

Managing Manure for Optimum Digestion

Don Hilborn Ron Fleming

Mar 11, 2006

London AD Workshop

What ideally does the Digester need to operate

- Continuous Uniform Input of manure
 - Concern regarding cleaning agents, antibiotics, excess water, sand etc
- Continuous or Seasonal Uniform Input of other materials if used

Ideal Livestock Structure

- Something that removes manure from barn on almost a continual basis
- Best- Gutter Cleaner, Alley Scrapers, or other daily removal systems (especially with ability to separate washwater and urine)
- Middle- Bi-weekly/Monthly Removal System,
 - small stop and flow gutters
 - Short term manure packs
- Worst – 6 month + storage
 - Long term liquid storage directly under barn
 - Long term manure packs

BEST: The belt-based housing system

- Excludes Urine, Washwater
- Concentrates Organics



Worst : Long Term Storage Under Barn

- Don't build any more
 - Not enough cost difference to justify lack of future options
 - Environmental concerns
 - Human and livestock safety issues that must be considered
- What to do with existing
 - Keep Slats,
 - Convert tank to a flow system –gravity, alley scraper, belts
 - Cover Slats,
 - Install alley scraper
 - Convert to short term pack (esp. beef)
 - Concern re structural issues
 - Possibility of using tank for effluent storage
 - Concern re gas management issues

Handling Solid Manure

- Most digesters work in liquid mode
- Must liquefy materials
 - Recycle effluent
 - Run effluent through a separator then recycle
 - Add dilution materials (could be off farm source materials)
 - 25% in
 - 40% removal via Digestion gives 15%
 - 50% removal in digestate gives 7.5% DM in recycling effluent
- Bedding Material should be reseasonably digestible
 - Straw -good
 - Wood chips – difficult –floating issues
 - Sand - impossible

Handling Solid Manure

- Operation in Solid Mode
 - Enclose Solid Material
 - Initial Aerobic Mode 5-8 days
 - Heats up to 40 degrees C uses up Oxygen
 - Switches to Anaerobic Mode Produces Biogas
 - Remove Enclosure Switches to Aerobic Produces Compost
- Challenge is in Enclosing Solid then Removing Resulting Material
- Paper by Bergmair, Austria

Sand Bedding and Limestone Feed Additives

- Sand Bedding 30 kg/cow/day
- Expected to drop in digester
- Negative
 - Fills a typical digester in 100 days
 - Systems to pre remove sand expensive, may add water and are not 100% effective, still fills digester
- Positive
 - Sand is separated in bottom of digester
 - Need a method to remove
 - Mechanical system
 - Vacuum system
- Limestone Feed Additive
 - Same Issues however Volume is not as large
 - May be best idea is to increase depth of digester, allow to build up and remove once every 5 years

Nitrogen Content in Manure

- Concern that high nitrogen content in manure will inhibit AD process
- Poultry and Swine Manures have high inorganic N content
- Possible Solutions
 - Digester may adapt to high NH_4 contents
 - Mixing with other manures, off farm source materials or energy crops with lower NH_4 content
 - Pretreat manure to separate Urine (Sloped Belts)

Centralized Plant

- Advantages include better control, more efficient process, closer to energy users
- Main Disadvantage is movement of materials in and out of plant
- Pipeline
- Concentrate Organics and move to central plant
 - Separator at Farm
 - Need a high efficiency separator
 - Denmark using a Centrifuge
 - Denmark testing a USAB (upflow anaerobic sludge bed) system to treat liquid portion at farm
 - Paper by Hartman, Denmark



Summary

- Prefer a steady supply of fresh concentrated manure that is lower in Nitrogen
- Inorganic matter such as added sand will go to bottom and will have to be eventually removed
- Mixing in other manures, energy crops or off farm sourced organics will allow a wider range of manure to be used