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Supplementary Materials

Integration of Microalgae Cultivation in a Biogas Production Process from Organic Municipal Solid Waste: from Laboratory to Pilot Scale

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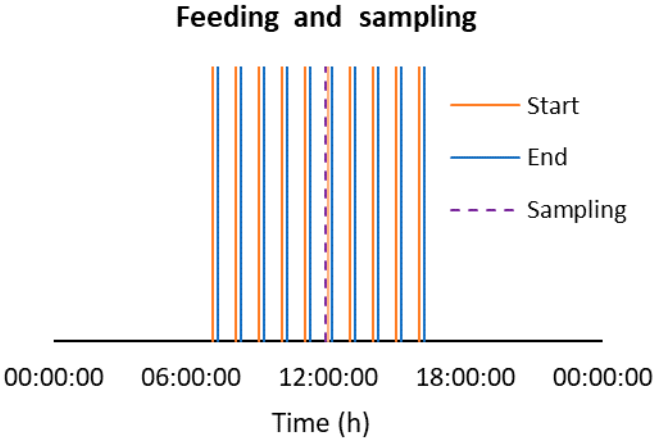

Figure 1. Scheme of automatic raceway feeding. Orange continuous line represents the start (–) and blue line (–) the end of the feeding pulse. Violet dotted line (●●●) represents the sampling time.

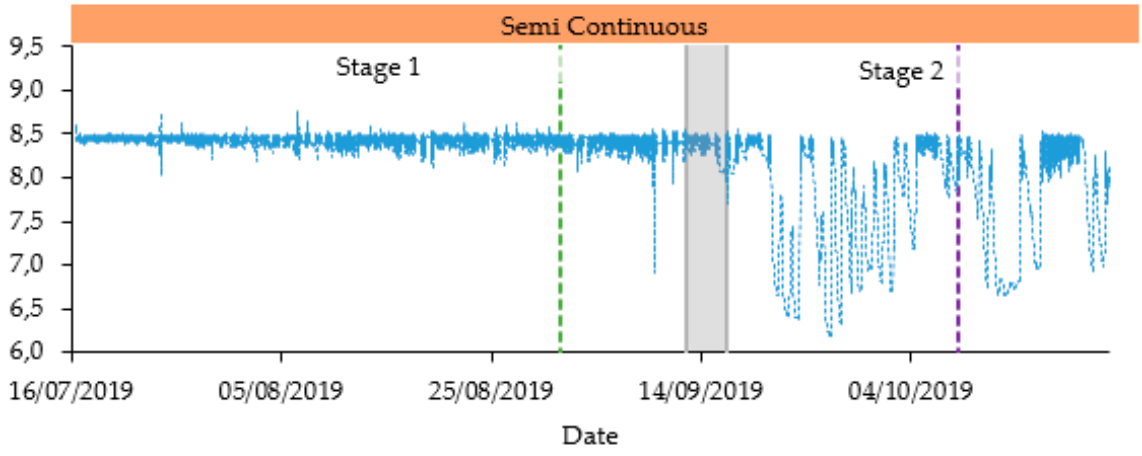

Figure 2. pH evolution during the raceway operation period. Semi Continuous operation is represented in orange, ■, and the Transitional Stage in grey, ■. Green dotted line (●●●)

represents the change in the feeding mode. Violet dotted line (●●●) represents the shift in the column depth.

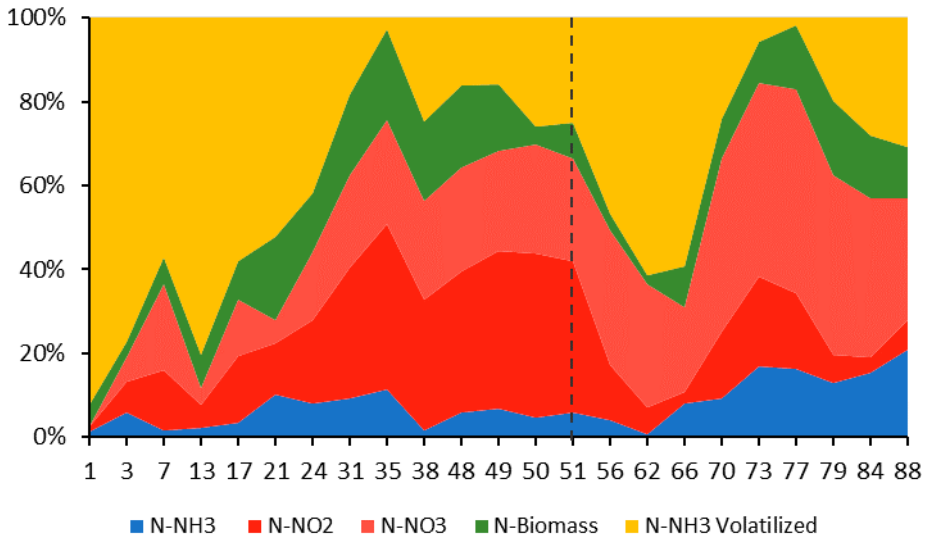

Figure 3. Main nitrogen conversion and removal mechanisms from raceway reactor. N-NH_3 is percentage is represented in blue, , N-NO_2^- in red, N-NO_3^- in pink, , N-Biomass in green, , and N-NH_3 volatilized in yellow, . Semi Continuous operation is represented in orange, , and the Transitional Stage with grey dotted line (....).

Table 1. Nitrogen transformations during raceway operation.

	N-NH_3		**N-NO_x**		**N-Biomass**		**N-Volatilized**		**N-Lost**	
	g N d^{-1}	%	g N d^{-1}	%	g N d^{-1}	%	g N d^{-1}	%	g N d^{-1}	%
Stage 1	0.4 ± 0.2	5.6 ± 3.3	3.1 ± 1.5	39.9 ± 22.6	1.0 ± 0.4	12.5 ± 6.7	4.5 ± 4.4	42.0 ± 27.9	5.5 ± 4.2	54.5 ± 23.9
Stage 2	1.5 ± 0.8	11.6 ± 4.9	6.6 ± 2.4	46.9 ± 15.0	1.4 ± 0.6	10.7 ± 5.1	4.5 ± 3.5	30.8 ± 21.3	6.0 ± 3.2	41.5 ± 18.4
Overall	0.9 ± 0.8	7.9 ± 5.6	4.4 ± 2.5	42.7 ± 19.9	1.2 ± 0.5	11.8 ± 6.1	4.5 ± 4.0	37.6 ± 25.6	5.7 ± 3.8	49.4 ± 22.4

Table 2. Characterization of anaerobic digestates.

Digestate	**Type of AD**	**sCOD (mg L^{-1})**	**tCOD (mg L^{-1})**	**TSS (mg L^{-1})**	**N-NH_3 (mg L^{-1})**	**P-PO_4^{3-} (mg L^{-1})**
D1	UFD	1207.1 ± 32.3	2515.3 ± 28.0	8700 ± 636	2887.2 ± 32.1	9.1 ± 0.0
D2	UFD	2943.5 ± 16.3	-	80 ± 28	3325.2 ± 13.2	13.7 ± 0.1
D3	UFD	1585.7 ± 32.4	-	120 ± 14	2019.7 ± 49.9	15.5 ± 0.4
D4	UFD	2356.8 ± 28.0	-	165 ± 7	1526.0 ± 2.3	35.2 ± 1.1
D5	UFD	2692.3 ± 25.4	-	262 ± 12	1797.2 ± 16.8	70.4 ± 2.9
D6	UFD	4413.9 ± 38.1	-	315 ± 64	1316.5 ± 48.6	96.3 ± 0.7
D7	UFD	3378.3 ± 349.8	-	300 ± 14	1532.4 ± 4.9	95.0 ± 2.15
D8	UFD -FD	5571.4 ± 158.8	7810.6 ± 390.6	1550 ± 71	3115.5 ± 80	80.5 ± 1.4
D9	FD	6278,4 ± 15.6	15145.7 ± 883.1	5875 ± 177	3799.4 ± 45.0	70.1 ± 0.4