Production of Non Methane Organic Compounds (NMOCs) During the Decomposition of Refuse and Individual Waste Components Under Various Operating Conditions

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Objectives

- Develop a basic understanding of the production of NMOCs and VOCs during refuse decomposition
- Compare NMOC release under different conditions for decomposition
- Measure NMOC yields for individual waste components
- Evaluate the relationship between refuse decomposition and NMOC production
- Identify major components of NMOCs in landfill gas
- Evaluate the significance of household hazardous waste (HHW) as a contributor to NMOCs

Experimental Design

- Seven series of reactors plus a control
- Triplicate 8-L reactors
- Seeded with leachate
- Leachate recycle and neutralization at 37°C

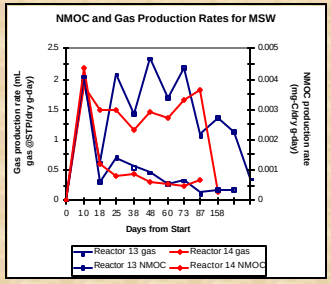
Treatments

- Anaerobic decomposition of residential food waste
- Anaerobic decomposition of a mixture of grass, leaves, and branches
- Anaerobic decomposition of a paper mixture
- Anaerobic decomposition of residential MSW
- Anaerobic decomposition of residential MSW plus HHW
  - 2g of HHW mixture added per kg of wet refuse -- nail polish remover, paint thinner, motor oil
- Residential MSW decomposed under NO_3-reducing conditions
- Residential MSW decomposed under aerobic conditions for 44 days followed by methanogenic conditions
- Control to measure background NMOC production from leachate seed

Equipment

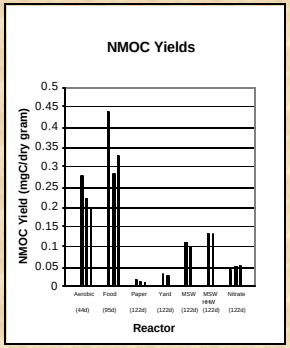
- 24 - 8 L teflon coated reactors with 1.5 L glass leachate collection vessels
- For aerobic reactors an additional port was drilled in the bottom for air flow
- The air flow system consists of an air regulator gage, 2 KOH traps (removes CO_2), DI H_2O Humidifier, 3 flow gages, 3 water traps
- 10 L and 20 L gas sampling bags with a 2 mil tedlar inner bag and an aluminum laminar cover
- Teflon coated tygon or kynar tubing

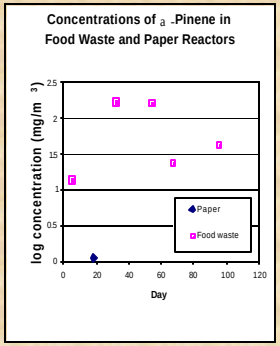
Anaerobic Reactor Design

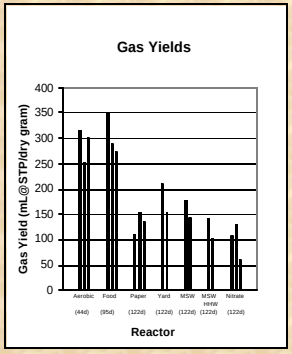


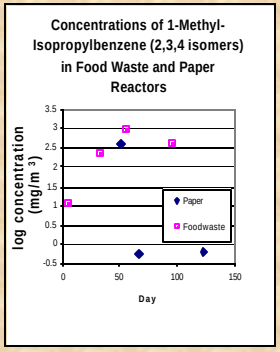
Preliminary Results

- NMOC yield from food waste is highest and the yield from paper is lowest.
  - This is consistent with the fact that paper has the most pure and narrow range of degradable organics
- Aeration resulted in the production of more NMOC relative to anaerobic MSW decomposition
- The presence of household hazardous waste appears to be a minor contributor to NMOC
- High gas yields are only roughly correlated with high NMOC yields
- Food waste has a wider array of speciated organics than paper waste
- Food waste has relatively high concentrations of terpenes (α-pinene, ß-pinene, γ-terpinene, camphene) while paper does not contain these compounds









Comparison of Volatile Organics in Food Waste and Paper (mg/m^3)

Compound	Paper (day 66)	Food waste (day 67)
1-Butanol	2.11	5.24
1-Propanol		5.55
2-Butanone	0.748	37
2-Methyl-1,3-Butadiene		0.749
2-methyl-1-butene	0.571	4.38
2-Pentanone		2.32
2-Propanol		3.11
Acetone	0.472	
α-Pinene		23.8
Benzene	0.148	
beta-Pinene		7.39
Camphene		3.08
cis-2-Pentene		0.71
Ethanol	1.61	
Ethyl Acetate		0.83
Ethylbenzene	0.399	0.394
γ-Terpinene		8.87
isobutylbenzene		1.22
m&p-Xylenes		1.42
octane		1.76
o-xylene		0.516
Pentane		2.02
t-Butanol	0.624	
Toluene	0.954	0.795

Future Work

- Specific organic compounds will be identified and quantified
- The significance of abiotic gas stripping and decomposition byproducts on NMOC yields will be studied
- Gas samples will be analyzed for carboxylic acids

Acknowledgement

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