

Particle Size Distribution – Not all that hits the fan sticks to the screen.

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In the last issue of *OK Pork Partner*, I described how the solids content of manure slurries can be either dissolved or suspended. A suspended solid is a particle that can be removed by settling. Settling depends largely on particle size. The official definition of Total Suspended Solids (TSS) is the mass percentage of total solids particles that cannot pass through a filter with 1.5 micron (1/17,000 inch) openings.

A 1.5 micron particle is a very tiny object. In soil, particles come in three sizes: clay, silt, and sand (Figure 1). Pieces larger than sand are called gravel. If a clay particle was a dime, a silt particle would be a Frisbee, and if a silt particle was a baseball, a sand particle would be a basketball. I suppose gravel would be a small car. A particle passing through a 1.5 micron filter is a large clay particle, perhaps a marble to a sandy basketball.

Very rarely are all the suspended particles in slurry the same size. Usually, particles are an assortment, or a distribution, of different sizes. To determine particle size distribution, a wet slurry sample is passed through a series of sieves with progressively smaller openings. The sieves are arranged so the first sieve has the largest holes; the second sieve has slightly smaller holes, the third sieve's holes smaller still, etc. A common arrangement is to stack five or six sieves with openings ranging from 5,000 to 100 microns. The particle size distribution is displayed as a graph of the particle sizes passing through each sieve such as the one shown in Figure 2.

Figure 2 shows two things about particle size distributions. First, what comes out of a pig resembles what goes in. The manure from pigs fed fine ground corn had smaller suspended

solids than those fed cracked corn. More fine ground corn manure particles passed through each sieve size. Second, a little more than half of the particles in both diets passed through all the sieves. These sieves (250 to 3,500 microns) represent particle sizes ranging from medium sand to very small gravel -- beach balls to Volkswagen beetles, plus tree trunks if you consider hog hair. If more than half of all solids passed through the 250 micron sieve, then more than half of the total solids in these manure slurries are fine sand sized and smaller.

A particle size analyses can tell how much of the suspended solids are likely to be removed using gravity screens. If a particle does not pass through the sieve, it is retained by the sieve. Notice how the numbers for % passing and % retained in Figure 1 add up to 100. If we had a screen with 2,000 micron openings, we would expect about 22% of the cracked corn manure and 12% of the fine ground manure to stay on the screen. Actually, this is the best we can expect. There are lots of adjustments to make on commercially available screens: slurry flow rate, screen angle, screen wash flow rate, etc. Unless the screen is set up correctly, much of the slurry passes over -- not through -- the screen.

To read more about suspended solids please go to, our website, <http://osuwastemanage.bae.okstate.edu/>, click on Factsheets, and read *Particle Size Distribution of Manure and Byproduct Slurries*. More information on solids removal can be found in *Solids Content of Wastewater and Manure* and *Solids Separation in Swine Manure Handling Systems* on the same webpage.

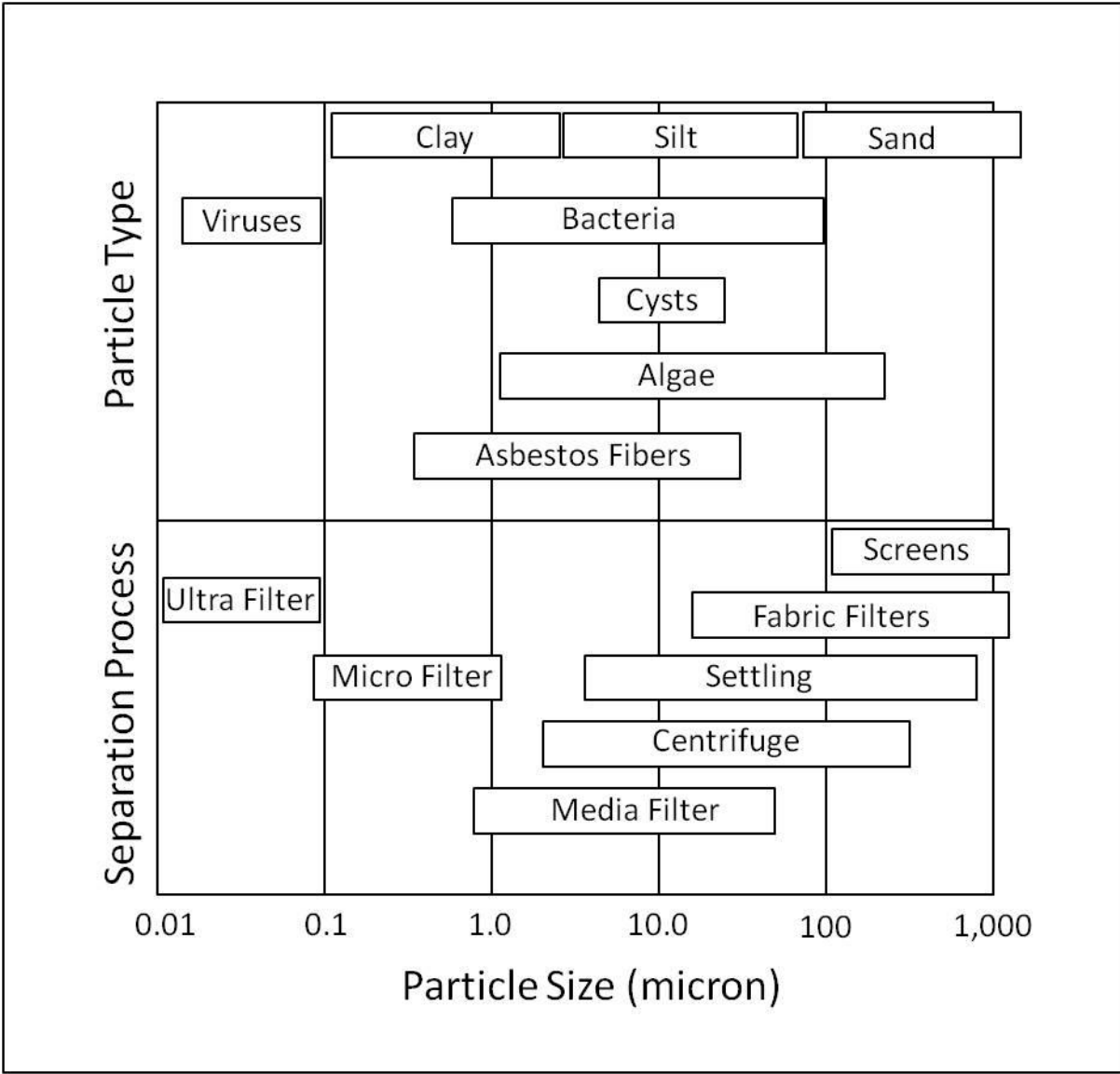


Figure 1. Size of common particles found in manure liquids and slurries (from OSU Factsheet BAE-1759, *Solids Content of Wastewater and Manure*).

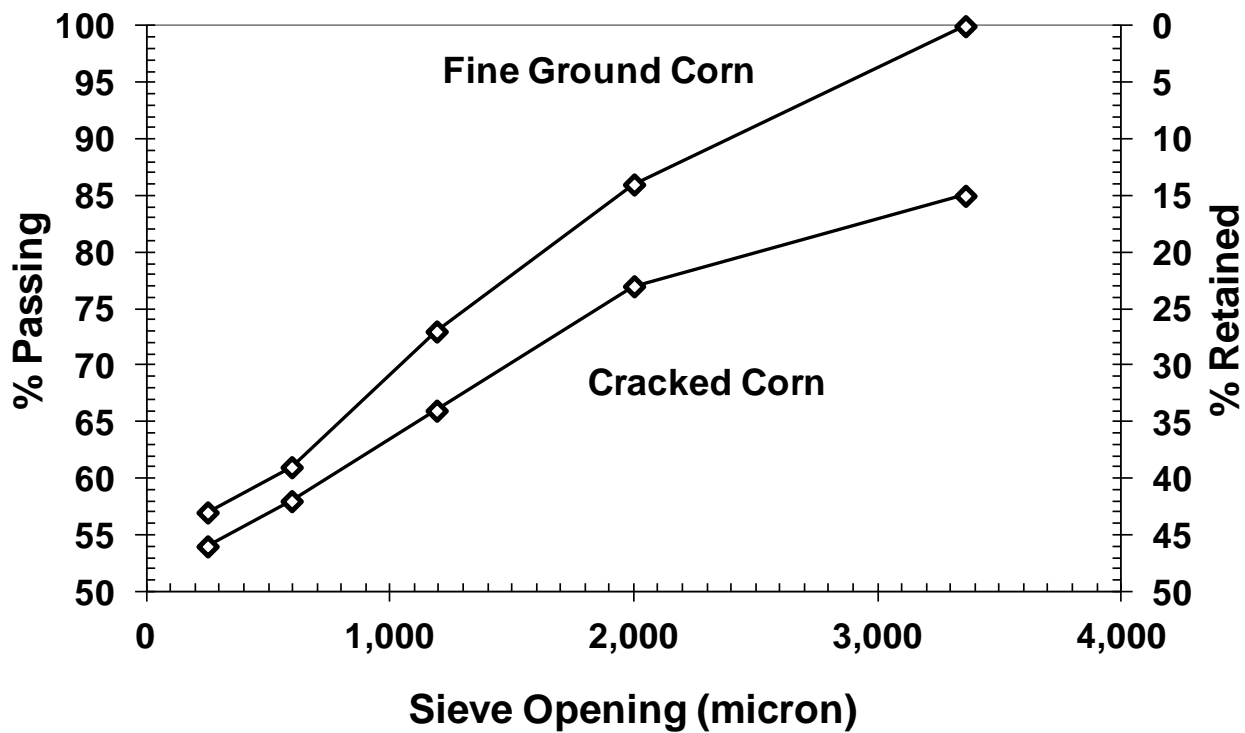


Figure 2. Particle size distribution of swine manure slurries resulting from two diets. (From OSU Factsheet, *Particle Size Distribution of Manure and Byproduct Slurries*)