness: Smaller particles are more sensitive to over-compression.

Ejection force: Small particles decrease interstitial space and increase drag and friction.

Lubrication levels: In general, higher percentages of small particles require increased quantities of lubricant. Magnesium stearate is the most commonly used lubricant and should be de-agglomerated before use.

Disintegration & dissolution: Small particles decrease disintegration time, and increase dissolution.

Friability: Larger particles usually lock together better which results in reduced friability while small particles often increase the potential for failure (higher friability).

Electro Static effects: Electro static charge is increased as the percentage of small particles increases.

Dust control: Fine particles create a dusty operation, creating a need for frequent production stoppages and press clean-ups.
Environmental conditions: Many products are hygroscopic and sensitive to heat. Variations in room conditions can result in poor flow, compression and ejection conditions.

Tooling condition: Punch tip & die clearance are designed to control air release allowing for improved compaction.

Machine condition: Cleaning and maintenance are downtime issues. A high percentage of fine particles and dust increases the potential for greater wear, increased cleaning frequency, reduced yield, greater particle segregation, and more tablet defects.

Punch lubrication: Dust and super fine particles become airborne and combine with the oils and greases which can produce black specks in tablets.

Cost: Fines (small dusty particles) increase operating costs, require increased levels of dust collection, decreased yields, increased frequency of cleaning, and generate greater machine & tool wear. Reducing fines will improve tablet quality.

In summary, establishing an appropriate particle size distribution will improve tablet quality and will reduce overall costs in the long run. Fine dusty particles are the source of most tablet defects.

**Quadro’s Approach**

The Quadro® Comil® delivers an optimum particle size distribution that is tighter than other size reduction equipment in the market. In addition, the Comil® delivers

- **High Capacity** - no restrictions to capacity due to Comil™’s plug/choke feeding capability
- **Low Heat** - excellent for milling products with low melting points
- **Low dust** - savings in dust collection/explosion retention devices with minimal product loss
- **Optimum particle distribution** - ability to achieve desired particle granulometry
- **User friendly design** - quick screen changes, easy clean, low maintenance, flexible feeding conditions, optimum results when plug/choke feeding
- **Versatile** - various screens and impellers with many specialized tools are available to accomplish any process requirement

![Particle Size Comparison](image-url)