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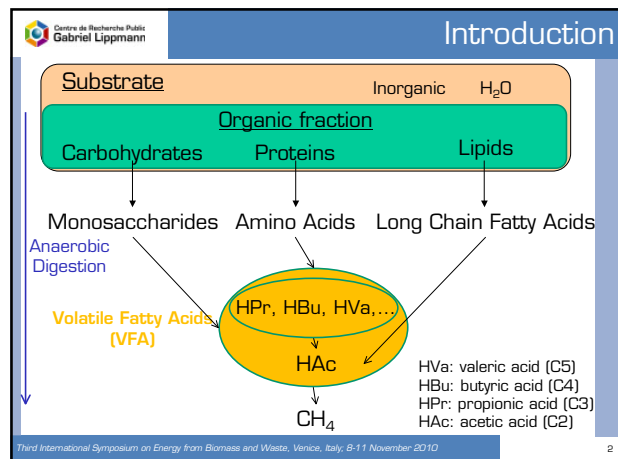
Monitoring volatile fatty acid production during mesophilic anaerobic digestion exposed to increasing feeding rates

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Third International Symposium on Energy from Biomass and Waste, Venice, Italy, 8-11 November 2010

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Materials

Inoculum: Sludge from AD of a sewage treatment plant
Substrate: Maize silage

5 feeding rates (gVS.L⁻¹)
0 (only inoculum)
5 (D5)
10 (D10)
20 (D20)
40 (D40)

4 analysis dates:
2 - 5 - 9 - 15 days

x triplicate = 60 digesters (37°C)

Gas analysis (Volume, CH₄, CO₂)

Digestate analysis (pH, VFA)

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Methods

Extraction (DIN 38414-19)

1 mL → Anion-exchange chromatography

- Dionex DX-500
- CD20 detector in suppressed conductivity mode
- Guard column: Dionex IonPac AG 18
- Analytical column: Dionex IonPac AS 18

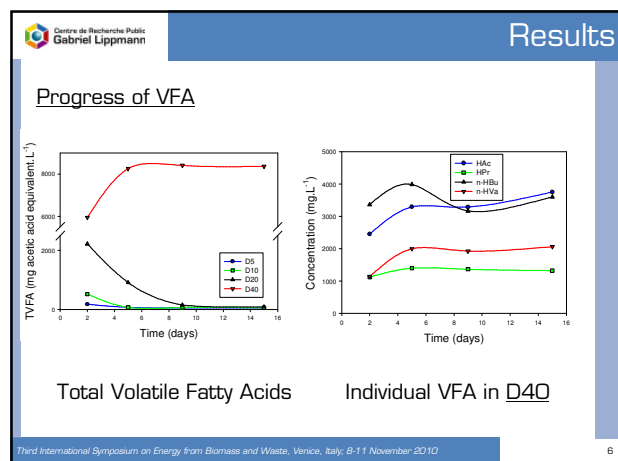
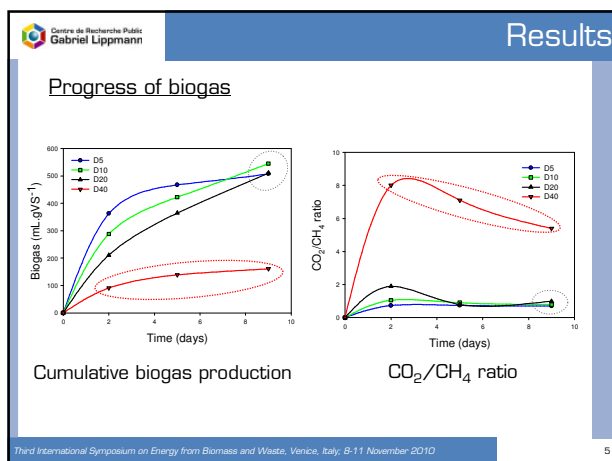
→ Individual VFA

± 500 mL → Titration 1M NaOH → Total VFA

Steam-distillation

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Substrate to inoculum ratio

The feeding rate affects the bioconversion of the substrate into methane

→ BMP can be estimated for OLR up to 20 gVS.L⁻¹ of sludge ($VS_{\text{substrate}}/VS_{\text{inoculum}} = 3$)

→ 40 gVS.L⁻¹ of sludge induces process imbalance and failure of the BMP measurement ($VS_{\text{substrate}}/VS_{\text{inoculum}} = 6$)

VDI 4630: ($VS_{\text{substrate}}/VS_{\text{inoculum}} \leq 0.5$)

VFA monitoring

Anion-exchange chromatography

- allows detection of *n*-acid (up to valeric acid)
- can highlight process imbalance due to overfeeding

In D40:

- Initial TVFA higher than 4 mg.L⁻¹ then 8 mg.L⁻¹ (Siegert & Banks, 2005)
- Propionic acid > 900 mg.L⁻¹ (Wang et al., 2009)
- HPr/HAc ratio ≤ 1,1. Hill (1987) suggested 1,4

BMP measurement can be performed with substrate ranging from 5 to 20 gVS.L⁻¹ of sludge

$0.75 < VS_{\text{substrate}}/VS_{\text{inoculum}} < 3$

Biodegradation occurs up to:

837 mg.L⁻¹ acetic acid
674 mg.L⁻¹ propionic acid
697 mg.L⁻¹ butyric acid
and/or 2219 mg.L⁻¹ acetic acid equivalent (TVFA)



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Thank you for your attention

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