

The Challenges of Sand-Manure Separation

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Sand is the gold standard for a freestall base and bedding. Maintaining a bed of loose sand, 6 inches minimum in depth:

- Enhances cow comfort and increases lying time (the sand bed conforms to the shape of the body components of the lying cow),
- Contributes to good udder health and clean cows (a clean, dry surface is always there for the lying cow), and
- Improves cow footing (large amounts of sand end up on the alley surface).

Choice of freestall base and bedding is a critical decision and should reflect management style and goals (milk yield, udder health, leg and feet condition). The only logical reason for avoiding sand for freestalls, other than sand not being available, is the difficulty it adds to the manure system. Sand in the manure is abrasive to handling equipment and tends to settle in trenches, pipes, tanks and storages. Experience shows that you should not put sandladen manure in pits, pipes, trenches or tanks which you cannot access easily in order to remove the sand or grit that settles.

Rule Number One...

Allow manure that contains sand or grit to enter only those places where sand or grit that separates and settles can be removed easily.

Managing sandladen manure with daily haul or long-term concrete storages operated as skim-and-haul, etc. are time-proven methods. Additional water is usually excluded from the sandladen manure to avoid dilution and unintentional separation and settling of the sand.

Separating sand from the sandladen manure is an option for those who want the benefits of bedding freestalls with sand without the aggravations that accompany sand in the

manure. The separation options depend largely on the reasons for removing the sand from the manure stream in the first place. Reasons may be:

- To remove most, but not all of the sand from the manure stream with no intention of using the removed sand for bedding— Removal is just enough to reduce downstream problems.
- To reclaim sand clean enough for reuse as freestall bedding—To take advantage of cost savings.
- To create a “sand-free” manure stream and reclaim sand for freestall bedding also— Planning on further manure treatment; e.g., installing an anaerobic digester.

Actually, this list of reasons mirrors the progression of our research on sand separation. We started with the goal of removing sand from the manure stream to reduce problems with damage to equipment and sand settling in storage. The removed sand was not perceived as having any use, so the fact that some manure solids stayed with the sand was deemed unimportant. Then we discovered that we could reclaim sand without manure solids being included. The fact that small quantities of sand remained in the manure stream was tolerated. Now we are seeing interest in manure treatment technologies that demand a “sand-free” manure stream. Typically, these farms want to use the reclaimed sand for freestall bedding, also. In other words, no sand should remain with the manure stream and no manure solids should be left with the reclaimed sand.

Achieving the last goal presents a complex challenge. The conditions most ideal for removing sand from manure are not the same as the conditions most ideal for reclaiming clean sand for reuse. Subsequently, systems in the third category must provide a high degree of control and likely will require more than one stage of separation. Sand-manure separation is not as simple as it first appears!

Separation involves three components—sand, water and manure. We can impact the type of sand and “quality” of the dilution water. Dilution water is added to sandladen manure, at a minimum ratio of 1:1 (water to manure). The mixture is agitated vigorously, washing the sand grains and manure solids free of mucous. They then act as discrete particles in the dilute mixture and settling occurs. The more dense sand grains settle to the bottom. Manure solids tend to settle as well. But, with just the right amount of buoyancy provided by moving water or injected air, the manure solids remain in suspension and are carried off with the manure stream.

Simply put, a difference in settling rates—sand grains and manure solids—is the basis for separation. Sand grains settle faster than manure solids. Generally speaking, this includes all methods of separation currently in use—mechanical separators, cyclones, sand lanes, and settling aprons and basins.

For these separation and settling techniques, the minimum requirements are:

- High quality dilution water containing few manure solids
- A dilution rate of at least 1:1, dilution water to sandladen manure
- A velocity component for buoyancy to keep manure solids in suspension.

In addition, choice of sand is important to the success of separation. Because sand grains vary in size and shape, they settle at different rates—coarse sand settles faster than fine sand. The same variability applies to manure solids which vary in size, shape and density—and settling velocity. Unfortunately, fine grained sands tend to settle at the same rate as some of the manure solids. Thus, separating fine sand from manure presents a challenge.

The degree of challenge accompanying fine sand depends upon our reasons for separating sand from the manure in the first place. Do we want to remove just enough sand to reduce downstream problems? A **moderate** challenge, some fine sand left in the manure stream is tolerable. Or, do we wish to reclaim sand for reuse as bedding? A **demanding** challenge, requiring that negligible manure solids remain in the separated sand. Some fine sand remaining in the manure stream is OK. Or, is the goal to reclaim sand for bedding as well as to create a “sand-free” manure stream for further treatment? A **complex** challenge, implying that the reclaimed sand is clean and that no sand remains in the manure stream.

Separating sand from sandladen manure is a straightforward process. The challenge ranges from moderate to complex, the end use of the sand and the manure stream dictating the level of control that must be built into the system. In the latter case, more than one stage of separation may be required. Regardless, any separation system, to be effective, requires time and attention and an operational plan that is followed consistently.

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