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Valorizing Organic Waste Via Arrested Anaerobic Digestion (AAD): Production of Volatile Fatty Acids (VFAs)

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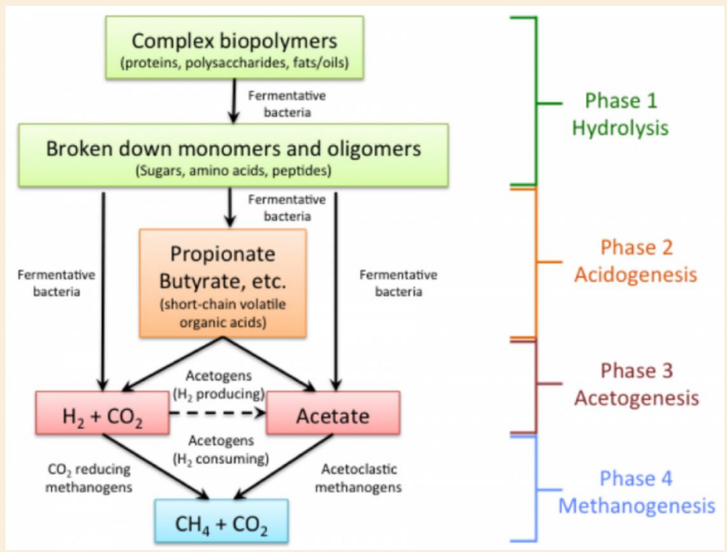
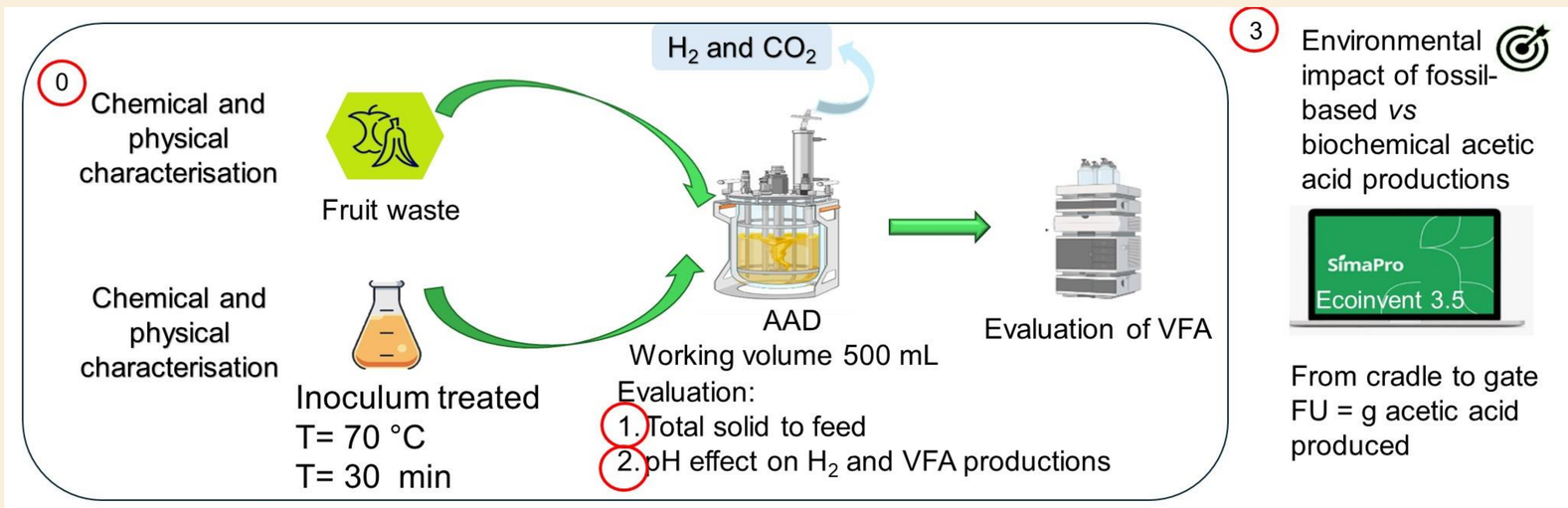
Introduction

Arrested anaerobic digestion (AAD) is a modified form of anaerobic digestion (AD) without methanogenesis. In AAD, volatile fatty acids (VFA) are the primary product with CO_2 and H_2.

AAD can provide an alternative for VFA production compared to petrochemical pathways, which have a high carbon footprint and rely on non-renewable resources.



Methodology



Objective

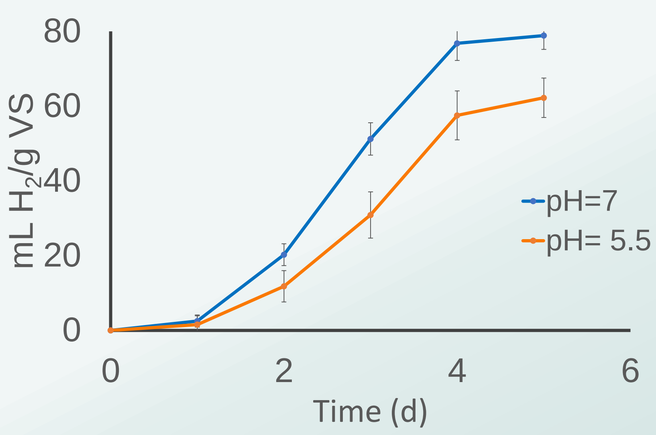
Investigation of AAD of fruit waste to produce VFAs and energy production by considering process and environmental parameters.

Results

0. Fruit waste and inoculum characterisation

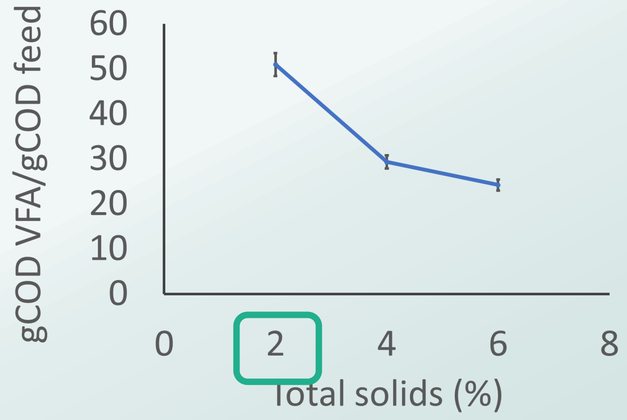
Parameters	Fruit waste	Inoculum
TS (%)	16.02 ± 0.9	5.37± 0.2
VS/TS (%)	97.02± 3.7	62.95± 1.3
Total COD (mg/g)	970.27± 24.6	50.82± 5.8
TKN (%TS)	0.53± 0.1	4.82± 0.7
C/N (-)	80.00± 3.9	30± 1.4
pH (-)	5.10± 0.3	6.80± 0.4

2. The pH effect on H2 and VFAs yields at TS =2 %



VFAs	gVFA/gVS pH=5.5	gVFA/gVS pH=7.0
Acetic acid	0.34± 0.02	0.42± 0.09
Butyrric acid	0.26± 0.09	0.3± 0.02
Propionic acid	0.22± 0.03	0.27± 0.01
Total	0.82± 0.05	0.99± 0.08

1. The total solids effect on VFAs yields



3. Environmental impact of fossil-based vs biochemical acetic acids

Method: **IPCC 2021 GWP20 V1.01** FU= 1.61 g acetic acid (AA)

	AAD TS=2% pH= 7	Fossil based (Ecoinvent 3.5)
Climate change g CO_2/g AA	-0.058	0.003

Conclusions

The optimal conditions of AAD are TS = 2% and pH= 7:

AAD has negative environmental impacts, but VFA recovery was not investigated.

Future perspective

- Improving AAD to increase VFA titres
- Scaling up the AAD
- Recovering VFA