

PARTICLE SIZE DISTRIBUTION (μm)

Particle size distribution was determined by laser diffraction using the Malvern Scirocco 2000 Mastersizer. Tabular results are presented as the size of the particles (μm) at different percentiles of the distribution curve (d). At d(0.1) i.e. the 10th percentile, 10% of the volume of flour particles are the indicated size (μm) or lower, at d(0.5) i.e. the 50th percentile, 50% of the volume of flour particles are the indicated size (μm) or lower, and at d(0.9) i.e. the 90th percentile, 90% of the volume of flour particles are the indicated size (μm) or lower. This is illustrated in Figure 1.

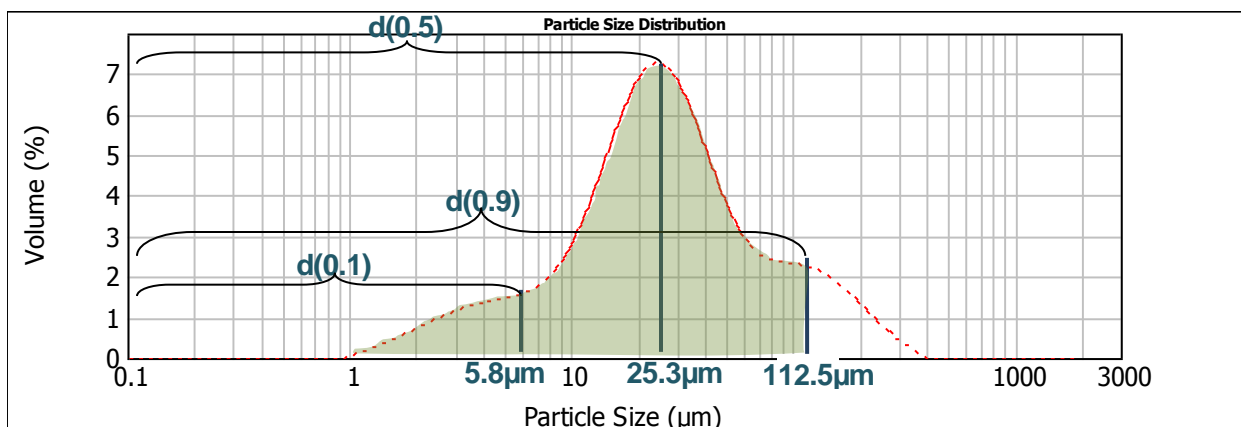


Figure 1: Illustration of a particle size distribution curve

The particle size distribution of flours describes both the range of the particles of the flour as well as the overall average particle size of the flour. These characteristics are important because they affect the functional properties of flour including but not limited to water absorption capacity, foaming, emulsification, pasting properties and starch damage and colour.

VOLUME WEIGHTED MEAN (μm)

Using the Malvern Scirocco 2000 Mastersizer, volume weighted mean was determined by laser diffraction. Volume weighted mean compares particles on the basis of weight, and indicates the mean size of the particles that make up the bulk of the sample volume. Volume weighted mean is most useful when wanting to know the size of the coarse particles that comprise the greatest part of the sample.

PROTEIN (% , dry weight basis)

Protein content was determined using the LECO FP-528 according to the method of Williams et al (1998). A nitrogen conversion factor of 6.25 was used to determine protein content.

ASH (% , dry weight basis)

Ash content was determined according to AACC method 08-01.01, Ash-Basic method. Ash is the measure of the overall mineral content of a food.



TOTAL STARCH (% , dry weight basis)

Total starch content was determined according to AACC method 76-13.01, Total starch assay procedure (Megazyme amyloglucosidase/ α -amylase method) using the Megazyme total starch assay kit. Starch content contributes to functional properties such as pasting properties which includes viscosity measurements.

TOTAL DIETARY FIBRE (% , dry weight basis)

Total dietary, soluble and insoluble fibre was determined using AOAC method 991.43.

PASTING PROPERTIES (Rapid Visco Units RVU, unless otherwise indicated)

The Perten Rapid Visco Analyzer (RVA) was used to determine the starch characteristics of the flours. The method measures the pasting properties of the flours under a controlled increase in temperature while being exposed to constant shearing conditions.

- Peak viscosity is the maximum viscosity during the heating cycle.
- Hot paste viscosity is the minimum viscosity observed during the heating period.
- Breakdown is the difference between peak and hot paste viscosities.
- Final viscosity is the viscosity at the end of the test.
- Setback is the difference between final and hot paste viscosities.
- Peak time (min) is the time at peak viscosity.

STARCH DAMAGE (%)

A Megazyme starch damage assay kit was used to enzymatically evaluate starch damage following the AACC Method 76-31.01. Starch damage is calculated and reported as a percentage of flour weight on an “as is” basis. Starch damage can contribute to functional properties such as water absorption capacity. However, too much starch damage results in the flour being able to absorb but not retain water and may contribute to issues during processing as well as in end-product quality.

WATER ABSORPTION CAPACITY (g water/g flour)

Water absorption capacity was determined according to the method of Beuchat (1977) with modifications. Water was added to the flour sample which was then vortexed and allowed to rest before being centrifuged. The water absorption capacity of flour is an important functional property, especially when the food product requires the development of dough. Determining optimal water absorption for food products is important in producing end-products of high quality and reducing processing problems.

OIL ABSORPTION CAPACITY (g oil/g flour)

Oil absorption was determined according to the method of Beuchat (1977) with modifications. Canola oil was added to the flour sample which was then vortexed



and allowed to rest before being centrifuged. The oil absorption capacity of a flour is an important functional property in fried foods.

FOAM CAPACITY & STABILITY (%)

Foam stability was determined according to the method of Sathe et al (1982) with modifications. Flour was mixed with water and then aerated via whipping. The height of the foam was recorded. To determine stability the height of the foam was recorded after the indicated time intervals. The foaming properties of a pulse flour is important in whipped products such as meringues and foam based cakes, whereas in products such as beverages and dressings, the production of foam is undesirable.

EMULSIFYING ACTIVITY & STABILITY (%)

Emulsification activity and stability was determined according to the method of Yasumatsu et al (1972) with modifications to pH adjustment and sample and solution quantities. Emulsification properties of a pulse flour are important in food applications such as beverages, dressings and sauces.

COLOUR (CIELAB)

Colour was analyzed using a Minolta CR-310 colorimeter using a D65 illuminant according to manufacturer's instructions. Parameters measured were L* which is a measure of darkness (0) to lightness (100), a* which is a measure of greenness (-) to redness (+) and b* which is a measure of blueness (-) to yellowness (+). Flour samples were prepared as a flour and water slurry according to AACC official method 14-30.01, Agtron color test for flour with respect to flour weight, volume of water, mixing time and waiting time.

REFERENCES

- AACC International. Approved Methods of Analysis, 11th Ed. Method 08-01.01.
Ash- Basic method. Approved November 3, 1999. AACC International, St. Paul, MN, U.S.A. <http://dx.doi.org/10.1094/AACCIntMethod-08-01.01>
- AACC International. Approved Methods of Analysis, 11th Ed. Method 14-30.01.
Agtron color test for flour. Approved November 3, 1999. AACC International, St. Paul, MN, U.S.A.
<http://dx.doi.org/10.1094/AACCIntMethod-14-30.01>
- AACC International. Approved Methods of Analysis, 11th Ed. Method 76.13.01.
Total starch assay procedure (Megazyme amyloglucosidase/ α -amylase method). Approved November 3, 1999. AACC International, St. Paul, MN, U.S.A. <http://dx.doi.org/10.1094/AACCIntMethod-76-13.01>
- AOAC International. (1995). Official Methods of Analysis. Method 991.43. Total, soluble and insoluble dietary fiber in foods. Gaithersburg, MD, U.S.A.
- Beuchat, L.R. (1977). Functional and electrophoretic characteristics of succinylated peanut flour protein. *Journal of Agriculture and Food Chemistry*, 25: 258-261.



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- Rawle, A. (n.d.). Basic principles of particle size analysis.
[http://www.malvern.com/malvern/kbase.nsf/allbyno/KB000021/\\$file/Basic_principles_of_particle_size_analysis_MRK034-low_res.pdf](http://www.malvern.com/malvern/kbase.nsf/allbyno/KB000021/$file/Basic_principles_of_particle_size_analysis_MRK034-low_res.pdf). Accessed September 17th, 2013.
- Sathe, S.K., Deshpande, S.S. and Salunkhe D.K. (1982). Functional properties of lupin seed (*Lupinus mutabilis*) proteins and protein concentrates. *Journal of Food Science*, 47: 491-497.
- Williams, P., Sobering, D., and Antoniszyn, J. (1998). Protein testing methods at the Canadian Grain Commission. In *Wheat Protein, Production and Marketing. Proceedings of the Wheat Protein Symposium*. (pp.37-47). Saskatoon, SK: University of Saskatchewan Press.
- Yasumatsu, K., Sawada, K., Moritaka, S., Misaki, M., Toda, J., Wada, T., & Ishii, I. (1972). Whipping and emulsifying properties of soybean products. *Journal of Agriculture and Biological Chemistry*, 36: 719-727.