

# Conversion of Wastewaters and Organic Waste into Chemicals, Energy and Biofertilizer

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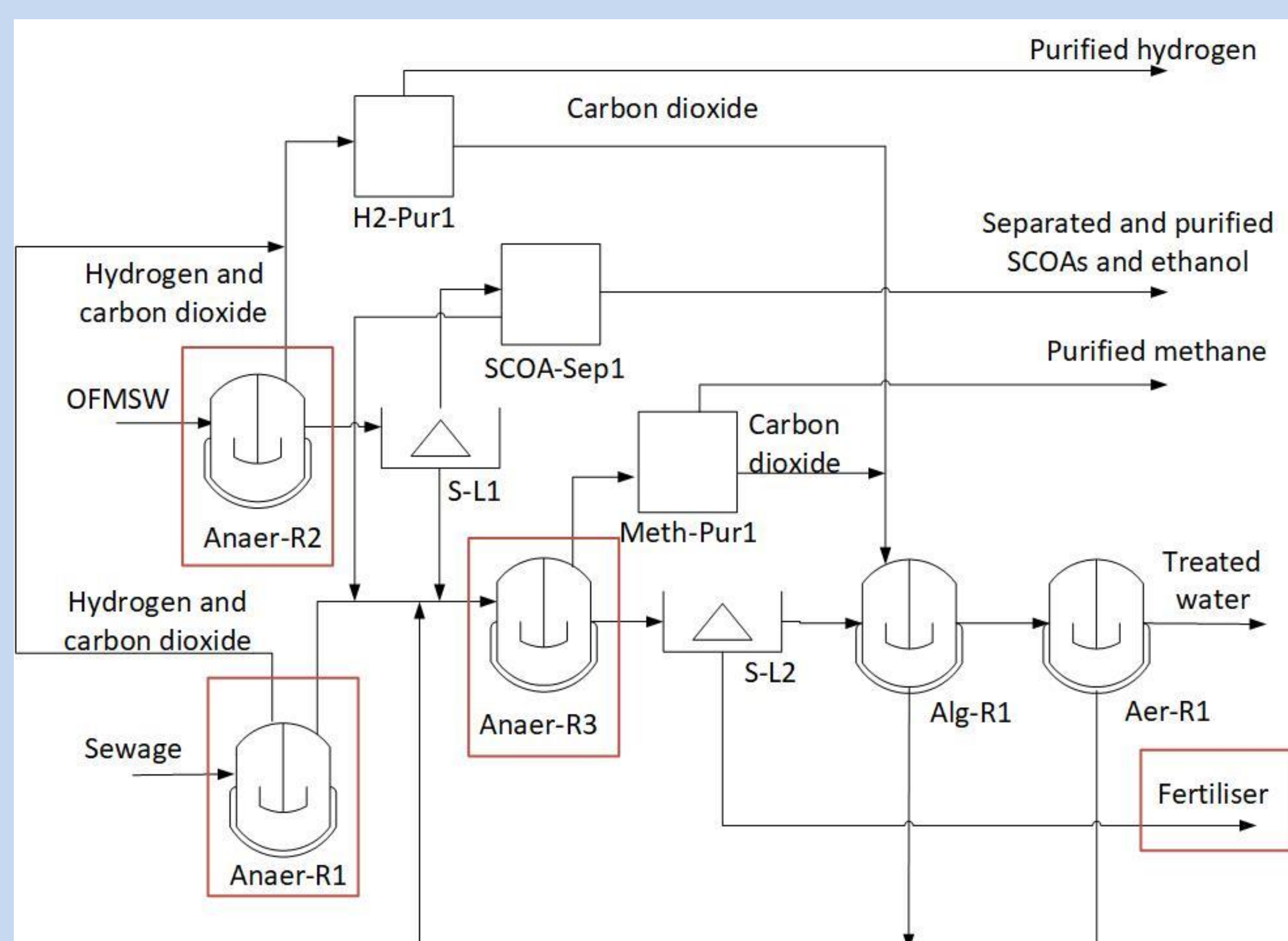
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## Introduction

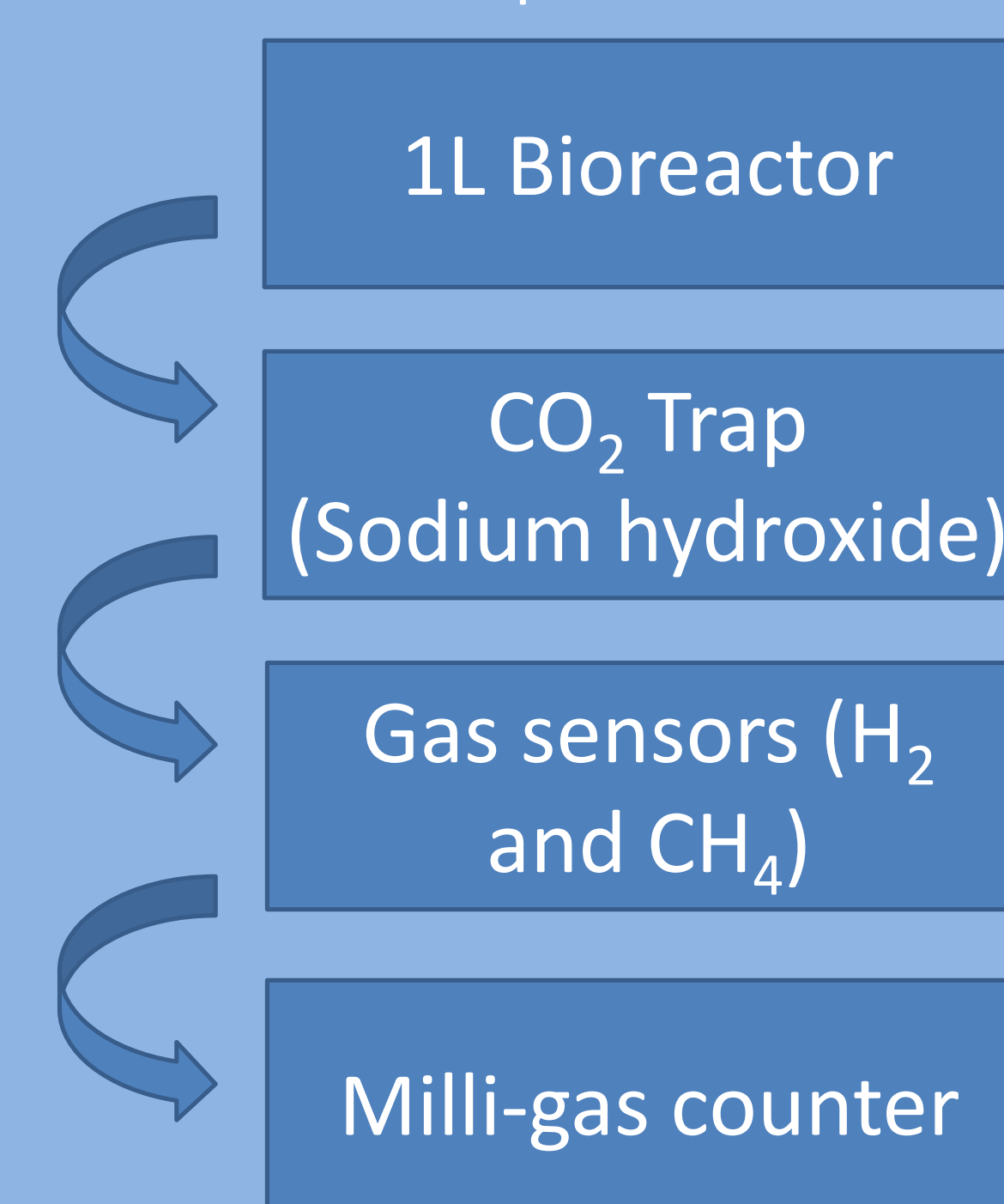
This study investigates an innovative process for the combined treatment of municipal wastewaters and organic waste, under anaerobic digestion, to enable a cost-effective industrial process.



**Figure 1:** Scheme of the combined treatment bioprocess. The boxes indicate the processes investigated in this project.

## Methods

The digestion will be investigated in 1L lab-scale bioreactors fed with a synthetic model of municipal wastewater (Anaer-R1). The reactors will be sampled on a regular basis to monitor the organic matter decomposition into valuable chemicals (short-chain organic acids SCOAs, ethanol, methane  $\text{CH}_4$  and hydrogen  $\text{H}_2$ ).



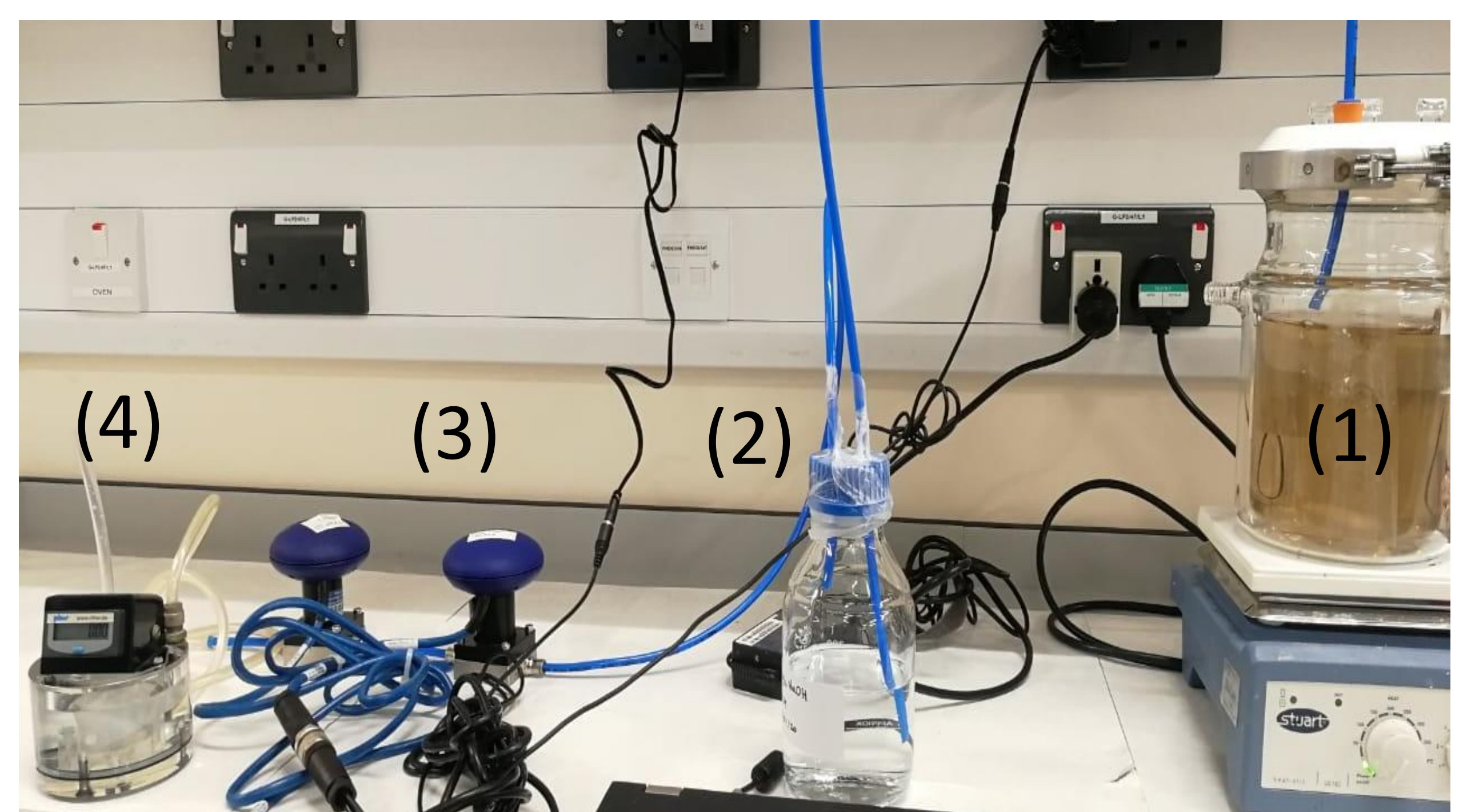
**Figure 2:** A preliminary experimental set-up.

## Results

A synthetic model of municipal wastewater was designed to simulate real domestic wastewater. The mixture contains carbohydrates (glucose, soluble potato starch), lipids (glycerol), proteins (peptone), yeast extract, urea, uric acid, sodium acetate, minerals and trace elements. The chosen inoculum is an open mixed bacterial culture, that does not require sterilisation. The experimental set-up is being optimized using a 1L batch bioreactor containing a single substrate and the gas production is being monitored from the start of the experiment.

## Future

The future experiments will investigate  $\text{H}_2$  and  $\text{CH}_4$  production, after anaerobic digestion of mixed substrates in batch and continuous bioreactors. The SRT (solids residence time) of the process will be varied to identify the optimum conditions for  $\text{H}_2$  and  $\text{CH}_4$  production. Afterwards, the gas production from co-digestion of municipal wastewaters and solid waste will be investigated. Also, the effect of the digestate on soil will be investigated.



**Figure 3:** Experimental set-up of 1L batch bioreactor (1) connected to a  $\text{CO}_2$  trap (2) further connected to gas sensors ( $\text{H}_2$  and  $\text{CH}_4$ ) system (3) and milli-gas counter (4).