

Improvement of anaerobic digestion systems co-digesting food waste and pig manure with addition of trace metals

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Waste generation (tonnes/annum/person or pig)

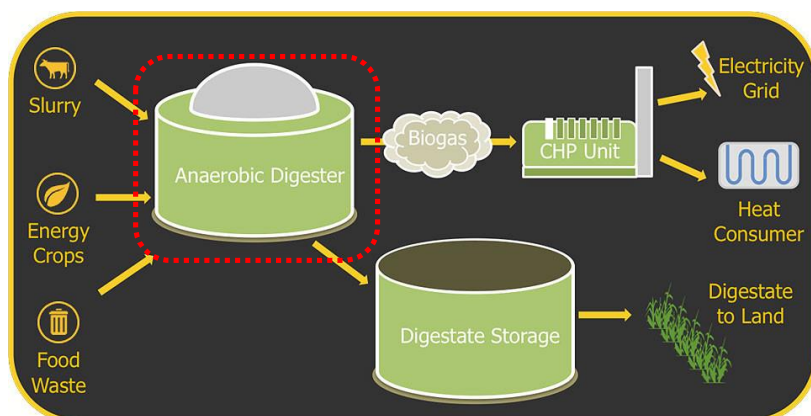
Average Per
Person
0.3-0.5

Average Per
Pig
1.45

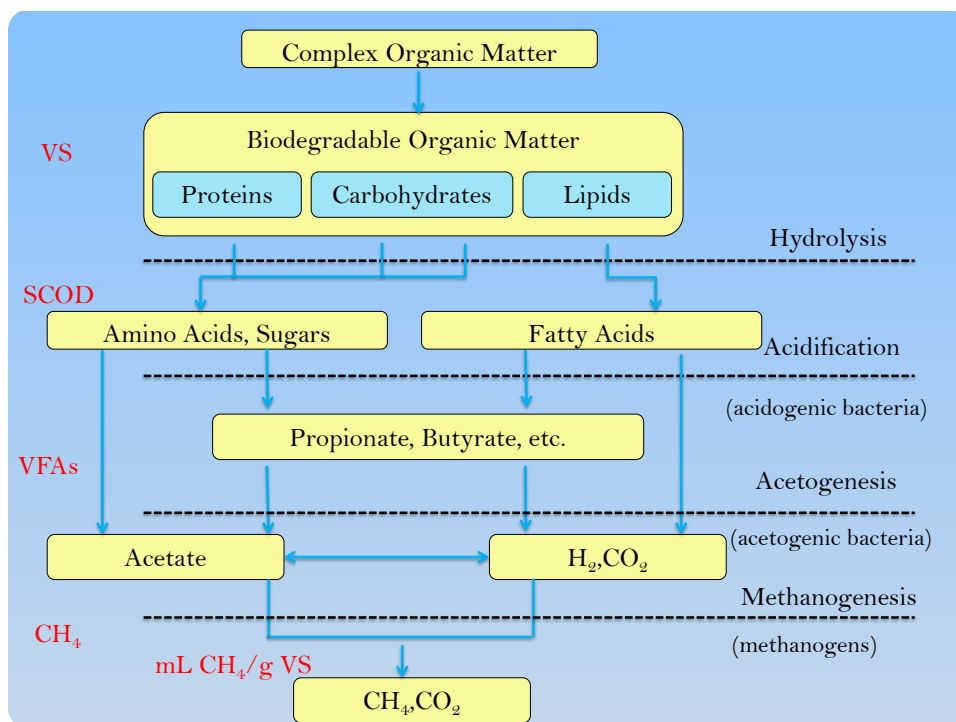


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Anaerobic Digestion

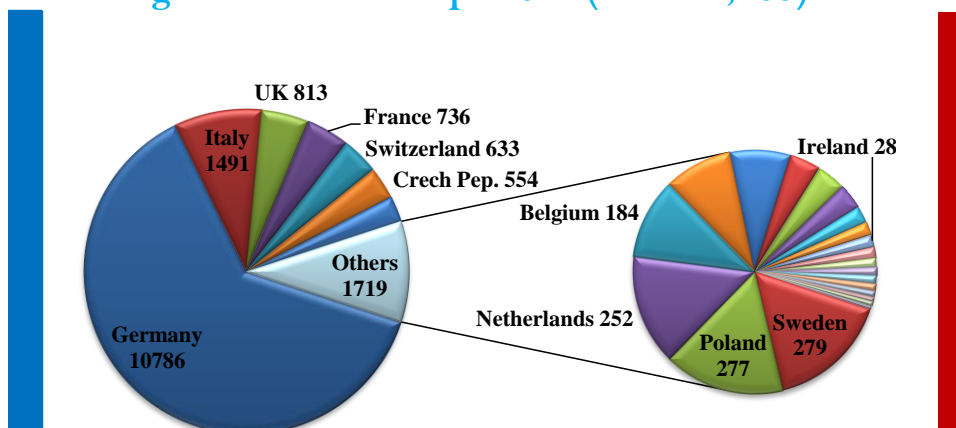


Resource recovery

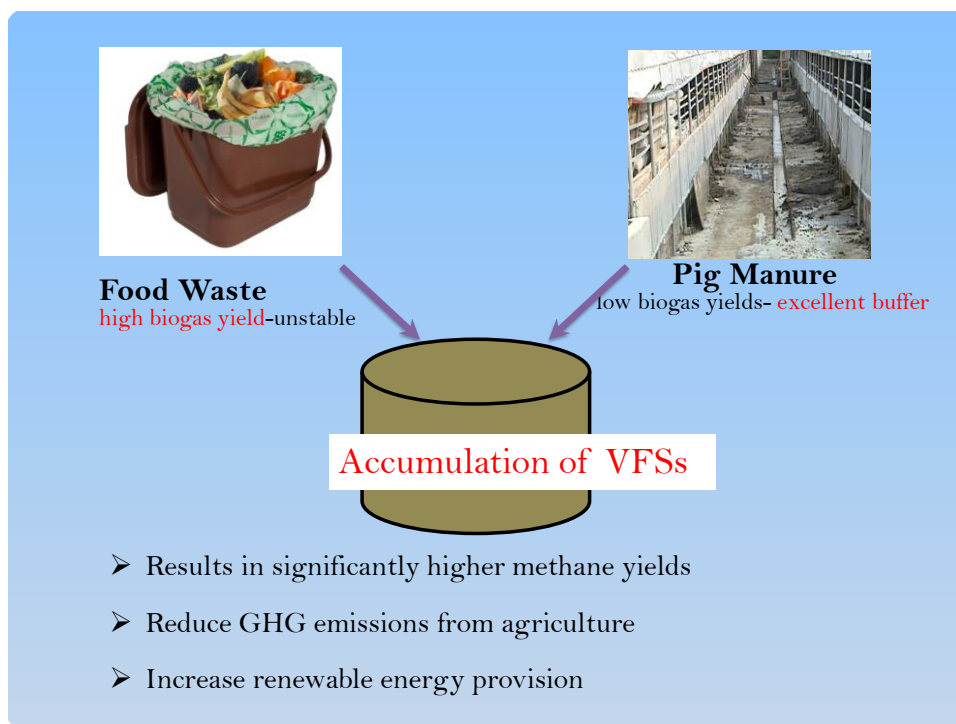


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Biogas Plants in Europe 2014 (total:17,168)



<http://european-biogas.eu/2015/12/16/biogasreport2015/>

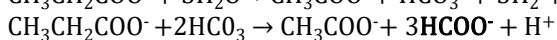
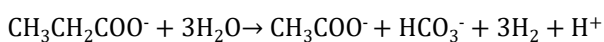


Trace metals	Functions
Mo	1) catalyzes the oxidation and reduction reactions of CO_2 2) is necessary for the formation of enzymes, such as formate dehydrogenase (FDH)
Se	1) increased levels of FDH 2) a growth-limiting factor for some methanogenic bacteria
Mo Se	1) long-term effect on methanogenic activity 2) release the accumulation of VFAs (i.e. propionate)

A set of enzymes that catalyse the oxidation of formate to CO_2 .

One of the enzymes in the oxidoreductase family is known to use a **selenium-molybdenum version of molybdopterin**.

Propionate Oxidation



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Research Aim

To assess the effect of trace metals (i.e. selenium (Se) and molybdenum (Mo)) on co-digestion of food waste (FW) and pig manure (PM)

- ❑ Enhance methane production yields
- ❑ Reduce the accumulation of fatty acids



Four of 10 L steel reactors

Working volume of 8 L

HRT: 25 days

Temperature: 35 °C

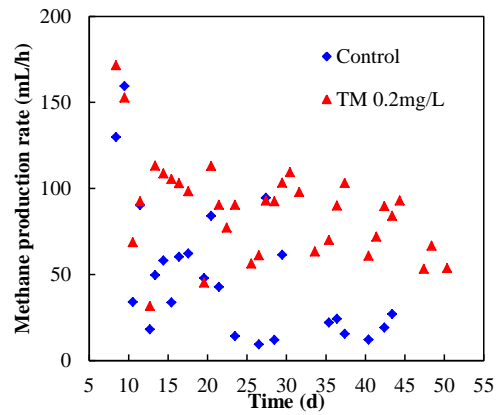
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- Inoculum/substrate (VS base): 3:1
- FW/PM (VS base): 1:1
- Trace metal: Se: 0.2 mg/L; Mo: 0.2 mg/L
- Mixing every two hours at the speed of 100 rpm

Characteristics of inoculum, PM and FW

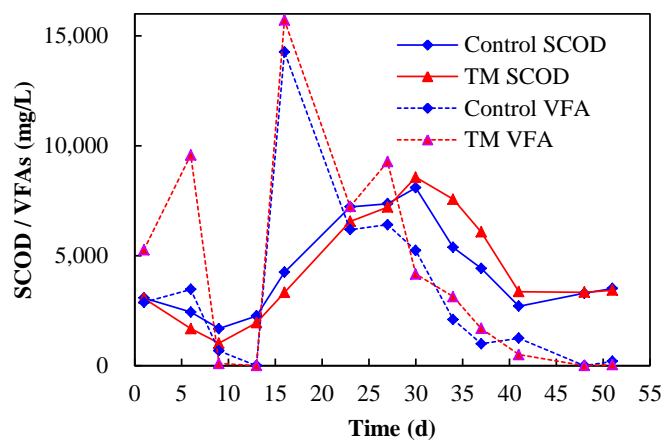
Parameter	Sludge	PM	FW
TS (%)	2.84	6.95	26.64
VS (%)	1.88	5.13	25.13
VS/TS (%)	66.11	73.85	94.33
pH	7.39	7.43	4.25
SCOD (mg/L)	751	30,449	52,260
VFA (mg/L)	0	12,133	8,665
Alkalinity (mg/L)	5,512	10,629	436
NH ₄ -N (mg/L)	1,114	4,124	29
PO ₄ -P (mg/L)	4.1	11.9	82.7

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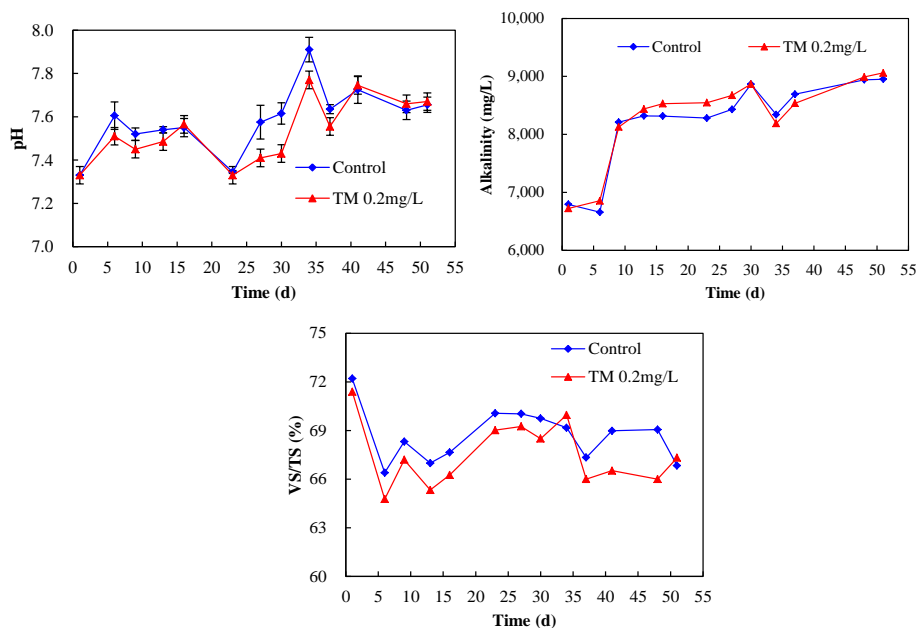


Time	Day 9-51	
Condition	Control	TM
Methane rate (mL/h)	46	84
Methane yield (mL/gVS)	81	244

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Addition of Se and Mo in FW and PM co-digestion systems significantly increased the methane production rate.

Thank you