EFFECT OF HYDROCHAR IN THE ANAEROBIC DIGESTION OF ORGANIC FRACTION OF MUNICIPAL WASTE

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Introduction

Energy recovery from the **organic fraction of municipal solid waste** (**OFMSW**) is an **attractive sustainable solution** to the world's growing population. **Anaerobic digestion**, a well-established energy conversion technology, involves a **limiting hydrolysis step** during the degradation of these raw materials. The application of **hydrothermal carbonization** (**HTC**) is proposed as a **pretreatment** due to its ability to process biomass waste with high moisture content and improve the hydrolysis rate.

Objectives

Effect of OFMSW-derived hydrochar addition on anaerobic digestion performance:

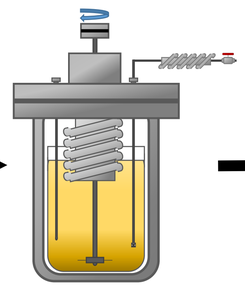
- ✓ To determine the most effective HTC operating conditions for biogas production optimization.
- ✓ To determine the synergistic effect of hydrochar in anaerobic digestion.

Materials and methods

Step 1: Pretreatment

OFMSW

HTC



1 kg feedstock; 85% moisture
180 ºC, 205 °C, 230 °C; 45 min

Slurry (S)

Centrifugation

8,000 rpm
40 min

Hydrochar (HC)

Process Water (PW)

Step 2: Biochemical Methane Potential

Inoculum: **15 g VS/L**
Inoculum/Substrate ratio: 2 (VS basis)
Temperature: **36 °C**

OFMSW
S-180, S-205, S-230
HC-180, HC-205, HC-230
PW-180, PW-205, PW-230

Step 3: Characterization

- Biogas volume and composition (GC-TCD)
- Total solids (TS), volatile solids (VS)
- Total chemical oxygen demand (TCOD)
- Soluble chemical oxygen demand (SCOD)
- Volatile fatty acids (VFAs)
- Total alkalinity (Alk), pH
- Total ammonia nitrogen (TAN)
- Total Kjeldahl nitrogen (TKN)
- Ultimate and metals analysis

Results and discussion

Figure 1. Cumulative methane production (a. 180 °C; b. 205 °C; c. 230 °C)

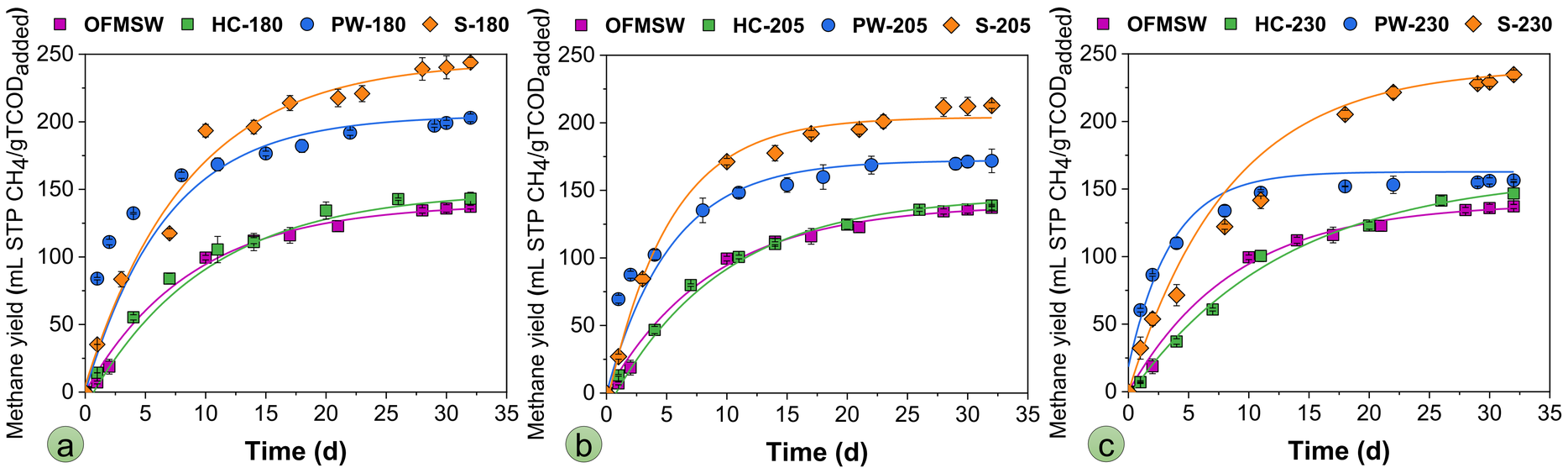


Figure 2. Synergistic effect

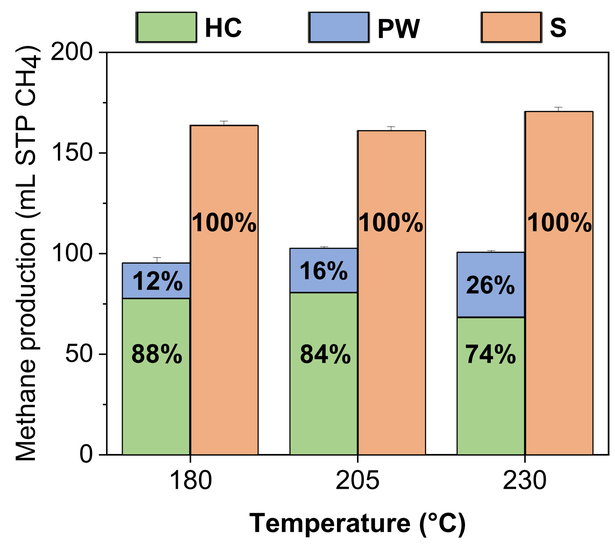


Figure 3. Degradability (a. VS removal; b. COD removal)

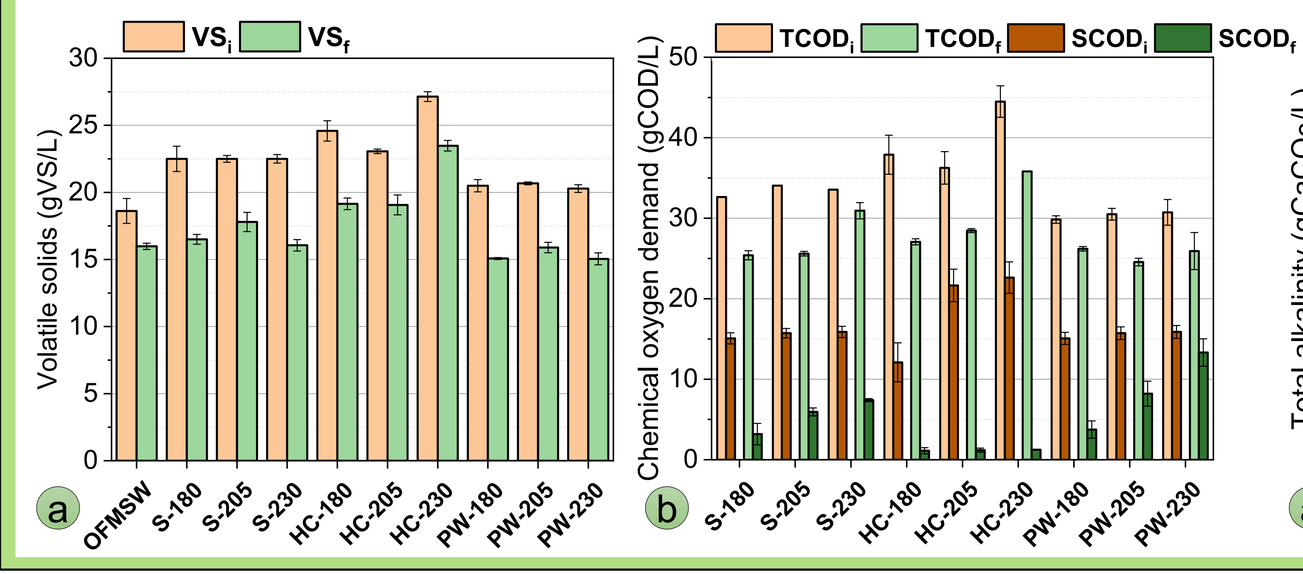
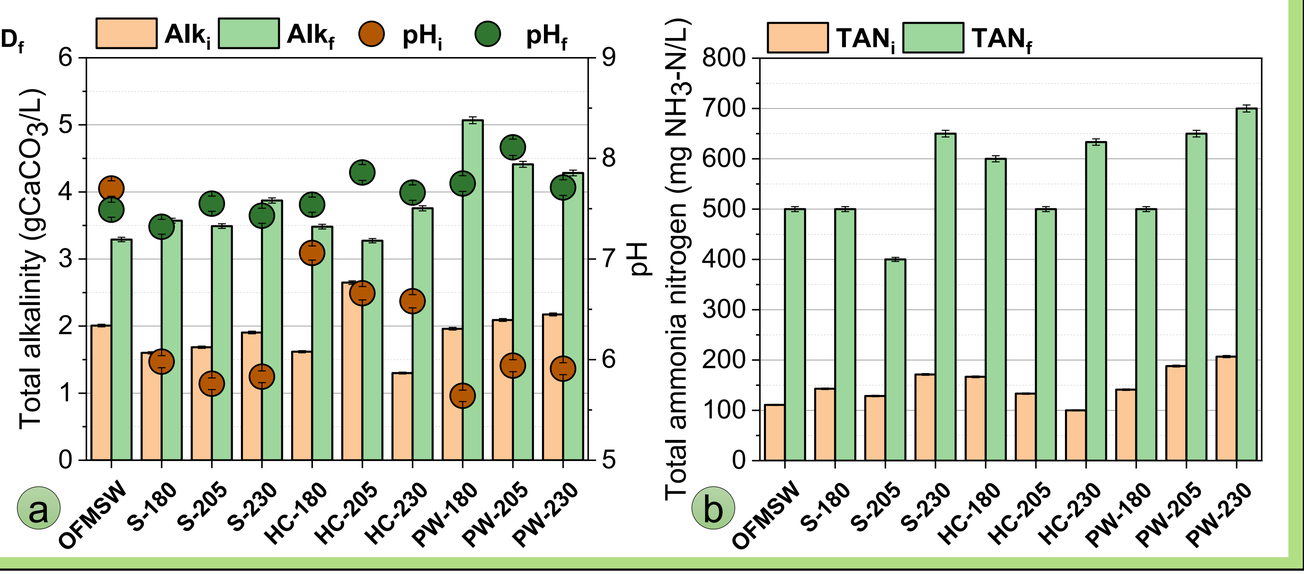


Figure 4. Anaerobic digestion control parameters (a. Alk and pH; b. TAN)



Conclusions

- ✓ **Methane production** was **highest** for the OFMSW treated at the **lowest carbonization temperature**.
- ✓ **Anaerobic digestion performance** was significantly **improved** by the **slurry** as **substrate, compared** with that of **hydrochar and process water separately**.
- ✓ This study highlighted the **potential** of using **hydrothermal carbonization** as a **pretreatment** for the **anaerobic digestion** of **OFMSW**.

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