

Waste Separation

(Waste Separation Facility 632)

Watch Your Step



What Will Be Covered?

- Why do waste separation?
- Terminology
- Overview of gravity systems
- Overview of mechanical systems
- What about sand?

How To Decide

- Landowner Goals and Objectives
- Advantages/disadvantages of waste separation
- Addressing resource concerns
- Working with multiple waste streams
- Distance to land application areas
- Added value products
- \$\$

What is it?

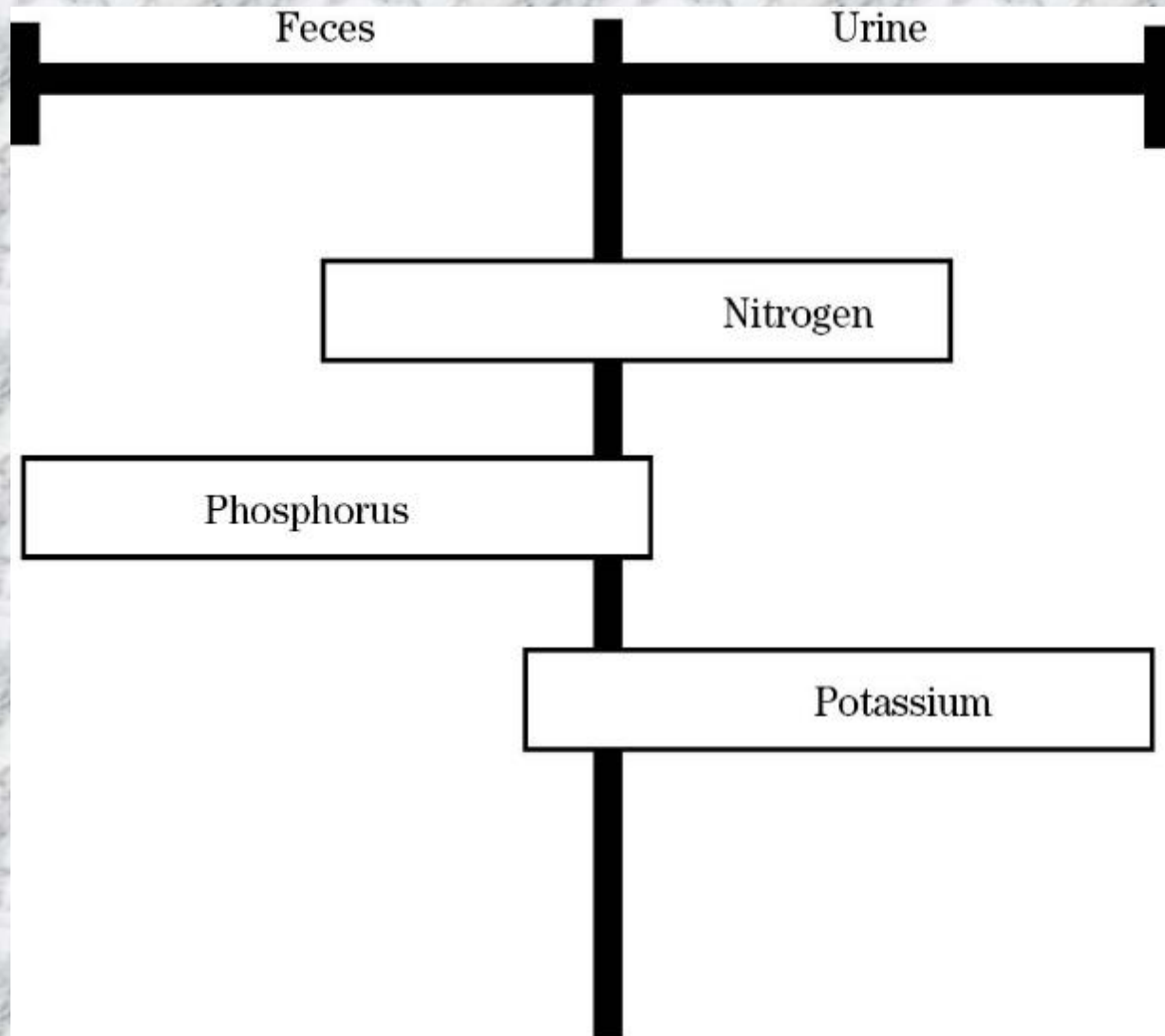
- Solid/liquid separation is simply the removal of manure solids (manure, bedding, other material) from the liquid waste stream

Goal – To partition solids, liquids and nutrients

Why Separate Solids?

- Manure fibers can be used for other purposes (bedding, composting, etc)
- Improved manure handling (not hauling water)
- Nutrients can be better utilized (put where needed)
- Organic load is decreased if additional treatments are desired (reduced odor – extend life of a lagoon/potentially reduce size).
- Minimal volume reduction in storage facilities

Distribution of Nutrients Between Feces and Urine



Solids Accumulation





Land Application



Potential Downside?

- Multiple waste streams (solid and liquid)
- Increased costs
 - Increased operating cost
 - Increased initial or capital costs
 - Energy requirements
- Increased management
 - Time and labor
 - Complication of system

What is the Right Choice?

- Need to understand the farm operation
- Need to understand the various unit processes
 - Physical
 - Chemical
 - Biological
- Most are physical processes
- Some apply chemical and biological processes to assist in the separation

Separation is accomplished by exploiting differences in

- Size ✓
- Density ✓
- Solubility
- Particle charge

Waste Separation Facility (632)

	Total Solids Capture Efficiency
Solid/Liquid Separators	
Static Inclined Screen	10-20%
Inclined Screen with Drag Chain	10-30%
Vibratory Screen	15-30%
Rotating Screen	20-40%
Centrifuge	20-45%
Screw or Roller Press	30-50%
Settling Basin	40-65%
Weeping Wall	50-85%
Dry Scrape	50-90%
Geotextile Container	50-98%
Membranes	60-99%
Sand Settling Lanes	50-70%
Mechanical Sand Separator	50-95%

Ways to evaluate liquid-solid separation performance

1. Concentration reduction
2. Mass removal efficiency

Soon to be Published Document

Solid-Liquid Separation Alternatives for Manure Handling and Treatment

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Separation Processes

- Gravity
 - Settling basins
 - Settling channels
- Mechanical
 - Screens
 - Centrifuge
 - Filtration/Pressing
- Chemical Addition

Gravity System Settling Basin



Gravity Systems



Inclined Screen



Drag Flight Screen





Rotating Screen



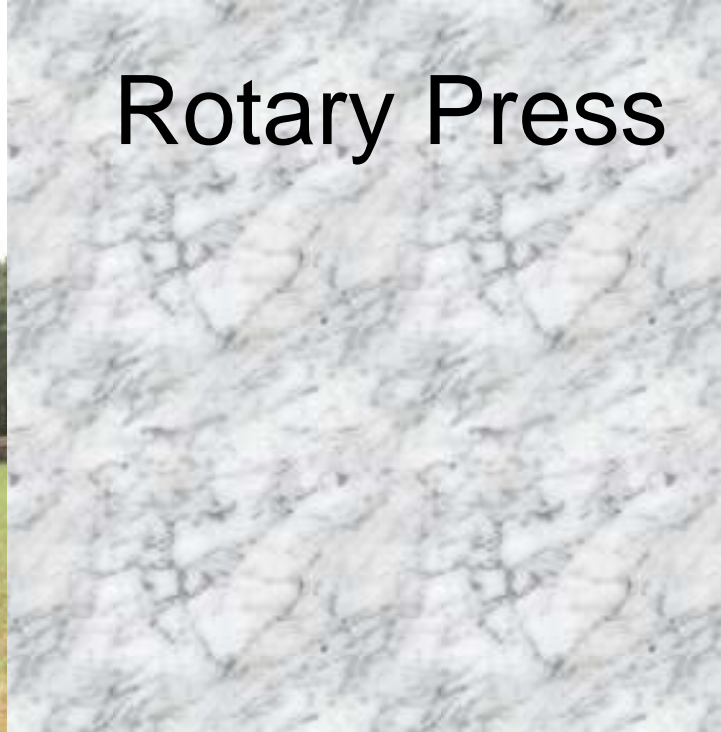
Centrifugal Centrifuges and Hydrocyclones

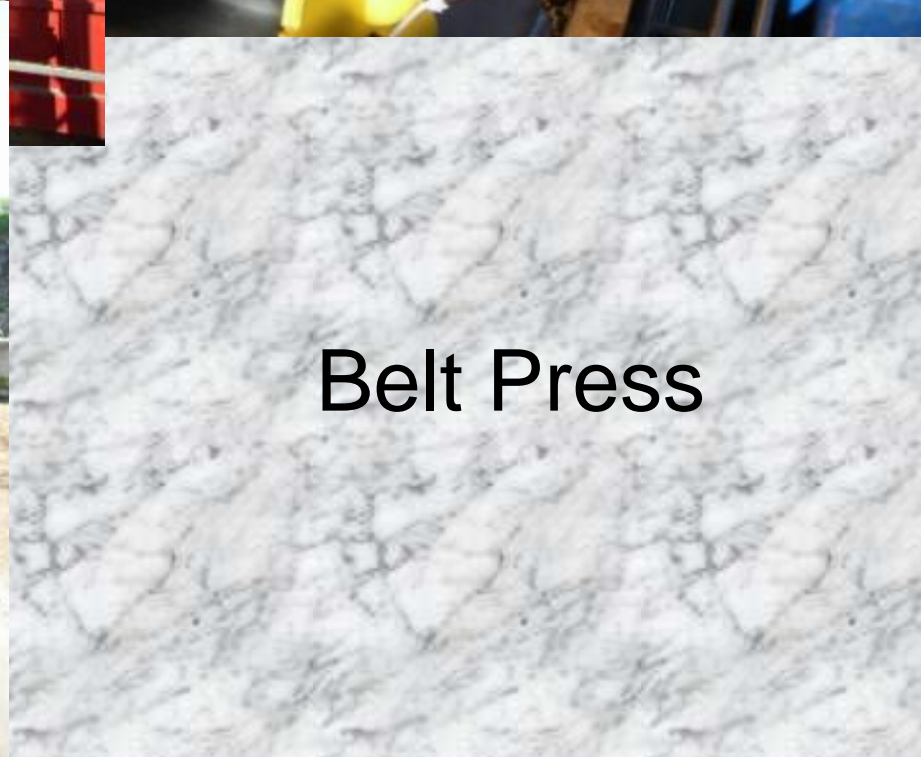


Screw Press



Rotary Press

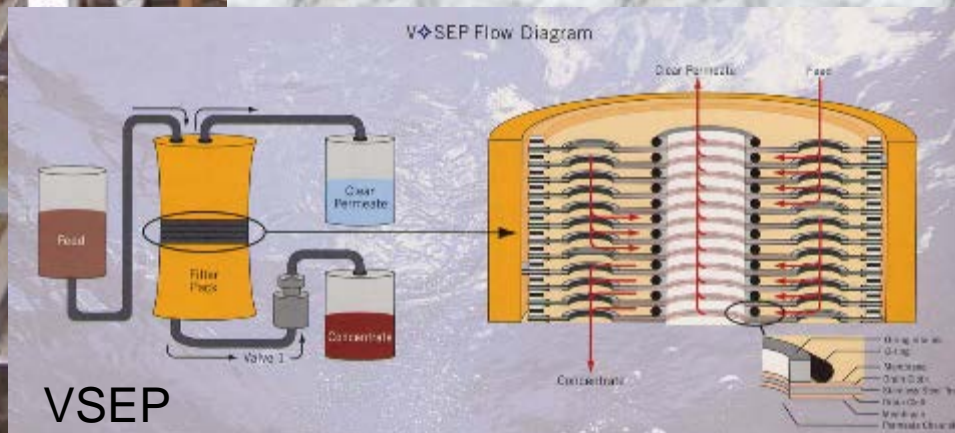




Belt Press



Membrane Technologies



Sand Systems

- Cow comfort
- Settle in storage facilities
- Abrasive issues with mechanical equipment
- Design of Dairy Flush Systems and Sand Settling Lanes (May 13, 2015)

Mechanical Sand Separation



Sand Settling Basin



Sand Lane



Chemicals To Enhance Solid-Liquid Separation

1. Use of a variety of chemicals can increase concentration reductions of TS, VS, P to 70% to 90%.
2. Cost of chemical and proper injection are main concerns.
3. Land and containment cost should be considered in the economics.

Illustration of Jar Test





Geo-Bag



Bio-Bag







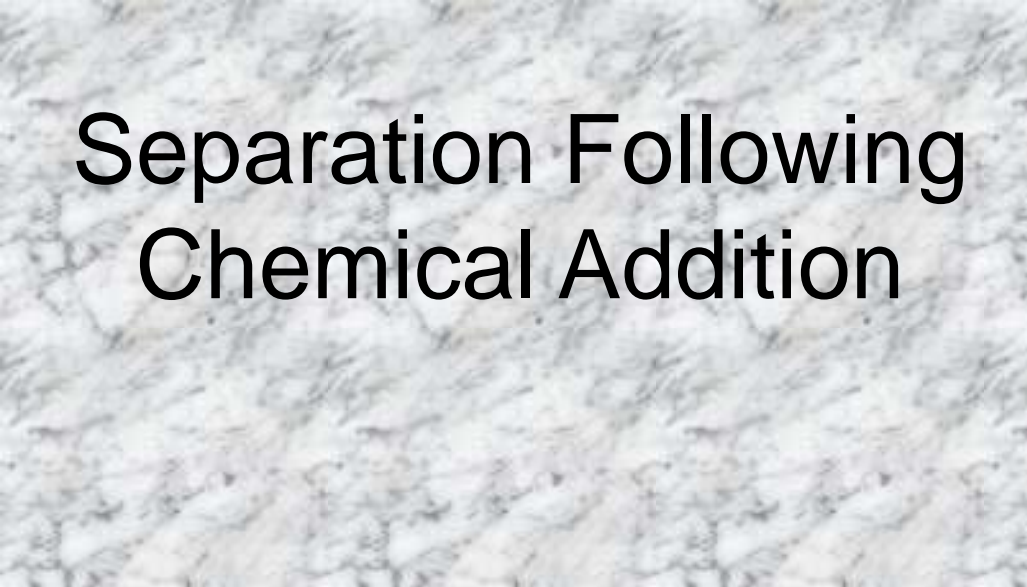
Solid Separation by Chemical Addition





**Dissolved Air
Flotation (DAF)**

Separation Following Chemical Addition



Projects With Solid Separation Processes (Systems)



Flush Dairy



Flush Dairy



Solid Separation System (Sand and Organic)







Screw Press Operation and Maintenance

Sand Settling Basin Sizing and Operational Concern



Value Added Products



Fiber board



Compost



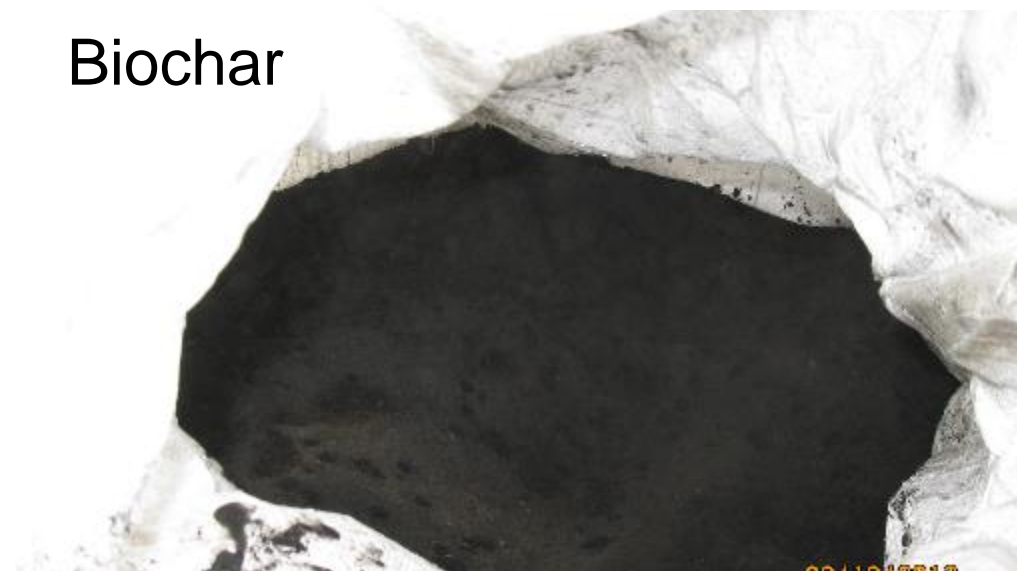
Nursery Planters



Soil Amendment

Value Added Products

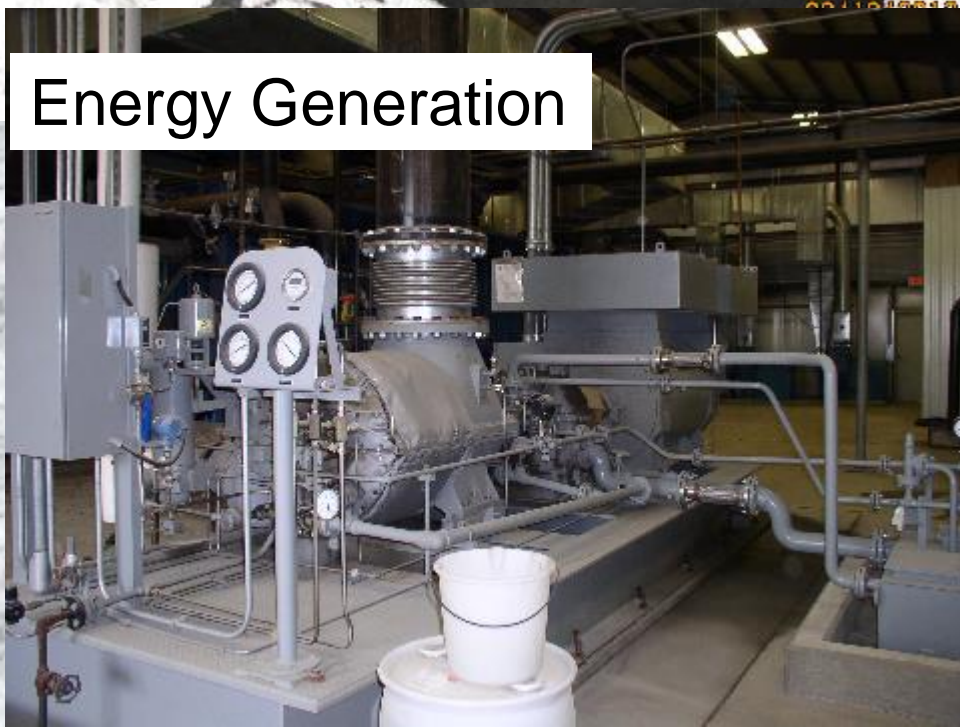
Biochar



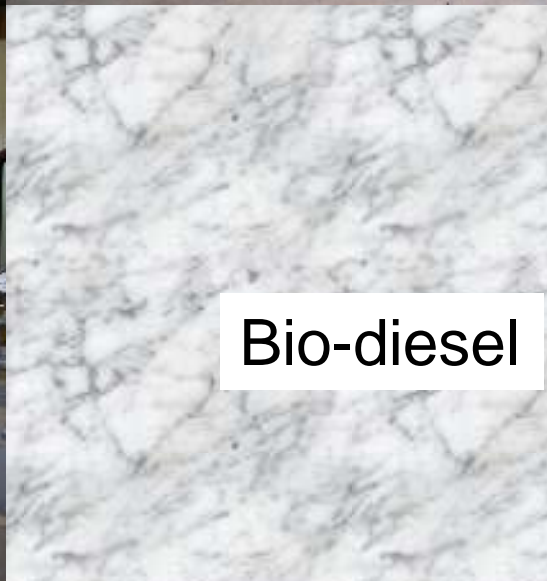
Bio-oil



Energy Generation



Bio-diesel





Sand



Bedding
Material



Manure Solids

Conclusions

- There are several options for addressing manure management issues
- There is no single solution which will address all manure management and solid/liquid separation concerns
- Option selections are dependent on a number of factors such as: objectives, land availability, nutrient loads, available markets
- Several processes may need to be combined to meet the desired outcome – system approach
- Many of the options may require significant financial investment

The End

Questions?

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