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Hydrothermal carbonization and anaerobic digestion as a solution for biowaste management

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INTRODUCTION

1.4·10⁶ BW/y (EU, 2019)

Hydrothermal carbonization (HTC) is an environmentally friendly and energy-efficient technology able to treat wet biowaste (BW) (180–250 ºC), yielding a solid so-called hydrochar (HC) with an interesting higher heating value (HHV) and a process water (PW) which can be valorized by anaerobic digestion.

MATERIALS AND METHODS

Biowaste consisting of garden and park waste (GPW) and food waste (FW) have been subjected to HTC. The individual raw waste as well as the obtained PW of food waste (PW-FW) and garden park waste (PW-GPW) have been anaerobically co-digested (AcoD) with the raw waste. Runs were carried out in 120 mL glass serum vials. Assays with initial inoculum concentration of 15 g VS/ L, inoculum to substrate ratio of 2 on a COD basis and 5 and 10% of total COD provided by PW were carried out. The obtained HC (HCF form FW and HCP from GPW) were characterized (Table 1)

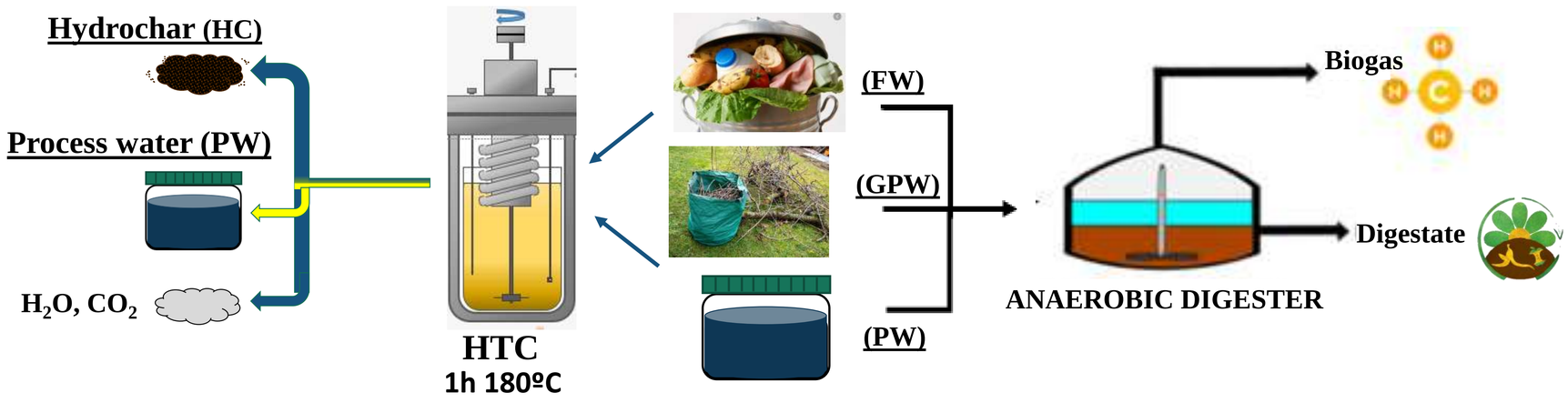

Table 1. Characterization of feedstock, hydrochar and process water

	pH	TS (g/L)	VS (g/L)	COD (g/L)	C/N ratio	TKN (mg/kg)	Fixed C %	VM %	Ash %	HHV (MJ/kg)
FW	-	144 ± 3	132 ± 3	258 ± 14	23.6 ± 0.1	1034 ± 59	20.6 ± 0.2	67.6 ± 0.1	11.8 ± 0.1	18.9 ± 0.1
GPW	-	939 ± 9	886 ± 8	1144 ± 51	52.2 ± 0.1	980 ± 6	18.4 ± 0.1	76.5 ± 0.1	5.1 ± 0.1	19.7 ± 0.1
PWF	5.4 ± 0.1	54 ± 1	45 ± 1	76 ± 1	14.3 ± 0.1	1635 ± 85	-	-	-	-
PWP	5.6 ± 0.1	35 ± 4	31 ± 1	47 ± 2	11.9 ± 0.1	621 ± 13	-	-	-	-
HCF	-	-	-	-	33.4 ± 0.1		14.4 ± 0.1	79.5 ± 1	6.1 ± 1	20.2 ± 1
HCP	-	-	-	-	40.1 ± 0.1		29.6 ± 0.1	67.1 ± 0.1	3.3 ± 0.1	20.7 ± 0.1

RESULTS

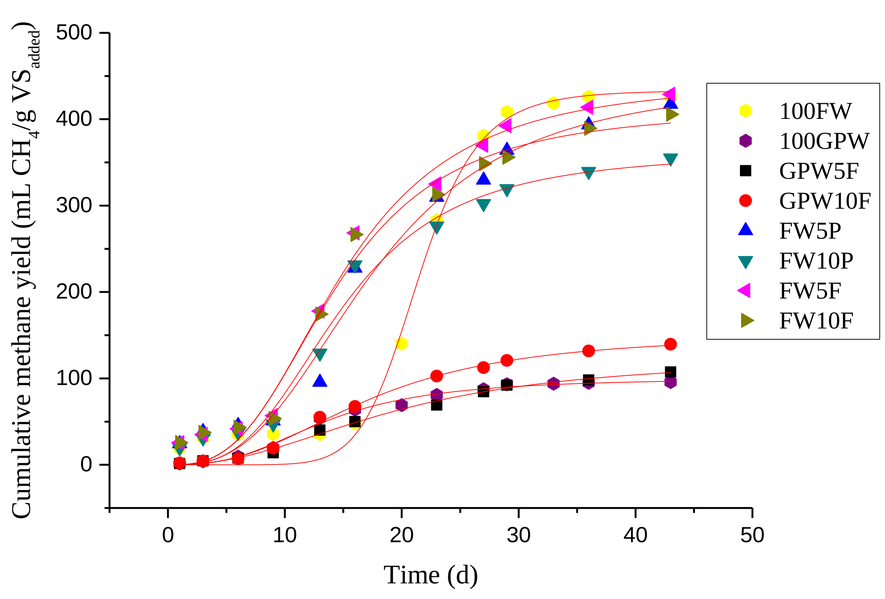

Figure 1. Experimental and simulated cumulative methane yield of raw BW and codigested with PW

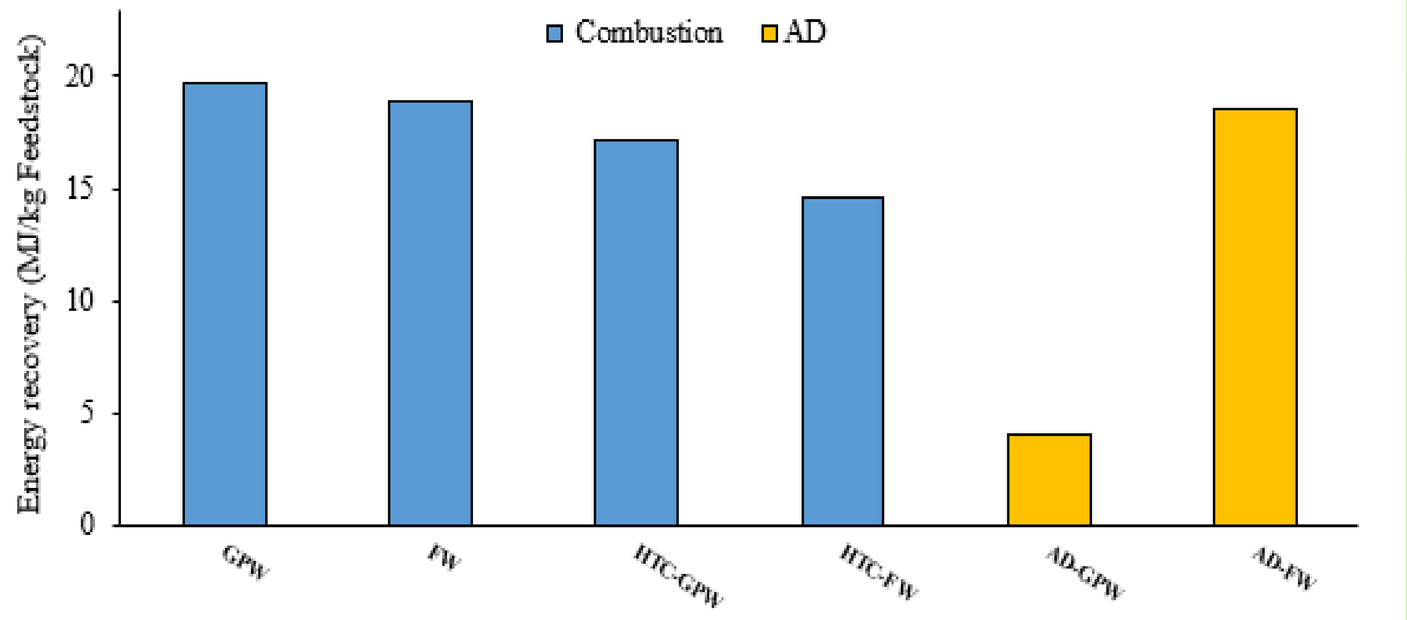

Figure 2. Potential energy recovery from raw materials, HC and AD

CONCLUSIONS

- HTC is a good option for GPW valorization (86.8% recovery) compared with AD (20.5% recovery), obtaining an HC with a HHV of 17.1 MJ/kg.
- No synergistic effects were observed in terms of biogas production comparing AcoD with AD of raw FW. However, combining HTC with AcoD could be a promising option for energy recovery from biowastes and PW which is generally categorized as unwanted subproduct, improving the system stability without hampering energy production and recovery.

ACKNOWLEDGEMENTS

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