Biogas4Industry

Biotechnological Methane from Industrial Waste Waters

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Biorefineries / Biochemical Technologies

Introduction

Currently significant challenges are rising regarding energy supply for large-scale industry when making the necessary shift away from fossil fuels. Diversification in green energy is getting more interesting for industries, driven by both societal pressure and regulatory frameworks such as the EU's CO_2 certificates and Green Deal, making a shift towards sustainability unavoidable.

The **Biogas4Industry** project focuses on transforming waste water from the paper production process, into biomethane. Currently, rejects from paper production, containing mostly water, are managed through inefficient incineration.

The project focuses on valorizing various rejects, including recycled fiber (RCF) sludge from the paper production. By converting organic contaminated streams in an anaerobic biogas reactor into methane, energy can be recovered by simultaneously reducing the organic load for the waste water treatment plant. On the other hand, aerobic sludge from the waste water treatment plant (ARA) itself is also tested for its biomethane potential.

At our facility in Tulln, we operate a laboratory-scale experimental setup to test the efficiency and feasibility of these processes for Laakirchen Papier AG. The aim is to develop a sustainable as well as scalable solution for industrial biogas production.

Materials and Methods

In our experimental setup, we test the four substrate combinations in four 2 L CSTR biogas reactors. Two of them will be highlighted in the following: Recycled fiber slurry and aerobic sludge from the waste water treatment plant.

The rejects are selected based on their annual quantities and previously calculated biogas potential, which was determined through prior batch tests.

Experiments are conducted at 37°C, which is provided by a tempered waterbath.

Various analyses are performed to determine volatile fatty acids, total solids, volatile solids, chemical oxygen demand as well as ammonium concentrations. The media are pH-adjusted and supplemented with trace elements. Gas volumes produced are measured by RITTER Milligascounter for precise measurements.

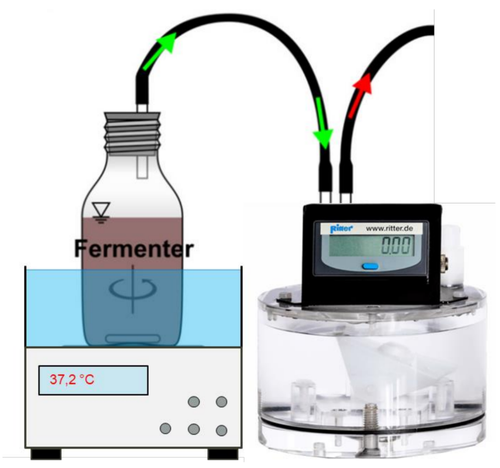

Figure 1: Simplified schematic representation of the experimental setup. Fermenter is placed in a tempered water bath. Produced biogas is measured in a RITTER Milligascounter.

Results

Organic loading rates were slowly increased in both experiments. Thereby volatile fatty acids were produced and converted into methane. By tracing the accumulation of volatile fatty acids (VFAs), the conversion rate can be determined. As seen in Figure 2 high accumulations of VFAs were detected after day 30 in the experiments with recycled fiber slurry. Therefore the organic loading rate was not raised like in the experiments with the aerobic sludge (Figure 3).

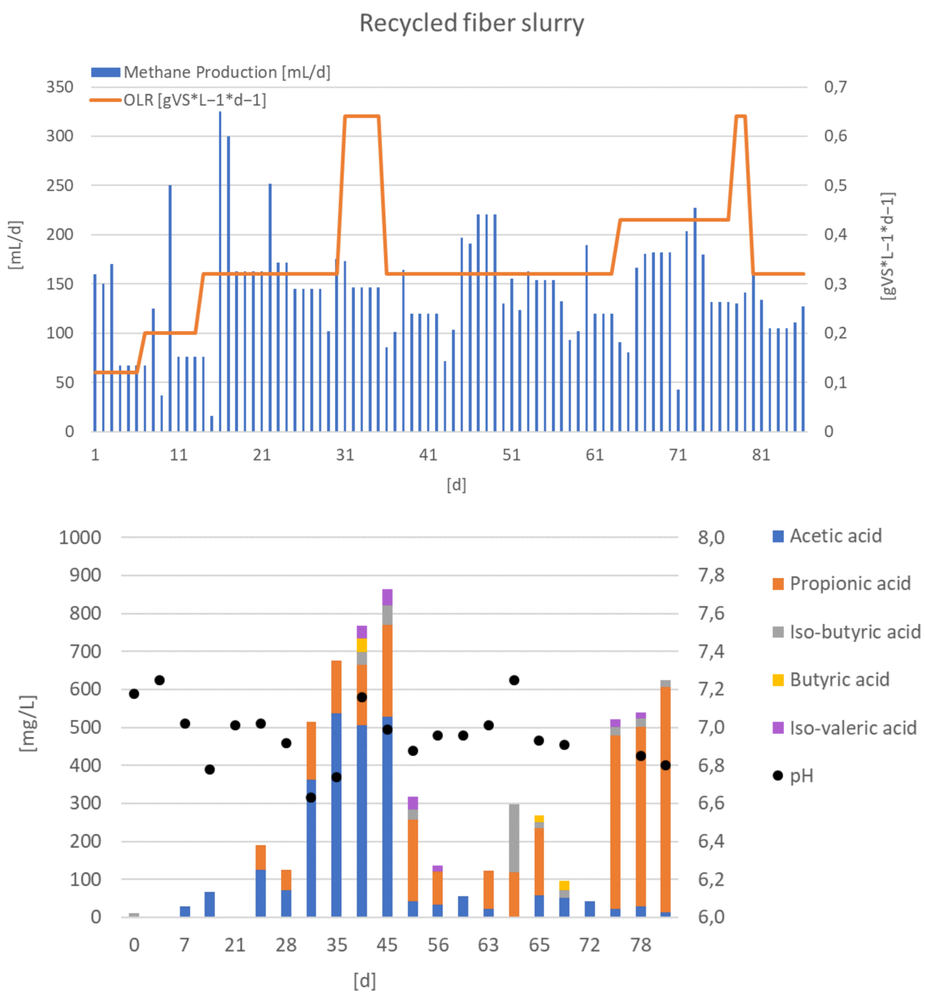

Figure 2: Results from recycled fiber slurry. Up: Methane production and organic loading rate (OLR). Low: pH and volatile fatty acids (VFAs)

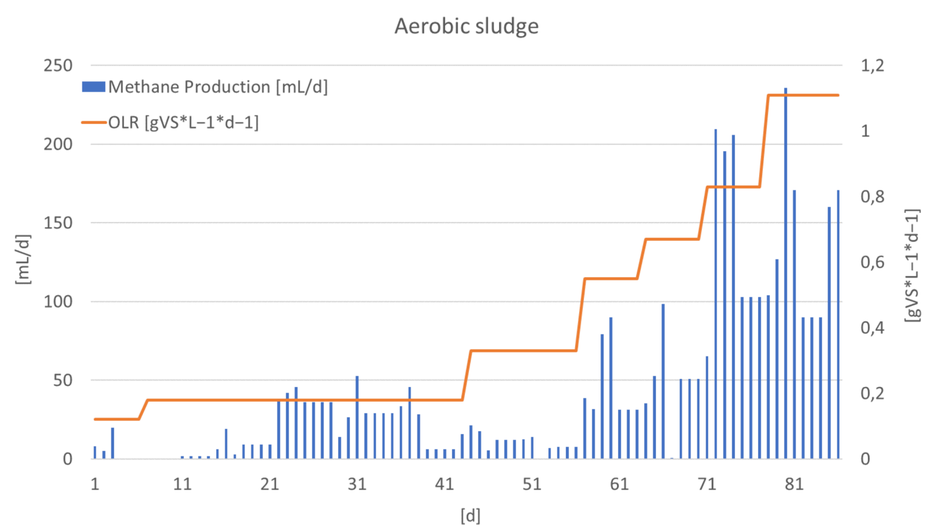

Figure 3: Results from aerobic sludge. Methane production and organic loading rate (OLR).

There were no significant VFAs detected in the experiments with aerobic sludge. Also pH was constant between 7.2 and 7.6. However, also methane production stayed at the low end.

Conclusion

Anaerobic digestion is a very sensitive process, where substrate plays a significant role. Complex substrate structures as well as impurities are influencing the process. To make a difference in the shift towards green energy, it is key to know the substrate and possibilities of inhouse industrial waste streams. By mastering this task, energy yield and renewable energy diversification can be maximized while fossil fuel input is reduced significantly.

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