Powdered and Granulated Foodstuff – Particle Size and Shape Analysis

Instrument: CAMSIZER X2

Application

The CAMSIZER X2 is suitable for the fast and accurate size and shape analysis of crystalline, powdered or granulated foodstuff. The size distribution of both raw materials and finished products affects taste, solubility, extraction behavior, mouth feel and many other physical properties. The sample material is often agglomerated, oily or sticky, so proper dispersion is a big challenge. Air-jet sieving or laser diffraction are commonly used techniques, but they suffer from bad resolution and high labour input (sieving) or limited sensitivity (laser diffraction).

In this application note we present two examples of analysing foodstuff with the CAMSIZER X2, but there are many other possible applications for dynamic image analysis in the food industry.

The following sample materials can conveniently be analysed with the CAMSIZER X2:

- Ground coffee
- Salt
- Spices
- Dietary supplements (vitamins etc.)
- Flavouring agents
- Food additives (citric acid, sweeteners etc.)
- Formula / Baby Food, Milk powder
- Animal Food
- Flour

Example 1: ground coffee

The CAMSIZER X2 is perfectly suitable for the size analysis of ground coffee. Different types of coffee require different fineness: espresso powder for example is much finer (d50~250µm) than coffee powder used to prepare filtered coffee (d50~500µm). Because the CAMSIZER X2 can detect the real image of individual particles, the result can be calculated based on particle width, length or equal area diameter. Note how different the results of laser diffraction and sieving are in Figure 1. Depending on which size definition is used with the CAMSIZER X2, the results of other techniques can be matched. Note that the $x_{c\,min}$ (particle width) is almost identical to sieving, laser diffraction tends to give wider distribution than image analysis, because this method is always considering spherical particles to calculate a size distribution, whereas the CAMSIZER X2 measures the direct length and width of every particle

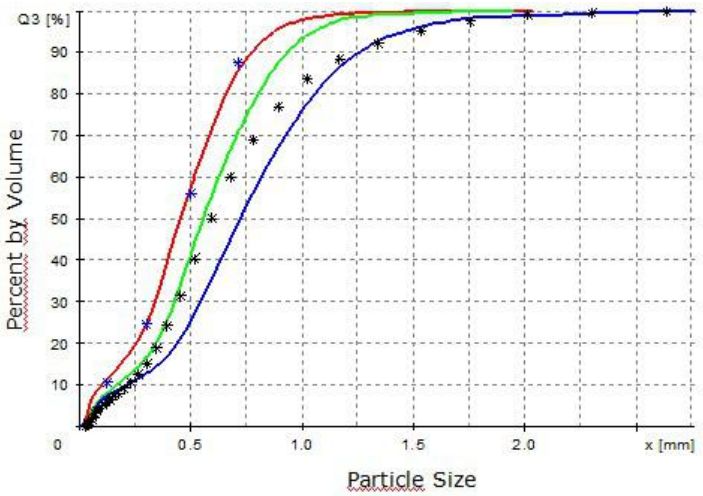

Fig. 1: *A sample of ground coffee, measured with the CAMSIZER X2. The red curve represents the size definition $x_{c\,min}$ (particle width), the green curve is the x_{area} (equivalent area diameter) result and the blue curve shows $x_{Fe\,max}$ (particle length). Black asterisks represent laser diffraction result, blue asterisks are the result of sieve analysis (air-jet sieving).*

Example 2: Baby Food (Formula, Milk Substitute)

The second example illustrates the ability of the CAMSIZER X2 to disperse and measure highly agglomerated samples like milk powder (baby food). The material contains particles down to 10µm. Fig. 2 shows measurements of the milk powder at different dispersion pressure (**red**: 30kPa, **green**: 150kPa, **blue**: 300kPa). Note that the result gets finer with increasing pressure, which means that the particles are better dispersed (upper graph). Dispersion can be monitored by saving and evaluating individual images (Fig. 2, right side). The lower graph shows the sphericity of the particles as Q_3 distribution. The particles are less round when measured at low dispersion pressure, agglomerates typically have a very irregular shape. However, it is not always advisable to use the highest possible dispersion pressure, because sample consumption is higher and particle breakage might occur.

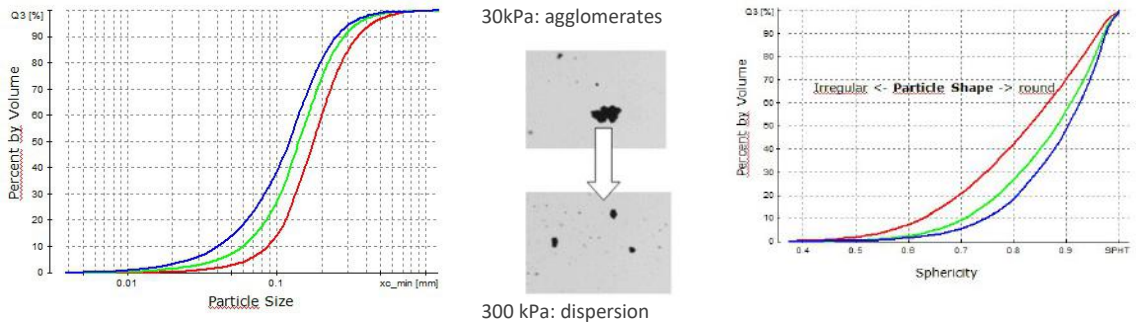

Fig. 2: *Milk powder measured with the CAMSIZER X2 in dry mode at different dispersion pressure. The result gets finer with increasing pressure. Agglomerates are broken up as the pressure is increased.*

CAMSIZER X2 measurement principle

In Dynamic Image Analysis, the particles move with the help of gravity, compressed air or dispersed in liquid through the measuring field. A light source illuminates them from one side while a camera takes their picture from the other side. The software evaluates the shadow projections of the particles to determine the size distribution of all particles of the sample in a very short time. The CAMSIZER X2 can analyze more than 300 images per second, each image containing a large number of individual particles. The measurement result is therefore based on a very robust dataset.

The maximum dynamic measuring range, i.e. the difference between the smallest and largest detectable particle, is substantially extended by using two aligned cameras with different magnifications. A high resolution (ZOOM) camera detects small particles in a small measuring field. A camera with lower resolution but a wider field of view (BASIC camera) simultaneously detects the larger particles.

The CAMSIZER X2 can be equipped with different dispersion modules for wet or dry measurement. The results shown in this application note have been acquired with the X-jet dry dispersion module which uses an air flow to disperse the particles.

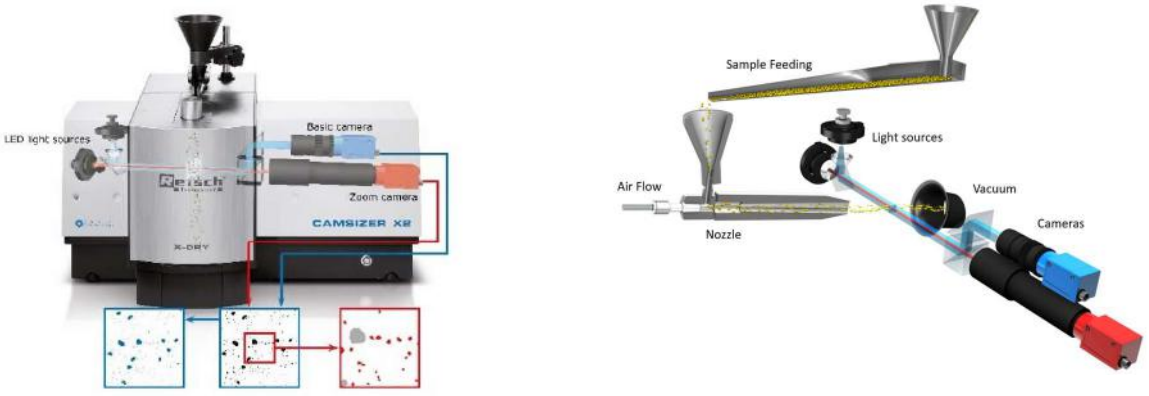

Fig. 3: *The CAMSIZER X2 dynamic image analyzer with dual camera technology (left). The X-Jet dry dispersion module of the CAMSIZER X2 guarantees effective, yet gentle disperison (right).*

CAMSIZER X2: benefits at a glance

- Only 2-5 minutes measurement time
- Less manpower required
- Wet measurements using water, alcohol, organic solvent, brine, vegetable oil
- Dry measurement with air-jet dispersion 0-460 kPa, free-fall option
- Higher resolution than sieving or laser diffraction
- High sample throughput
- Excellent reproducibility
- Large sample quantity per measurement provides a robust dataset
- Objective, independent of operator
- Higher sensitivity for oversize particles than laser diffraction
- Shape analysis possible
- Easy to use
- Low maintenance, robust design

For further information please contact us at:

www.microtrac.com