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Particle Size Distribution (PSD) Explained

WHY DO WE CARE ABOUT PSD?

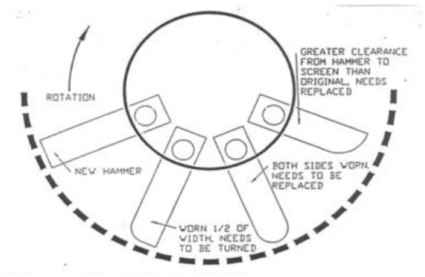
Particle size reduction has a great impact on the efficiency of feed utilization. Decreasing particle size improves the digestibility of nutrients by increasing surface area. This allows enzymes of all types in the pig's digestive lumen greater access to the nutrient matrix inside the material being broken down. Digestibility of the protein, energy and other nutrients is generally improved with smaller particle size and this should not be understated. This improved digestibility should result in an improved feed conversion which is the primary sought after financial benefit. In addition, particle size reduction can influence how uniformly feed is mixed and can assist in reducing the amount of segregation, which occurs during storage and delivery of the feed. It should be noted that the benefits of providing a well balanced diet could be completely lost if adequate care is not taken during particle size reduction of the feed ingredients.

THE 1ST STEP IS MAKING SURE YOU'RE TAKING A PROPER SAMPLE

Before a PSD can be determined, it is vital that a representative sample is obtained. In the case where the material to be analysed is flowing, the sample must be withdrawn from the stream in such a way that the sample has the same proportions of particle sizes as the stream. The best way to do this is to take many samples of the whole stream over a period, instead of taking a portion of the stream for the whole time. In the case where the material is in a heap, scoop or thief sampling needs to be done, which is inaccurate: the sample should ideally have been taken while the powder was flowing towards the heap. After sampling, the sample volume typically needs to be reduced. The material to be analysed must be carefully blended, and the sample withdrawn using techniques that avoid size segregation, for example using a rotary divider. Particular attention must be paid to avoidance of loss of fines during manipulation of the sample. Average costs for samples can range from $15 - $60 per test.

WHAT TO LOOK OUT FOR AND ADJUST

- Reducing the RPM's generally produces a lower percentage of fines, although the time required to grind is increased. The number and condition of the hammers will affect fineness.
- Moisture content of the grain determines particle size. Low moisture grain will shatter more, increasing the amount of fines as compared to normal moisture content grains which are 10-12 percent. Increasing the flow rate of grain through the hammer mill will tend to increase particle size, but may result in more variation of particle size.
- Grain sorghum and wheat tend to shatter more than corn.
- The key areas to look for on the analysis are the average particle size in relation to your goal. The shape of the graph/curve (bell-shaped or normal) and should not indicate results higher than 10% percent of the sample being too coarse (>1850 microns) or too fine (<300 microns).
- Items that will influence feed uniformity and increase mixing time include: particle size and density, moisture content of the grain, equipment wear, RPM of the mixer, overfill of the mixer, and buildup of fats and oils. Larger particle size or coarse ground grain may increase the mixing time and increase the amount of ingredient separation.



Did You Know?

Over an 18-month period, Kansas State University (KSU) researchers collected 674 one-half pound feed samples from producers. Analysis of the samples found that only 65% were in the recommended 600 to 800 micron range for particle size. The optimum range is 650 to 750 microns.

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Guidelines for Particle Size in Swine Diets

	microns (μ)
Nursery Phase	500 - 600
Grower Phase	550 - 650
Finisher Phase	550 - 650
Breeding Sows	650 - 800
Gestation Sows	650 - 800
Lactation Sows	900 - 1100
Boars	650 - 800
Gilt Developer Unit	550 - 800

WHAT IS A MICRON?

A unit of length measuring:

- One millionth of a metre
- One thousandth of a millimetre (0.001 mm)
- 0.000039 inch

RISKS ASSOCIATED WITH MANIPULATING THE PSD TOO FAR

Grinding the feed too fine includes these risks,

Increased power usuage for the grinder, increased wear and tear on the equipment, increased feed transit time in the gastrointestinal tract which has multiple effects, reduced feed conversion, increased erosion of the lining of the stomach otherwise knows as ulcerations (not associated with erysipelas and swine fever), increased risk of enteritis, constipation, increased dust, auger and feeder plugging, and rectal prolaspes.

Grinding the feed too coarse includes these risks,

Reduced ADG and ADFI, reduced FCR, substantial separation in the finished feed which includes vitamins minerals and amino acids, feeder setting issues, selective picking at the feeder, and increased wastage.

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