

## **How Can a Liquid be Solid? Don't Keep Me in Suspense**

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A couple of years back, I wrote in *OK Pork Partner* that manure exists as either a liquid or slurry on Oklahoma swine farms. If manure is liquid, how can it be solid? It can't, but liquid manure may contain solids.

"Solid" is a state of consistency. "Solids" are what's left in a ceramic cup after liquids have evaporated from a sample.

Believe it or not, this is actually how solids are defined in *Standard Methods for the Examination of Water and Wastewater*. The full definition specifies that the sample must be dried in a ventilated oven at 103° C for 24 hours. The residue remaining is solids, Total Solids (TS) to be exact.

There are a number of "test defined" parameters in wastewater analysis. Another one is Suspended Solids. In everyday speech, a suspended solid is a visible speck floating in water. *Standard Methods* defines Total Suspended Solids (TSS) as the amount of material that will not pass through a filter with 1.5 micron holes (1.5 millionths of a meter), dried for 24 hours in a 103° C oven.

The test for TSS may seem arbitrary, but it has a practical use. Why 1.5 microns? Well, a two micron diameter particle is about the smallest we can expect to settle out of still liquids. The TSS test, therefore, tells us the portion of TS we can remove by settling. Of course, some particles do pass through the filter. These we pronounce Total Dissolved Solids (TDS), but are they all dissolved? Not really.

Figure 1 shows the size of common pollutant particles found in wastewater, and the processes used to remove them. Silt and sand are TSS, but clay particles are TDS. Cysts are TSS. Some bacteria and algae are TSS, some are TDS. Does this mean the bacteria that pass through the filter are dissolved? No. It means they are smaller than 1.5 microns, and it's unlikely you will remove them by settling. To remove particles smaller than 1.5 microns you need to use another method, such as a media filter (sand) or micro filter (similar to the kind you can buy and attach to your faucet).

How do you figure the amount of TSS removed using a fabric filter? This requires another test called Particle Size Distribution (PSD), and that is the subject of another article.

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

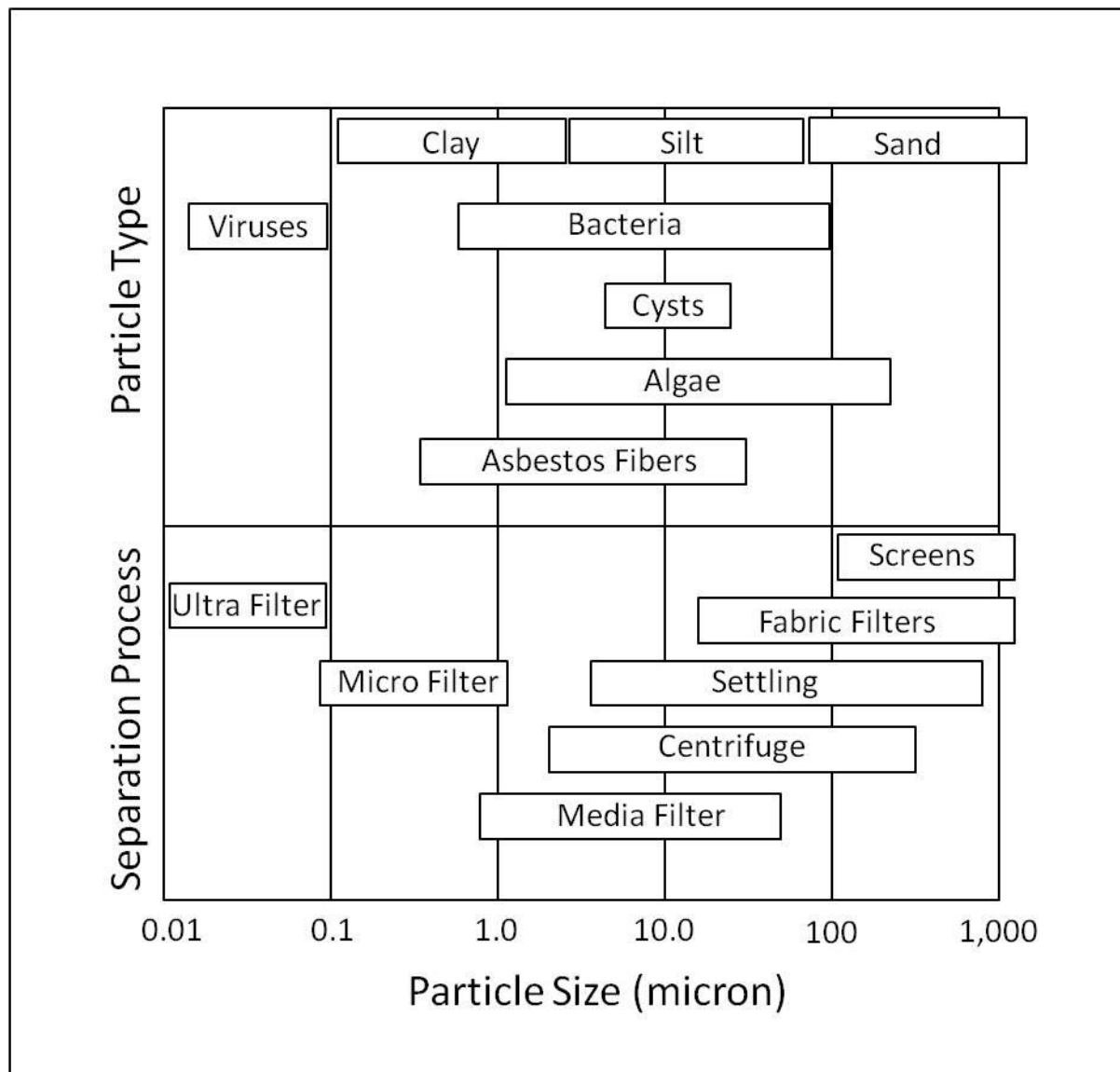


Figure 1. Size of Common Particles found in Manure Liquids and Slurries (from OSU Factsheet BAE-1759, *Solids Content of Wastewater and Manure*).