

Supplementary Material

The Effect of Ammonia Toxicity on Methane Production of a Full-Scale Biogas Plant—An Estimation Method

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Table S1. Volatile Fatty Acids (VFAs) concentrations at the end of BMP tests of the diluted with water (1:1 volume ratio) and undiluted biogas plant's effluent from the 1st period.

Volatile Fatty Acid-VFA	Effluent diluted with water	Undiluted Effluent
Acetic acid (mM)	0.40242 ± 0.19035	1.05935 ± 0.35627
Propionic acid (mM)	0.08098	ND
Isobutyric acid (mM)	ND	ND
Butyric acid (mM)	ND	ND
Isovaleric acid (mM)	ND	0.00897
n-Valeric acid (mM)	ND	ND
Isocaproic acid (mM)	0.01792 ± 0.00674	0.02243 ± 0.00275
n-Caproic acid (mM)	ND	ND
Heptanoic acid (mM)	0.01203	0.00553

ND: Not Detected.

Table S2. Descriptive statistics for the co-digestion BMP tests and for the duration of 1 HRT (30 days). Methane potential is expressed as mLCH₄ g⁻¹ VS added.

mLCH ₄ g ⁻¹ VS added								
Treatment	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum
					Mean			
					Lower Bound	Upper Bound		
2N	2	330.6760	10.83424	7.66097	233.3342	428.0178	323.02	338.34
3N	3	284.3093	4.70899	2.71874	272.6115	296.0071	279.04	288.10
4N	3	262.6752	4.54020	2.62128	251.3967	273.9537	259.77	267.91
5N	3	214.9502	10.54634	6.08893	188.7516	241.1487	205.18	226.13
Total	11	267.9233	41.96166	12.65192	239.7331	296.1135	205.18	338.34

Table S3. ANOVA for the co-digestion BMP tests and for the duration of 1 HRT (30 days). Methane potential is expressed as mLCH₄ g⁻¹ VS added.

mLCH ₄ g ⁻¹ VS added					
Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17,182.401	3	5727.467	94.244	0.000
Within Groups	425.407	7	60.772	-	-
Total	17,607.808	10	-	-	-

Table S4. Multiple comparisons for the co-digestion BMP tests and for the duration of 1 HRT (30 days). Methane potential is expressed as mLCH₄ g⁻¹ VS added.

Dependent Variable mLCH ₄ g ⁻¹ VS added						
LSD						
(I) Batch_increased	(J) Batch_increased	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2N	3N	46.36671*	7.11644	0.000	29.5390	63.1944
	4N	68.00081*	7.11644	0.000	51.1731	84.8285
	5N	115.72586*	7.11644	0.000	98.8982	132.5536
3N	2N	-46.36671*	7.11644	0.000	-63.1944	-29.5390
	4N	21.63410*	6.36514	0.011	6.5829	36.6853
	5N	69.35915*	6.36514	0.000	54.3080	84.4103
4N	2N	-68.00081*	7.11644	0.000	-84.8285	-51.1731
	3N	-21.63410*	6.36514	0.011	-36.6853	-6.5829
	5N	47.72505*	6.36514	0.000	32.6739	62.7762
5N	2N	-115.72586*	7.11644	0.000	-132.5536	-98.8982
	3N	-69.35915*	6.36514	0.000	-84.4103	-54.3080
	4N	-47.72505*	6.36514	0.000	-62.7762	-32.6739

*. The mean difference is significant at the 0.05 level.

Table S5. Descriptive statistics for the co-digestion BMP tests and for the duration of 60 days. Methane potential is expressed as mLCH₄ g⁻¹ VS added.

mLCH ₄ g ⁻¹ VS added								
Treatment	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum
					Mean			
					Lower Bound	Upper Bound		
2N	2	367.4087	15.57280	11.01163	227.4927	507.3248	356.40	378.42
3N	3	311.3081	2.65235	1.53133	304.7193	317.8969	308.25	312.99
4N	3	297.3943	4.77437	2.75649	285.5341	309.2545	292.46	302.00
5N	3	277.8593	20.87219	12.05056	226.0099	329.7087	258.07	299.66
Total	11	308.5911	33.65128	10.14624	285.9839	331.1984	258.07	378.42

Table S6. ANOVA for the co-digestion BMP tests and for the duration of 60 days. Methane potential is expressed as mLCH₄ g⁻¹ VS added.

mLCH ₄ g ⁻¹ VS added					
Source of variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10,150.618	3	3383.539	20.184	0.001
Within Groups	1173.468	7	167.638	-	-
Total	11,324.085	10	-	-	-

Table S7. Multiple comparisons for the co-digestion BMP tests and for the duration of 60 days. Methane potential is expressed as mLCH₄ g⁻¹ VS added.

Dependent Variable: LCH ₄ /g VS added						
LSD						
(I) Batch_increased	(J) Batch_increased	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
2N	3N	56.10063*	11.81941	0.002	28.1522	84.0491
	4N	70.01448*	11.81941	0.001	42.0660	97.9629
	5N	89.54946*	11.81941	0.000	61.6010	117.4979
3N	2N	-56.10063*	11.81941	0.002	-84.0491	-28.1522
	4N	13.91384	10.57161	0.230	-11.0840	38.9117
	5N	33.44883*	10.57161	0.016	8.4510	58.4467
4N	2N	-70.01448*	11.81941	0.001	-97.9629	-42.0660
	3N	-13.91384	10.57161	0.230	-38.9117	11.0840
	5N	19.53498	10.57161	0.107	-5.4629	44.5329
5N	2N	-89.54946*	11.81941	0.000	-117.4979	-61.6010
	3N	-33.44883*	10.57161	0.016	-58.4467	-8.4510
	4N	-19.53498	10.57161	0.107	-44.5329	5.4629

*. The mean difference is significant at the 0.05 level.

Table S8. Additional characteristics of the inoculum.

Sample	FOS mg L ⁻¹	TAC mg L ⁻¹	FOS/TAC	P ₂ O ₅ mg L ⁻¹
Inoculum	4524	19371	0.234	1751