

Screw Press Solid-Liquid Separation

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Overview

Solid-liquid separation (SLS) partitions barn effluent (mixture of manure, bedding, wastewater, etc.) with TS content greater than 3% into two effluent streams; a “separated solids” stream (20 to 35% dry matter) and a “separated liquid” stream (1 to 8% dry matter).¹ SLS can be accomplished on-farm by passive and mechanical methods. Farms may utilize SLS for reducing the pumping head of liquids, nutrient management, liquid volume reduction, pre-treatment for subsequent manure treatments, volatile solid reduction of liquid storage, solid removal for covered storage, or for bedding solids reclamation.

The process

Inclined/rotary screens are used when manure is substantially diluted from a flush system, while screw press separators are used for less dilute slurries. Screw press separators use an auger to move raw or digested manure under pressure through a perforated cylindrical screen. The liquid fraction moves through the screen while the solids are retained and pushed out the end (Figure 1). The pressure created in the cylinder by the gate is controlled with weights or hydraulics, with the solid dryness determined by the amount of pressure.

An example of the separation of slightly diluted manure is shown in Figure 2, and the distribution of total mass (TM) and total solids (TS) in the separation process is provided. The separated solids still contain 70 to 75% liquid in this example. Approximately 40 to 70% of total solids and 40 to 50% of all volatile solids were

captured through screw press separation.¹ This range is dependent on the efficiency and type of separation system, liquid effluent recycling through the farm, and the screen size utilized.¹ The majority of the mass flow is always with the liquid stream.

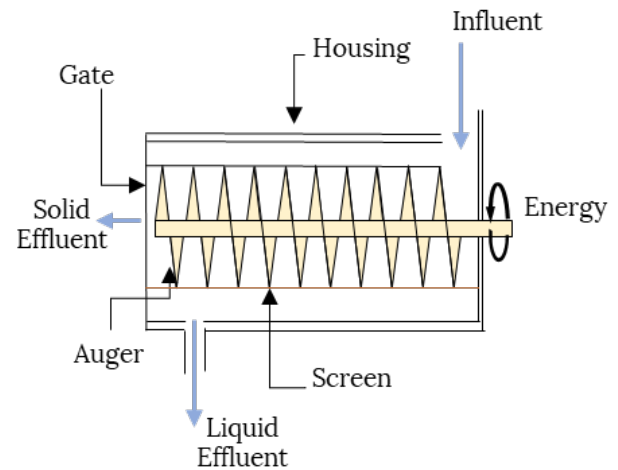


Figure 1. Cross-section view of a screw press SLS.

Economics

The capital cost includes the equipment and building to house the operation. The main operating costs are energy to operate electric motors and replacement of screens and augers that wear out. Additional operation costs are daily maintenance required for managing the screw press and stacked solids. Separated solids require daily maintenance and additional storage space.

Reduction of volume entering the liquid storage ponds allows for immediate cost saving on hauling of liquid manure. The reduction of solids in the separated liquids allow for easier pumping over longer distances, lowering need to haul.

This technology can produce a bedding material for on-farm use and the potential to be sold off-farm.

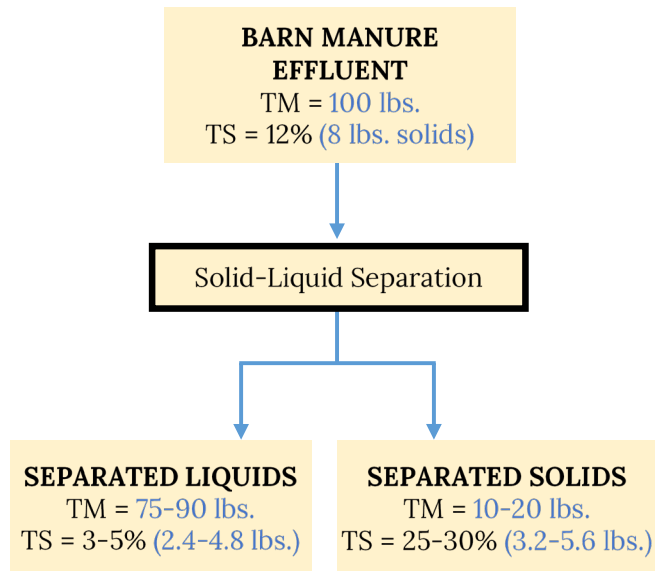


Figure 2. Solid-liquid separation total mass and total solids. Blue text shows example partitioning of solids.

Benefits

Screw press technology is a mature technology with application across multiple industries, including agricultural manure treatment. SLS systems can be found on thousands of dairy farms across the US. Adoption of this technology has been widespread due to its many benefits:

- Volume reduction of 5 to 15% less volume entering the lagoon which reduces costly lagoon clean out and preserves volume for liquid storage.²

- “Reduced GHG emissions from long-term storages of 30 to 40% because some of the volatile solids are captured and prevented from going into the storage, with subsequent solids storage more readily managed for aerobic conditions and control of GHG emissions occurring under anaerobic conditions”.²
- Separated fiber can be used for bedding.
- The solids / fiber fraction of the manure can be stacked and handled dry.
- If fiber is land applied, the carbon content and moisture retention of the soil is improved.
- Nutrient separation: about 10 to 30% of the mass of the original manure nutrient mass is contained in the separated solids.²
- Solid-liquid separation provides the opportunity for farms to more easily pump manure long distances thus reducing manure hauling with tanker trucks.

Considerations

It is important to consider the properties of the influent manure. SLS systems do not work well with dilute manure (below approximately 3% TS) or raw manure containing sand bedding.¹

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¹ Goch, C.A. Inglis, S.F. Czymmek, K.J. 2005. *Mechanical Solid-Liquid Manure Separation: Performance Evaluation on Four New York State Dairy Farms – A Preliminary Report*. ASAE 05-4104.

² <https://www.newtrient.com/Catalog/Technology-Types/Screw-Press>