Two-stage solid-state anaerobic digester development for food waste valorisation in psychrophilic condition

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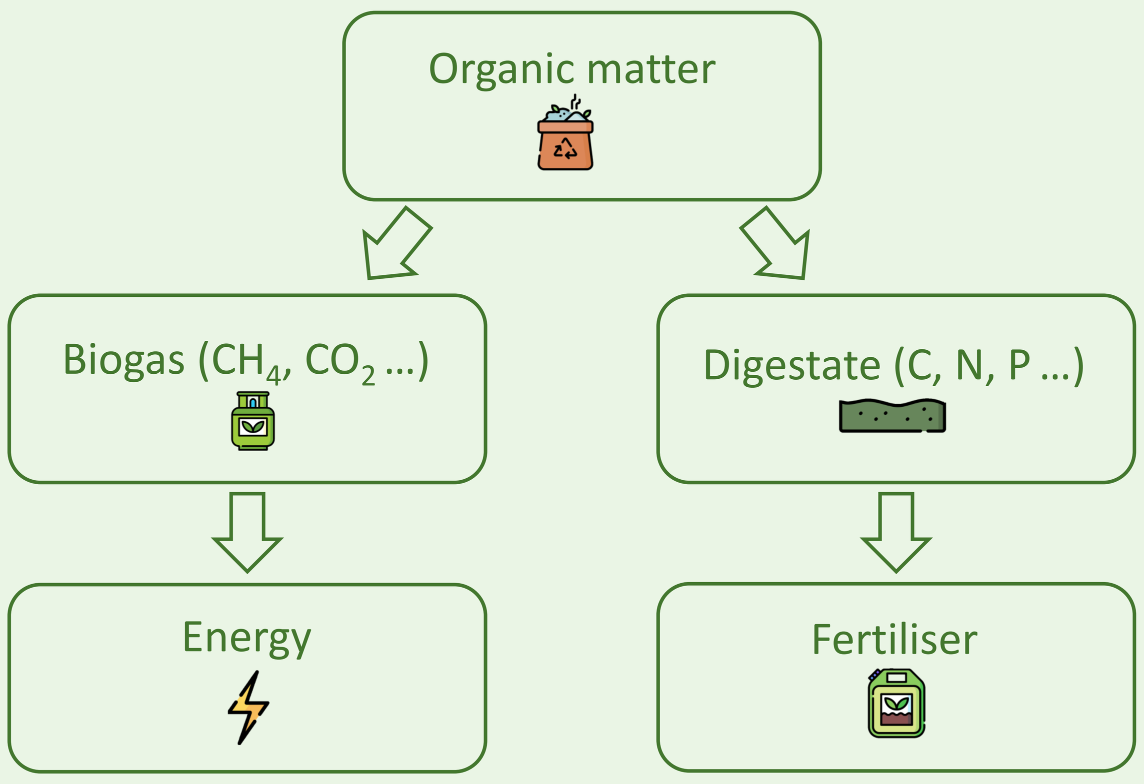
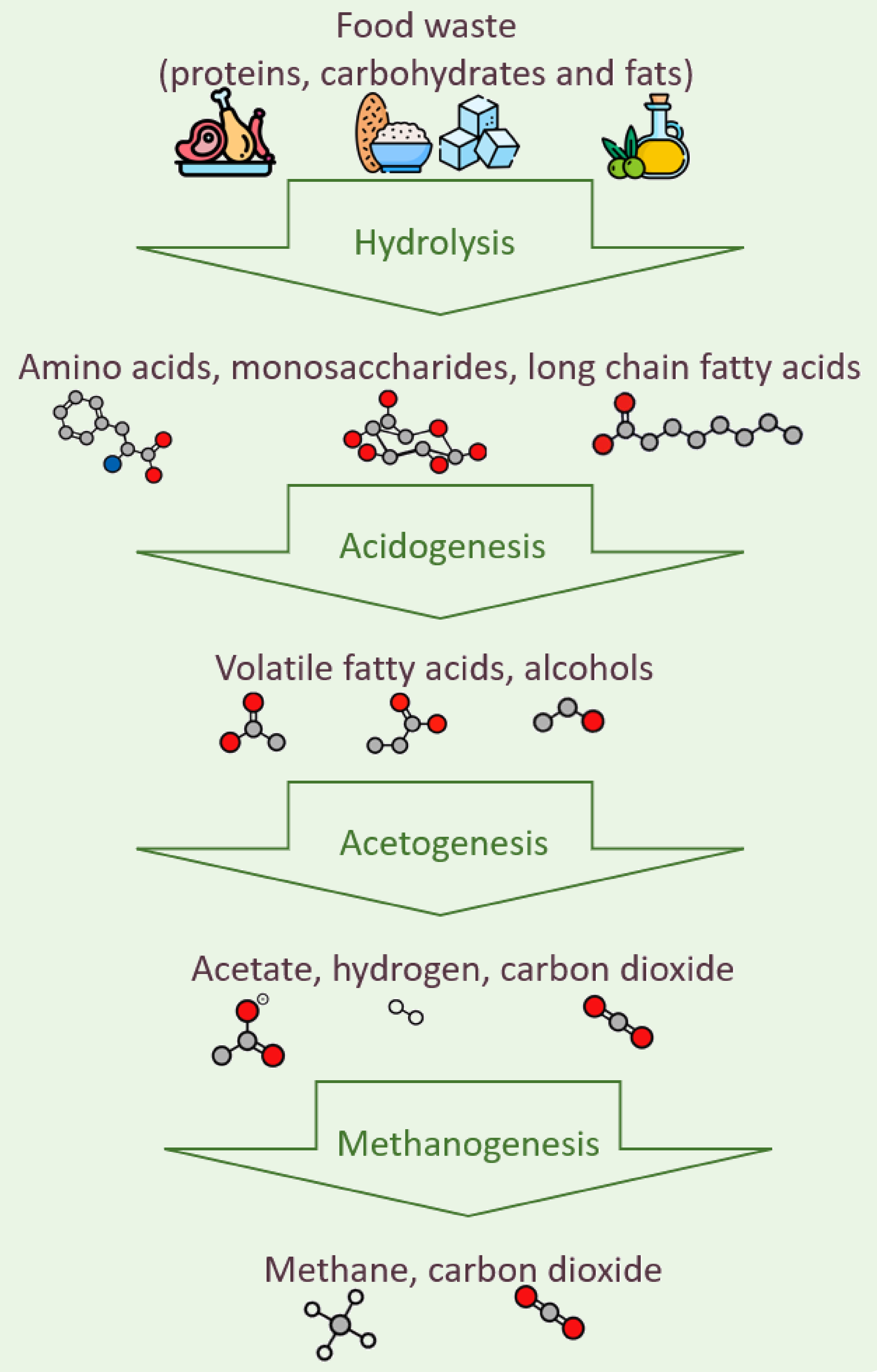
Introduction

Anaerobic digestion is a well-known process in which microorganisms transform organic matter into biogas and digestate. The first one, mainly composed of methane and carbon dioxide, can be converted into energy while the second one can become a fertilizer. The biomethanisation consists of four steps : hydrolysis, acidogenesis, acetogenesis and methanogenesis [1]. Based on those reactions specificities, improved performance are achieved by dividing the system into two separate reactors, one for the two first reactions and another for the two remaining ones [2].

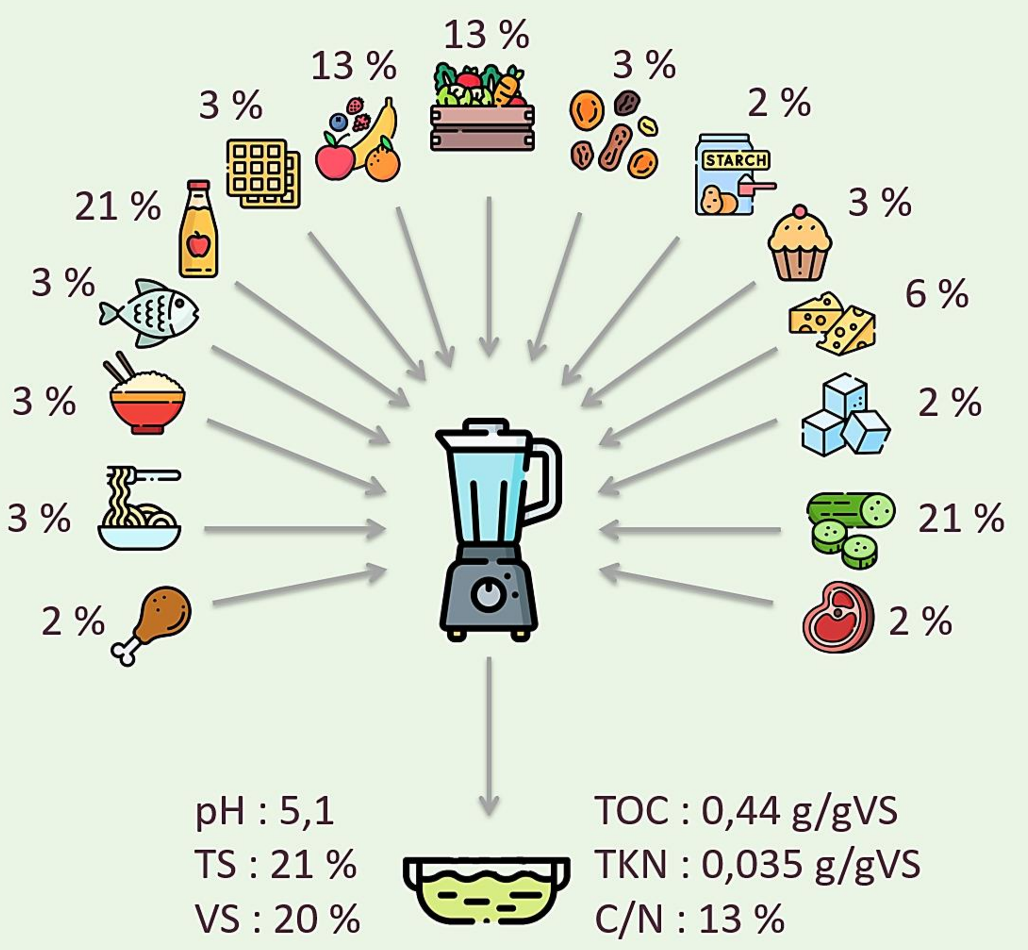


- Traditionally operated under thermophilic (50 - 60°C) or mesophilic (30 - 40°C) conditions, the development of this technology at psychrophilic temperatures (< 20°C) is of particular interest to reduce its energy consumption and to promote the development of decentralised installations [3].
- Biomethanisation presents an opportunity to valorise food waste which is even more advantageous under dry conditions to preserve water resources.
- Those are the reasons why one objective of the WalBioPower project is to optimize the dry psychrophilic anaerobic digestion of food waste.

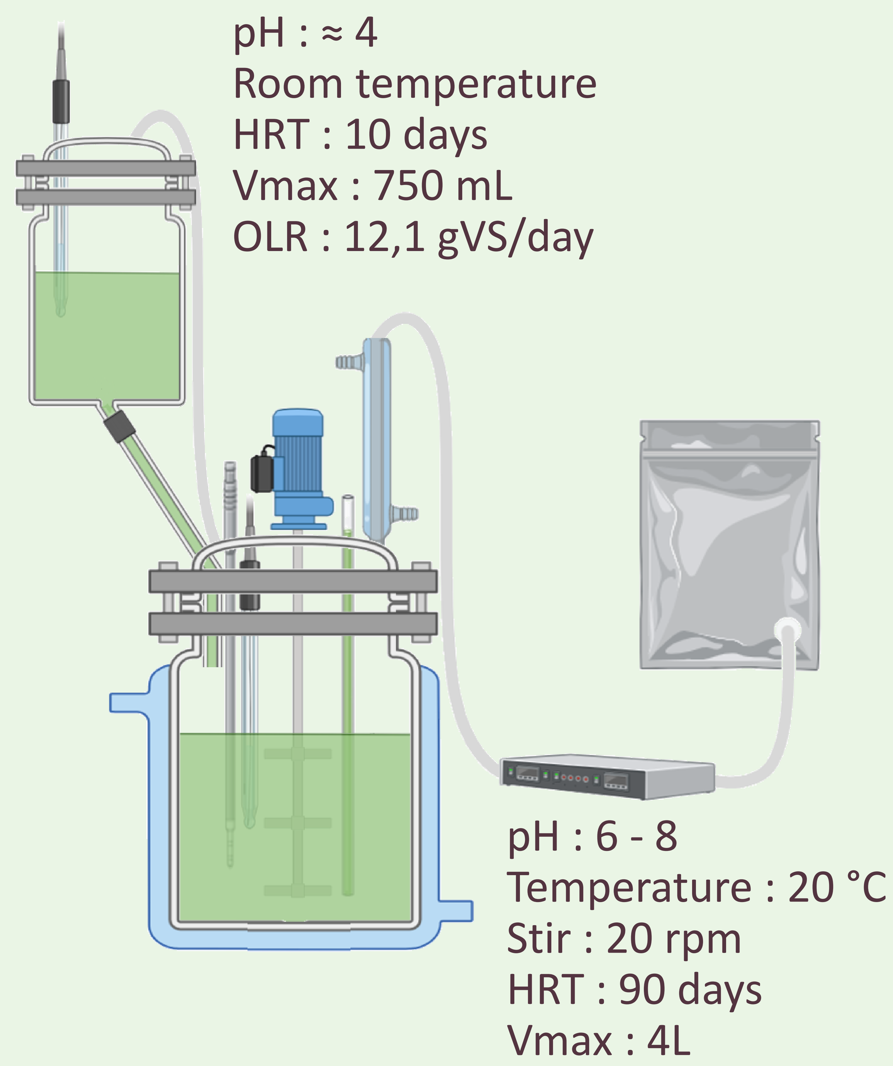


Experimentation

Substrate composition and characterisation

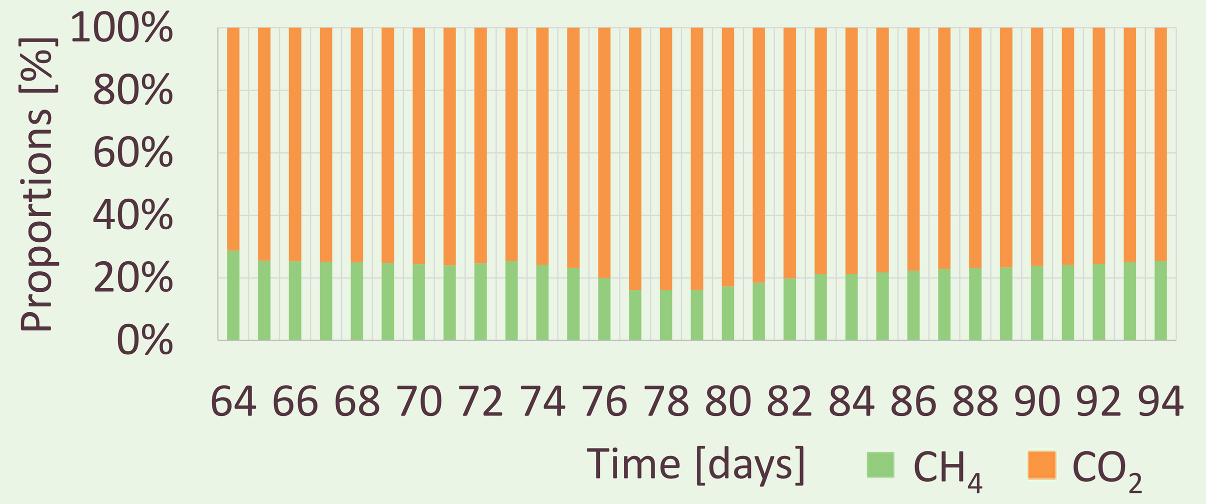


Anaerobic reactor design and parameters

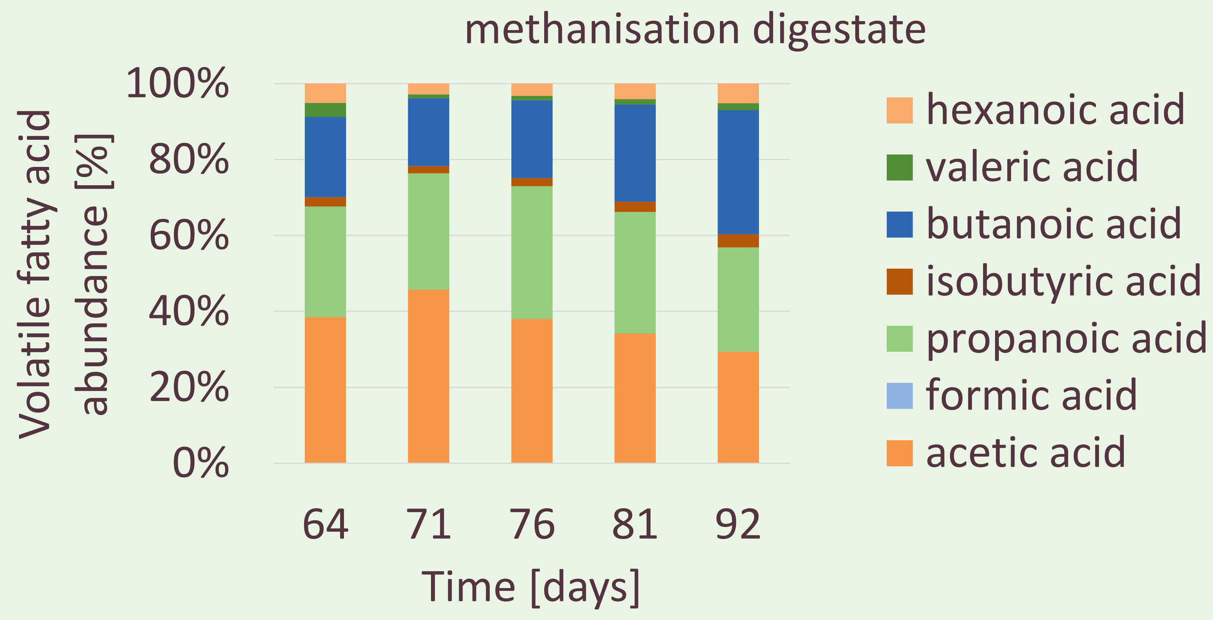


Biogas and digestate characterisations

Evolution of CH_4 and CO_2 proportions in the biogas produced by the methanogenesis stage



Evolution of various fatty acids relative abundance in methanisation digestate



Discussion

- Best tested configuration : biogas flow rate : 216,1 mL/day ; biogas yield : 549,2 mL/gVS ; methane yield : 0,193 L/gVS but still need to be improved ;
- Some BMP tests should be performed ;

Acknowledgements

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References

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