Optimized Coffee Particle Grind Sizes for Single-Serve Pods

Enhanced extraction efficiency requires 20% less coffee for same taste

Background:
Single serving disposable coffee filter cartridges and their automatic brewing machines have become a popular, efficient and convenient way of brewing coffee beverages on-demand. However, the overall process of brewing in 25-50 seconds combined with low pressure heated water is challenging and best results are obtained by carefully balancing coffee particle grind sizes and rates of water flow through the pod to optimize the extraction of flavor, caffeine, color, anti-oxidants and other nutrients from the beans. If the particle sizes are too small in pods used for current brewing machines, they clog the filter and prevent or slow brewing. If the particle sizes are too large, extraction is inefficient during brewing and more coffee must be used in each individual pod in order to obtain similar amounts of caffeine, nutrients, aroma and taste.

Our invention provides a simple solution for increasing the amount of natural components extracted from a given amount of coffee placed into a single serving filter cartridge. We have found the optimal weighted average particle size (WAPS) for large scale grinds of coffee beans packaged into single serving pods falls around 450 microns. The single serve brewing efficiency can be further improved by “truncating” the Gaussian particle size distribution to remove those particles larger than 500-600 microns from the mix using commercial high-throughput sieve-shakers (e.g. US Standard No. 30 or 35 sieving opening) or air classifying. This additional step lowers the WAPS to ~350 microns.

The additional sieving process removes 30-35% of the larger coffee particles by weight from the grind. However, we have found that these largest particles actually release only half of their potential extractable components during the short single serve brewing process when compared to the smaller-sized sieved particles. In order to maximize cost of goods (COGs) and manufacturing investments, all larger particles can be re-directed into other ground coffee products used in drip and percolator brewing machines. Our proprietary process provides a cost-savings of 15-20% per unit through decreased raw ingredient requirements.

Summary:
- Coffee particles >500 micons are less efficient for extracting components in 25-50 sec. brews
- Smaller particles extract more efficiently with low pressure heated water (15-40% better extractions)
- Most commercial coffee pods tested have 1/3 to 2/3 by weight of particle sizes larger than 500 microns
- Our invention is the use of optimal weighted average particle sizes in single serving pods (~450 microns)
- Extraction efficiency is further optimized by removal of coffee particles >500-600 microns by size-sieving
- Added step of sieving is implemented prior to packaging the ground coffee into filter cartridges

Advantages:
- Low cost solution for maximizing coffee bean sales
- Increases gross margins by decreasing COGs (i.e. uses less coffee in each cup for same brewed taste)
- Alternatively increases brew strength from pods per unit weight as compared to non-size-selected grinds
- Optimal particle size increases w/w yield by 20%
- Simple manufacturing modification without waste
- Small footprint, high capacity commercial shaker-sieves are readily available and cost-effective
- Larger coffee particles (>500 microns) removed during sieving are used in drip / percolator grinds