Nutrient Treatment Technologies for Manure Using Solid Separation Methods

October 26th, 2011

Bob Monley, General Manager
Farm Pilot Project Coordination, Inc.

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Application

- **Data - 699 animals, flushed dairy farm in Florida.**
- **No sand used for bedding.**
- **Raw waste solids captured with inclined screen and removed from the farm.**
- **Effluent after screening was applied to hay crop for irrigation purposes.**
- **Farmer wanted to double his dairy size but land limited. Nitrogen was limiting nutrient.**

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Objective

- Recover the solids

  - Settleable solids (large -fine particles)
  - Suspended solids

- Treat effluent

- Understand nutrient change with size/amount

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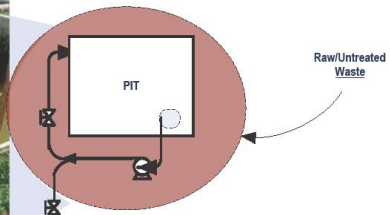
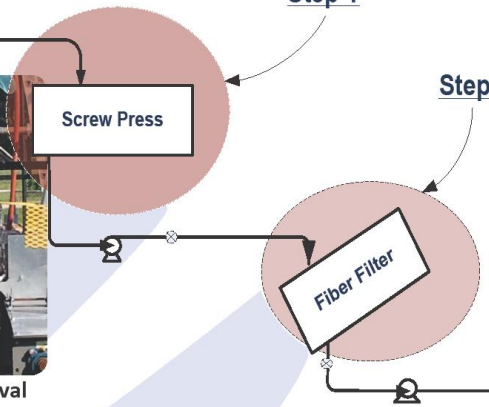
Solid Separation Process for Wet Waste

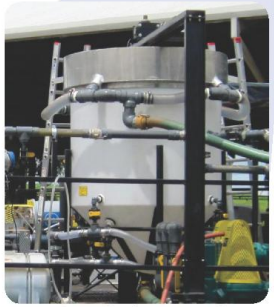
Pit storage of untreated dairy waste



STEP 1 - Coarse fiber removal



STEP 2 - Large particle removal



STEP 3 - Chemical separation using Ferric Sulfate to remove fine particles

Results:

95% Solids Captured
90-95% *P* Removed
50% *N* Removed

Outputs:

Solids to be removed off farm

Clear water to be reused on farm

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Controlling Variability of the Waste Stream

Total Solids Data

Test	Pit Slurry	Screw Press (Step 1)	Fiber filter (Step 2)
	mg/Liter	mg/Liter	mg/Liter
1	10,300	9,200	n/a
2	n/a	n/a	4,000
3	n/a	n/a	4,100
4	7,900	6,000	3,600
5	6,700	6,700	4,400
6	11,900	7,100	5,000
7	4,600	7,100	5,100
8	7,600	5,500	4,400
9	n/a	n/a	4,600
10	12,000	8,200	5,200
11	n/a	n/a	5,300
12	6,900	6,100	3,900
Mean	8,488	6,987	4,509
Standard Deviation	2,652	1,222	579
Variability in Percent	31	17	13

n/a: Data Not Collected or Rejected

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Strategy

Because of high variability of the raw dairy waste, fully characterize the waste stream:

- **Use a multi-step separation approach**
- **Employ commercially available mechanical separators when possible**
- **Minimize cost of chemical additions where possible**
- **Evaluate solids and nutrient removal at each step**

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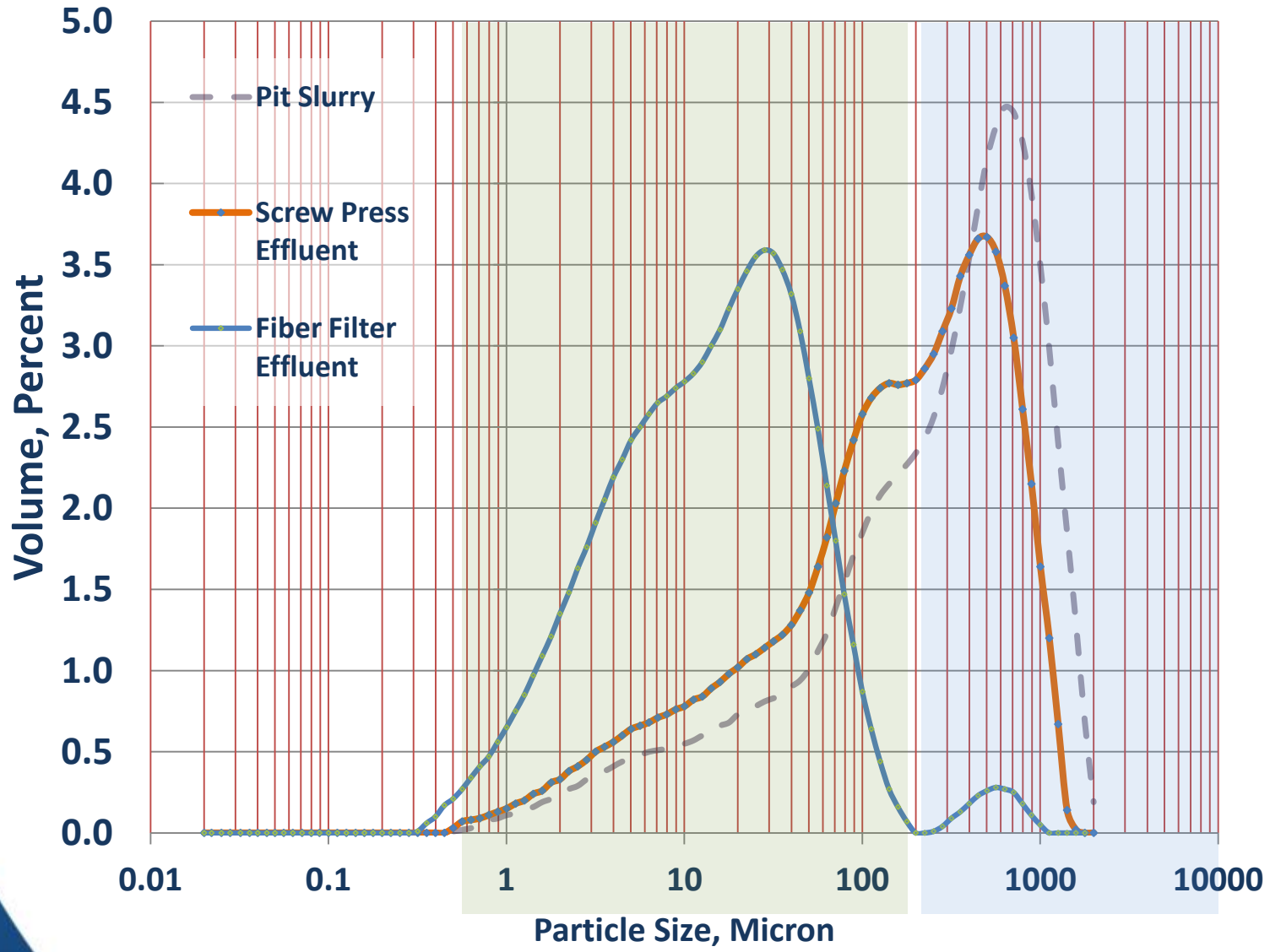
Particle Size - Characterization



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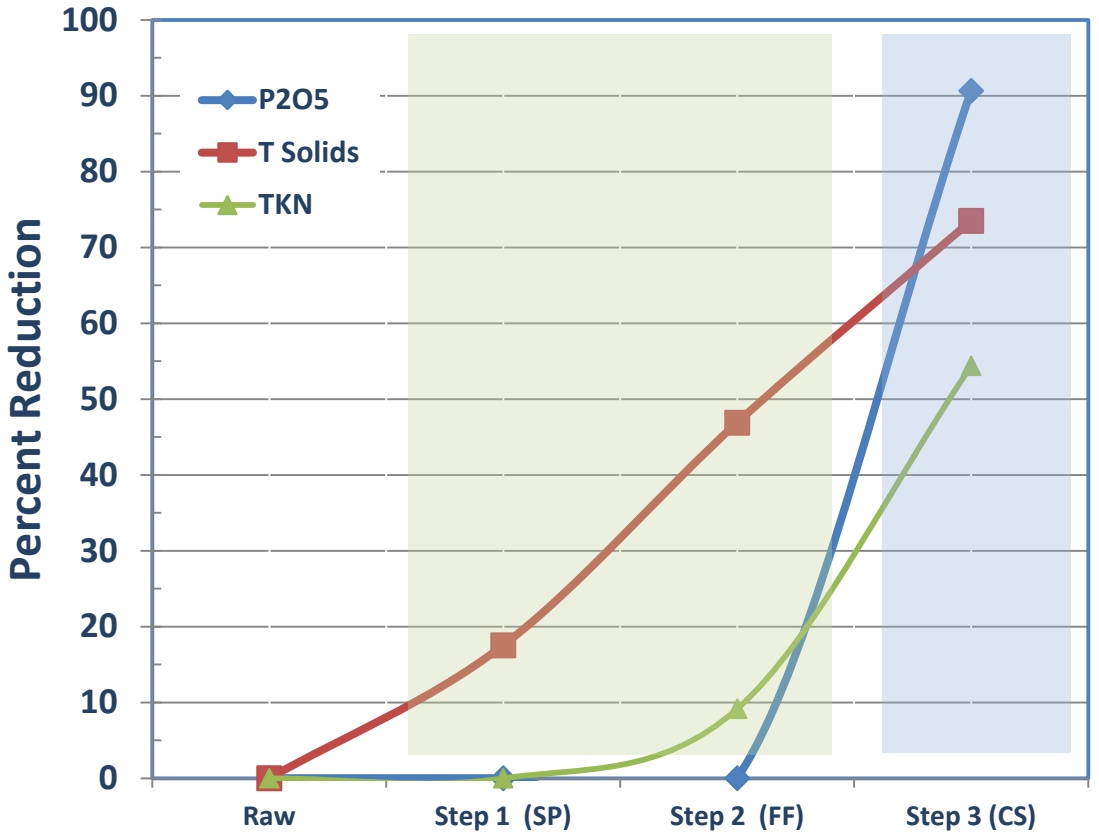
Multi-Step System's Performance



	Total Solids Concentration, mg/l	Total Phosphorus Concentration, mg/l	Total Nitrogen Concentration, mg/l
Raw (Pit Slurry)	8,500	125	428
Step 1 (Screw Press)	7,000	122	413
Step 2 (Fiber Filter)	4,500	119	388
Step 3 (Chemical Separator)	2,500	11.7	195

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In Conclusion:

- Multi step process reduces particle size of solids and variability of raw waste stream
- Treating anaerobic digestate will be easier - more stable, homogenous and should exhibit less variability
- For AD, expect combination of mechanical separation followed by a chemical separation will generate similar results and be cost effective
    - Total settleable/suspended solids by as high as 99%
    - Total Phosphorus by as high as 95%
    - Total Nitrogen by as high as 54%

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Thank you,

Any questions ?

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