COFFEE LABORATORY
ANALYTICAL EQUIPMENT
www.coffeelabequipment.com

PARTICLE SIZE ANALYSIS IN COFFEE GRINDS "Comparing the accuracy of existing methods"

Why is particle size so important as it relates to ground coffee?

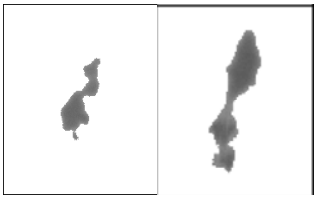
Simply put, smaller particles provide more exposed surface area. The more exposed surface area you have, the less time it takes for water to contact it, and extract the right amount of coffee solubles. If you put Turkish Coffee in a drip coffee maker, you'll see what happens. The same is true with tea. Anyone that has left a tea bag in too long, can attest to the bitter result.

If you're a big commercial facility, grinding large volumes of coffee, eventually your grinder is going to require maintenance. To gauge grinder performance, frequent particle size analysis tests are required. A shift in the particle size distribution of the coffee grinds, signals a problem. When a problem arises, it is important to catch it quickly, for obvious reasons.

Three common methods of determining particle size, are generally employed in the coffee industry:

SIEVE ANALYSIS- Assumes particles are round (DIRECT METHOD NIST TRACEABLE)
LASER DIFFRACTION-Assumes particles are round
DIGITAL IMAGE ANALYSIS-Captures images and shape of particles (DIRECT METHOD NIST TRACEABLE)

With perfectly round particles, all three methods will be in alignment. However, with non-spherical particles like coffee grinds, the similarities diminish quickly.



Espresso Images captured with Occhio Coffee-Trak

Occhio Virtual Discs used to calculate sieve correlation

OCCHIO COFFEE-TRAK

PARTICLE SIZE AND SHAPE ANALYZER (Directly traceable to NIST)

These **Espresso Particles** are far from round. **Laser diffraction** will measure the angular variation in intensity of scattered light, as a laser beam passes through a dispersed particulate sample, giving a fairly robust measure of surface area. The method. However, when compared with direct measurement methods, like digital image analysis, laser diffraction results for plates can be 31% off, and rods up to 70% wrong.

REF: Gabas N, Hiquily N, Laguuerie C. Response of Laser Diffraction Particle Sizer to Anisometric Particles. Part Part Syst Charact, 11:121-126, 1994

Using sieves for sizing non-spherical particles, has its' own set of complications. Because the widest part of a particles width, is the dimension that determines what sized sieve aperture, it will be retained by, the results will not correlate with actual surface area, very well.

High resolution digital imaging, however, has the ability, to provide measurement data, that correlates with either method.

To correlate with laser diffraction, a digital image analyzer instead of measuring diffraction, eliminates diffraction, and captures actual images of the particles. Occhio uses more advanced geometric algorithms, but it can be as simple as counting pixels, to establish a surface area measurement, because we know the microns per pixel rating of the lens.

To correlate with sieve analysis, OCCHIO employs a virtual disc to help ascertain the dimension of the particle that would be retained in a sieve. Slight differences will result, because some particle fall through a sieve on the aperture diagonal, but this can be accounted for with the OCCHIO Size & Shape Correlation Program, where offsets may be applied to make results match exactly.

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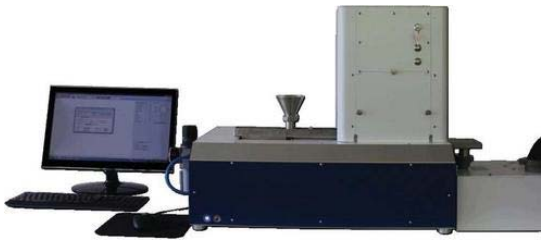
COFFEE-TRAK & COFFEE-TRAK 2

Most accurate method for particle sizing. Unique ability to measure shape, allows for near perfect correlation to an existing laser diffraction, or sieve analysis program.

SPECIAL PROGRAMMING DESIGNED ESPECIALLY FOR COFFEE.

DIRECT METHOD TRACEABLE TO NIST



OCCHIO COFFEE-TRAK PARTICLE SIZER FOR HIGH SPEED ANALYSIS OF COFFEE GRINDS (30 SECONDS)

Horizontal vacuum dispersion with vibrating hopper and air jet optics cleaning

Technical specifications
Working conditions
Description
Working temperature Temperature 5°C – 45°C
Humidity 35% - 80% non condensing
Power Supply 100 or 220 Vac 50-60Hz (auto-switching is not available please ask to Occhio to set power supply)
Computer (supplied by Occhio)
Description
Processor Intel Core i5-650 @3.2GHz, 4MB cache
Ram 4 GB @ 1156MHz
Hard Disk 500MB
Display LCD, FullHD, 21.5”
Mouse, keyboard USB (English)
Operating system Windows Seven Compatible XP Vista
Optics and imaging device
Description
Standard camera type Camera 5Mpixels Gigabit Ethernet 2/3” interline
progressive scan CCD
Camera resolution 5.0 Millions of pixels 2448 x 2050 pixels
Pixel size 3.45 µm
Lens type Macro lens, non telecentric
Lens resolution Calibration: 20 µm/pixel up to 40 µm/Pixel* (+/- 5%)
* for others lens configurations please contact Occhio
Field of view 48960 x 41000µm @20µm/pixel
98000 x 82000µm @40µm/pixel
Light source Diffused light LED
Light wavelength Red light

High resolution dynamic digital image analyzers work by dispersing particulates, and passing them by a special high speed camera. Using proprietary monochromatic back lighting techniques, and collimated light beams, the images of particles are captured with near perfect definition, opening the door to particle shape analysis.

MAXIMUM INSCRIBED DISC

In digital imaging, a virtual maximum inscribed disc, is used to determine a sieve correlation value.

For the analysis of coffee grinds, two parameters are of primary concern, AREA DIAMETER, and MAXIMUM INSCRIBED DISC, although there are a large number of size and shape parameters available.

OCCHIO ESR COFFEE TRAK 2

PARTICLE SIZE AND SHAPE FOR BEANS AND GRINDS

Vibrating hopper with vertical (gravity) dispersion (Vacuum Assist)

Technical specifications
Working conditions
Description
Working temperature Temperature 5°C – 45°C
Humidity 35% - 80% non condensing
Power Supply 100 or 220 Vac 50-60Hz (auto-switching is not available please ask to Occhio to set power supply)
Computer (supplied by Occhio)
Description
Processor Intel Core i7-2600 @3.4GHz, 4MB cache
Ram 4 GB @ 1600MHz
Hard Disk 500MB
Display LCD, Full HD, 22”
Mouse, keyboard USB (English)
Operating system Windows Seven Compatible XP Vista
Optics and imaging device
Description
Standard camera type Camera 5Mpixels Gigabit Ethernet 2/3” progressive scan CCD
Camera resolution 5.0 Millions of pixels 2448 x 2050 pixels
Pixel size 3.45 µm
Lens type Telecentric
Lens resolution standard lens: 10µm/pixel
Lens resolution auxilliary: 7µm/pixel

Field of view standard lens 24480 x 20500 @20µm/pixel
Field of auxiliary lens 17136 x 14350 @7µm/pixel