

Anaerobic Digestion of Horse Stall Waste

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Outline

- Problem Definition
- Why Anaerobic Digestion?
- Objectives
- Methods
- Results
- Options For Further Study



Problem Definition

- Ocala Horse Population
 - Over 30,000 (2007)
 - 50 Pounds of manure a day/horse
- Common method of Manure Management:
 - Stockpiling:
 - Wasted resource
 - Nutrient run-off
 - Odor issues
- What are alternatives?

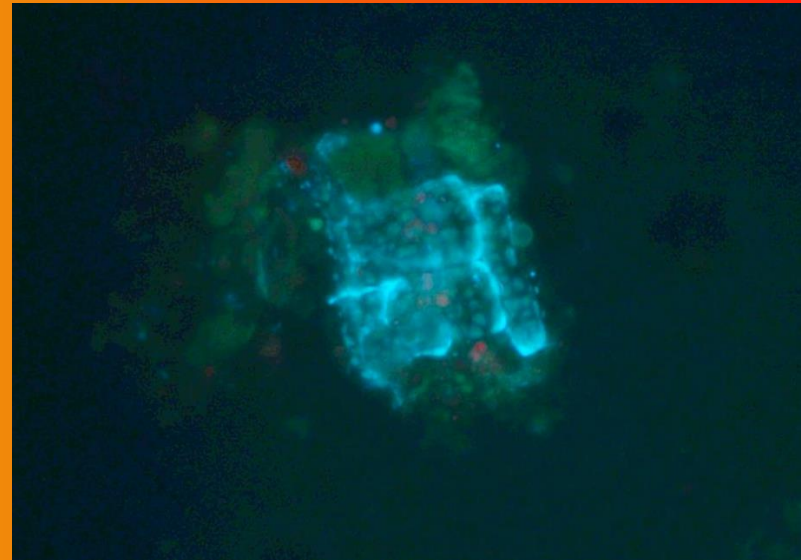




Why Anaerobic Digestion?

- Microbes break-down organic material in an oxygen free-environment
- Produces biogas!
- Effluent can be used as a fertilizer
- Manages waste and odor

Methanogens in Horse Manure





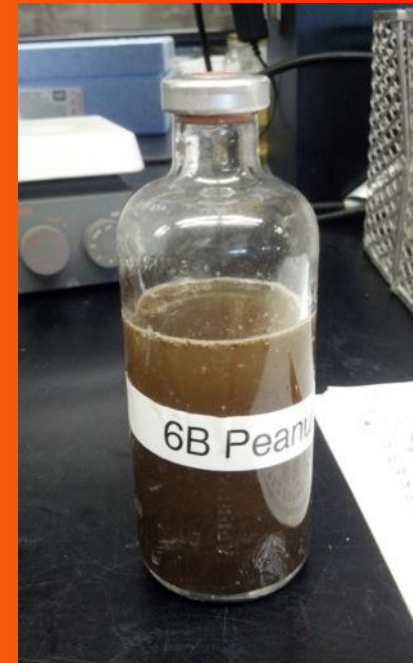
Objectives

- Determine the most digestible bedding type.
- Evaluate the solubility of bedding waste.
 - Wash Water
 - Digest
 - Fertilize
 - Solid Leftover
 - Compost
 - Gasify



Methods

- 250 mL serum bottles were filled with 200mL of inoculum and 0.4g of bedding ground to 2mm particle size.
 - Manure
 - Fresh Shavings
 - Used Shavings
 - Peanut Hulls
- Methane production was measured by displacement through saturated KOH solution





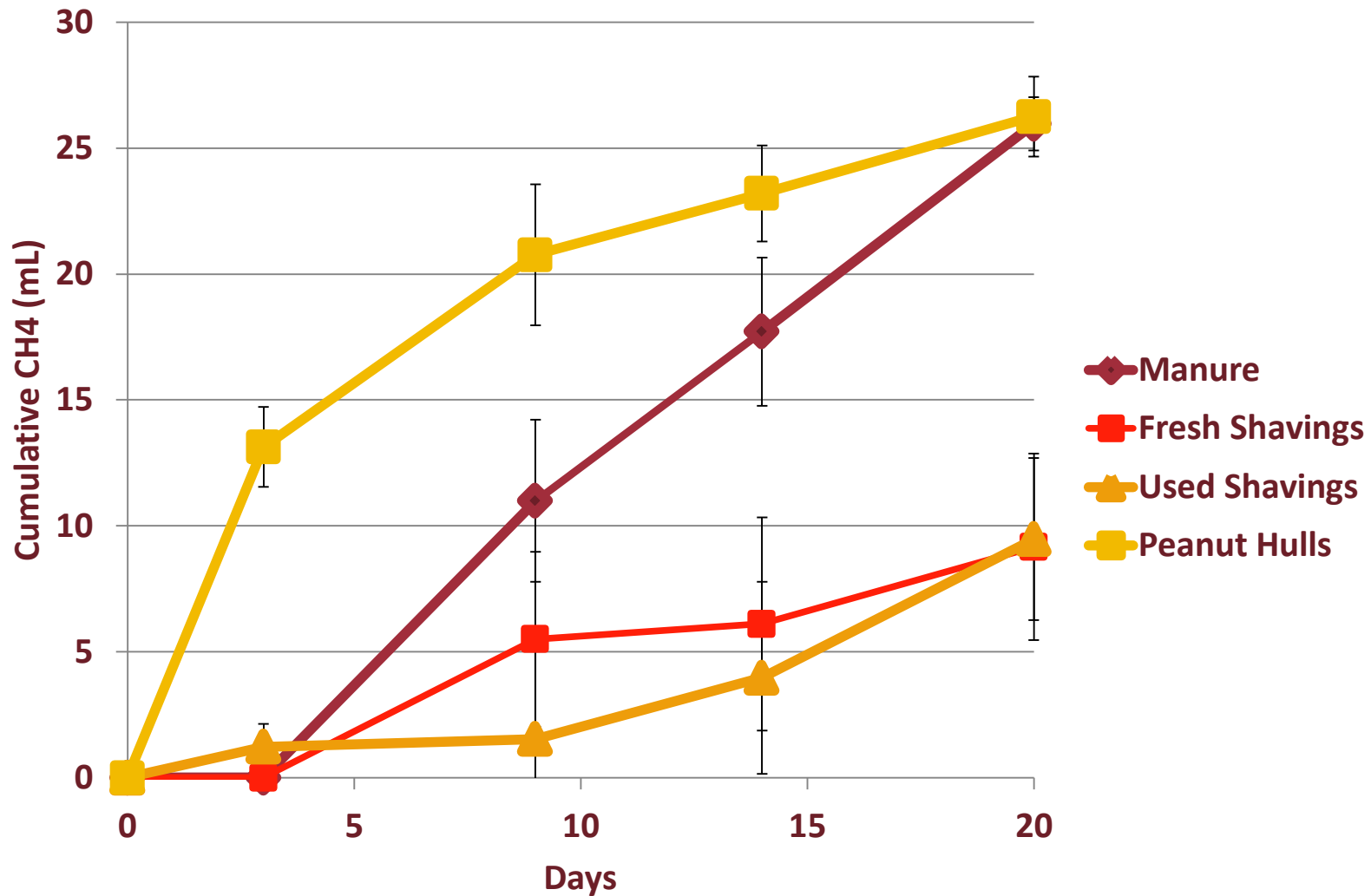
Methods

- Total Solids and Volatile Solids tests:
 - Samples were ground to 2mm and weight was recorded
 - Placed in the oven for 24 hours and weight was recorded
 - Placed in the furnace for 4 hours and weight was recorded
- Chemical Oxygen Demand (Hach)
- Materials tested:
 - Manure
 - Fresh Shavings
 - Used Shavings
 - Peanut Hulls
 - Wood Pellets
 - Corn Husks
 - Newspaper





Results





Results

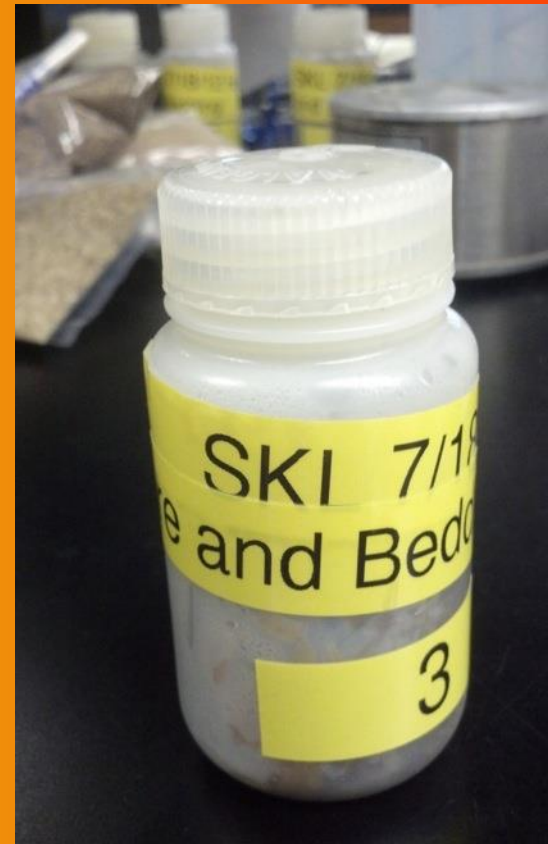
Feedstock	Total Solids	Volatile Solids	Total COD (g COD/ kg Material)	CH ₄ Estimated (mL/kg)
Manure	87%	84%	682	243
Fresh Shavings	94%	97%	406	145
Used Shavings	77%	90%	385	137
Peanut Hulls	94%	96%	996	355
Wood Pellets	96%	99%	978	349*
Corn Husks	82%	93%	387	138
Newspaper	94%	97%	997	356

*Estimated COD includes fraction of materials resistant to biological degradation (e.g. lignin)



Methods

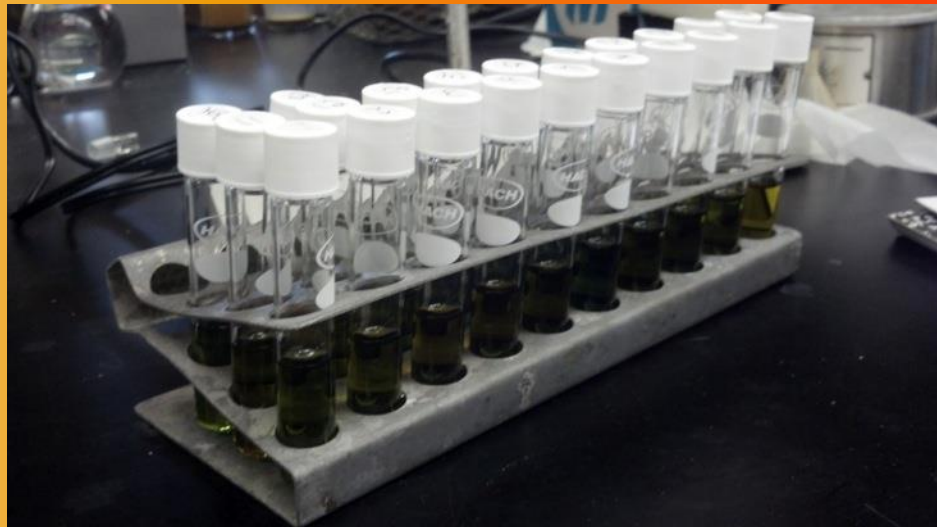
- 125 mL Nalgene Bottles
 - Filled with 12g of used shavings and 100mL of deionized water
 - Set on shaker for 1 hour
- 5 Wash Stages





Methods

- Chemical Oxygen Demand, Total Nitrogen, and Total Phosphorus (Hach).



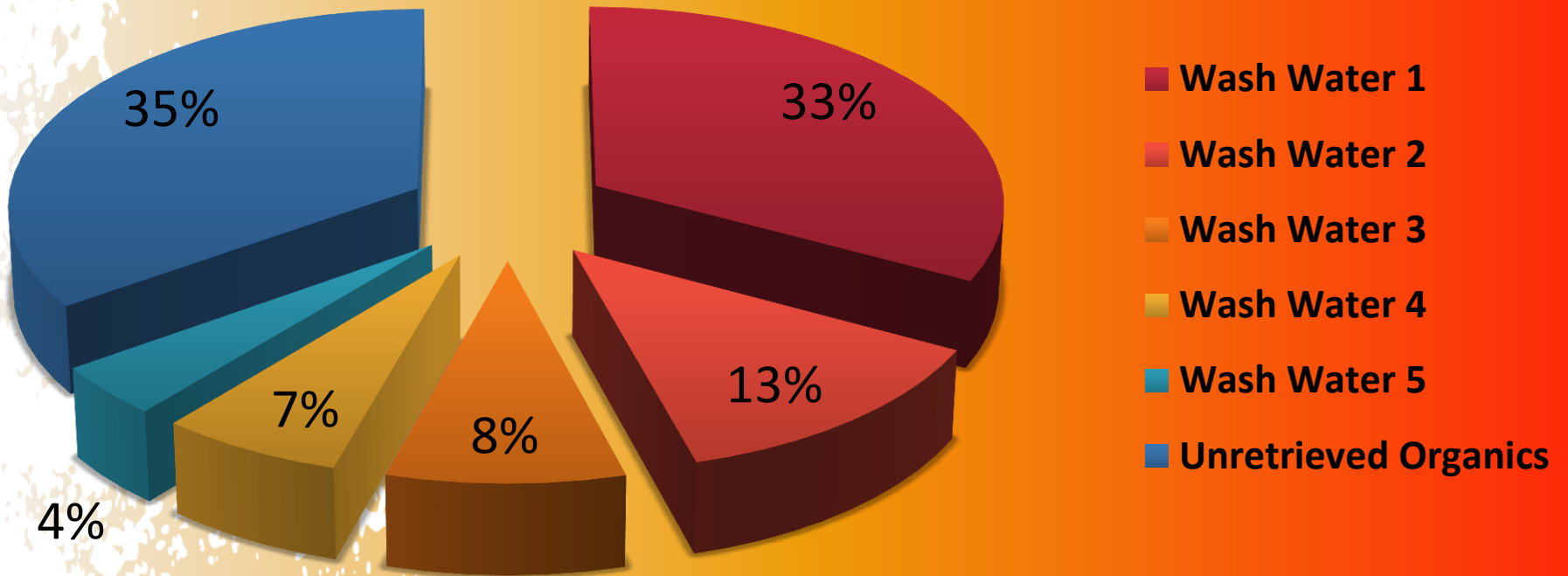


Results

Wash Stage	Total COD (mg COD/ g Used Shavings)	Estimated CH4 (ml/g Used Shavings)
Used Shavings	385	0.154
Wash Water 1	101	0.051
Wash Water 2	40	0.020
Wash Water 3	26	0.013
Wash Water 4	20	0.010
Wash Water 5	13	0.006

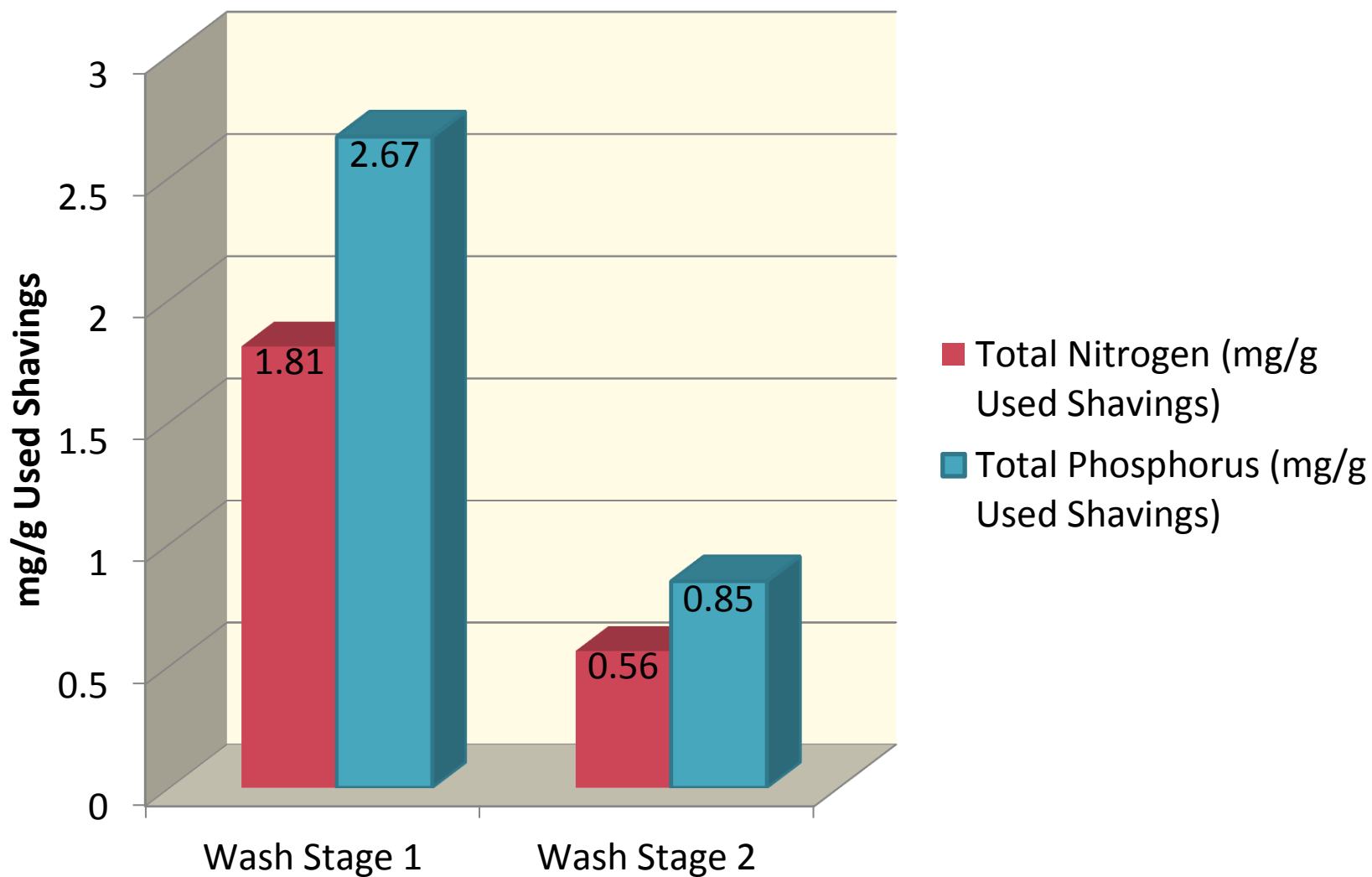


Results





Results





Options for Further Study

- Change in the ratio of water to material
- Pretreatment



Questions?