

TOWARDS A SUSTAINABLE MANAGEMENT OF POULTRY FARM SOLID WASTES

Guillermo Zinola^{1,2}, Claudia Etchehebere²

¹Natural Recourses Technological Unit, Technological University (UTEC), Durazno-Uruguay. e-mail: guillermo.zinola@utec.edu.uy

²Microbial Ecology Laboratory, Microbial Biochemistry and Genomics Department, Biological Research Institute Clemente Estable (IIBCE), Uruguay. e-mail: cetcchebere@iibce.edu.uy

INTRODUCTION

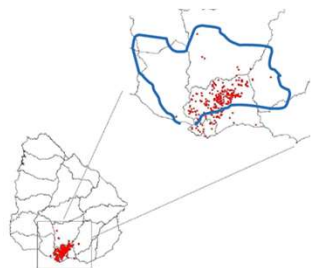


Figure 1. Poultry farms in Uruguay (DIEA, 2016). Blue line represent the Santa Lucia River Basin

Poultry production in Uruguay is concentrated in the south of the country, where it is estimated that egg and broiler production farms generate 26% of the total agro-industrial solid wastes (Fig. 1).

The main residues generated in poultry farms are Laying Heng Manure (LM-3.300 tonTS/year), from eggs production process, and Broiler Litter (BL-81.000 tonTS/year) as consequences of grower for meat production (LM:BT ratio of 24:1 in ST). In the case of LM, three different egg production systems were considered to determine the effect of poultry management on the waste recovery possibilities (Benzano et al 2016) (Fig. 2).

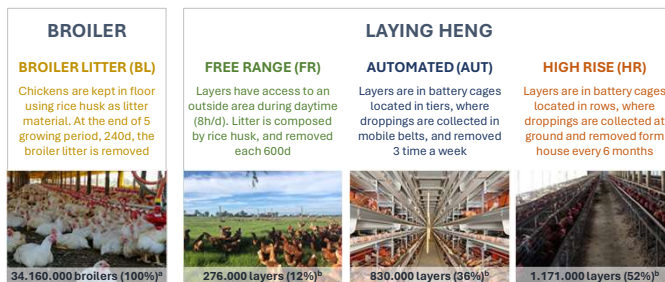


Figure 2. Productions systems and wastes generation in poultry farms. a. DIEA (2016). b. Arenare, L. (2017).

OBJETIVES AND ACTIVITIES

This work focuses on the Anaerobic Co-Digestion (Co-AD) process of BL and LM, as well as its mixtures, thinking in the implementation of centralized recovery plants.

- Characterize and determine of Biochemical Methane Potential (BMP) of wastes.
- Evaluation of the Co-DA process of three BL:LM mixtures (24:1, 12:1 and 1:1 in ST), based on the BMP results and the time required to achieve it.
- Select the best scenario for the centralized methane production using poultry waste.

METHODS AND MATERIALS

- Physicochemical analysis were base in Standards Methods (APHA, 2023).
- BMP test were determined based on VDI 4630:2016 Standard (VDI, 2016) and Holliger et al (2021).
- AMPTS II® (Bioprocess Control) equipment was used, include the CO₂ removal and CH₄ measurement that is registered constantly (Fig. 3).

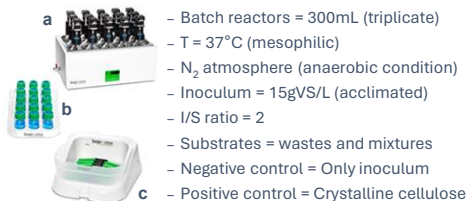


Figure 3. Right: AMPTS II. a. Water bath with stirred reactors. b. Gas washing unit. c. Gas measurement unit. Left: Conditions of BMP test

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- Alatrastre-Mondragon, F. et al (2006). Anaerobic codigestion of municipal, farm, and industrial organic wastes. *Water Environ. Res.* 78(6), 607-636.
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CONCLUSIONS AND FUTURE

The Co-AD of waste decreased the total methane potential compared to the mono-AD, although the variations was not affected significantly by the proportions and type of egg production process.

However, the times of the anaerobic process could be reduced in 17% (12:1) and 15% (24:1) using BL:LM.

These results should be considerate in a sustainability analysis of the technology feasibility.

RESULTS AND DISCUSSIONS

Table 1. Physicochemical characterization. a. Concentration expressed in dry matter.

Parameters	Symbol	BL	LM-FR	LM-AUT	LM-HR	Units
Waste generation (%)	JTS	81.000 (100)	396 (12)	1.118 (36)	1.716 (52)	tonTS/year
Humidity	%HUM	42	16	76	47	%
Total solids	TS	583	839	244	534	gTS/kg
Volatile solids (VS/TS)	VS	472 (81)	521 (62)	173 (71)	323 (60)	gVS/kg (%)
Carbon	C	35	29	27	27	%
Total Nitrogen (C/TN)	TN	3,5 (10)	2,9 (10)	5,3 (4)	3,7 (7)	% ^a (gC/gN)
Total Phosphorous (TN/TP)	TP	1,63 (2,1)	2,21 (1,3)	2,05 (2,6)	3,69 (1,0)	% ^a (gN/gP)

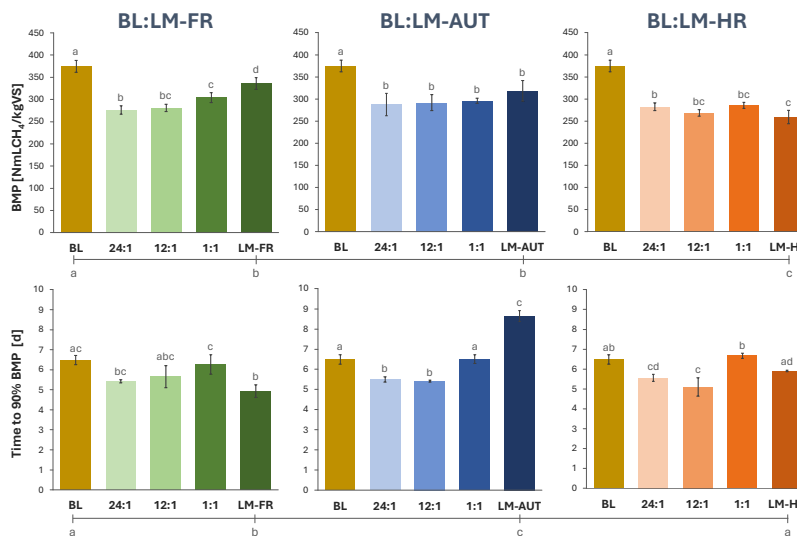
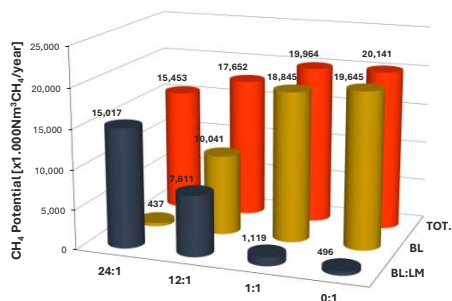


Figure 4. Above: BMP of wastes and mixtures BL:LM. Below: Time to achieve the 90% of methane production. Tukey's multiple comparison test, different letters indicated significative difference (p< 0.05).



ACKNOWLEDGEMENTS

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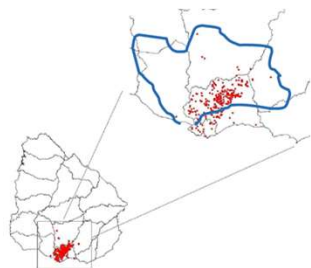


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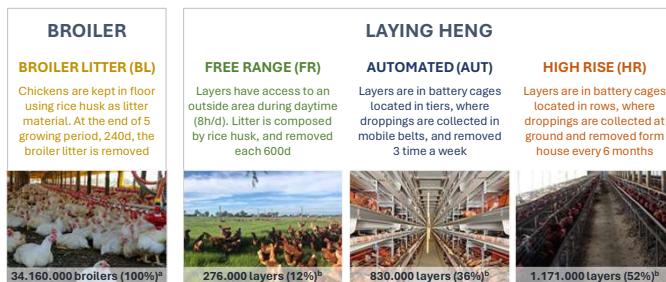


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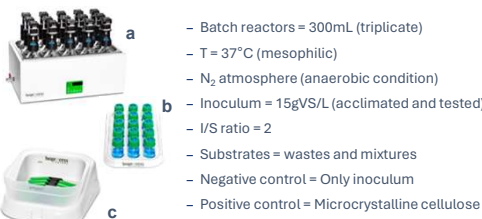


Figure 3. Left: AMPTS II (Bioprocess Control). a. Water bath with stirred reactors. b. Gas washing unit. c. Gas measurement unit. Right: Conditions of BMP test

- %Hum and TN in wastes were affected by collection periods in breeding houses.
- Systems with rice hunk, as litter materials (BL and LM-FR), had high C/N ratios.
- NH₄⁺ concentration could be inhibit the Co-AD process.

RESULTS AND DISCUSSIONS

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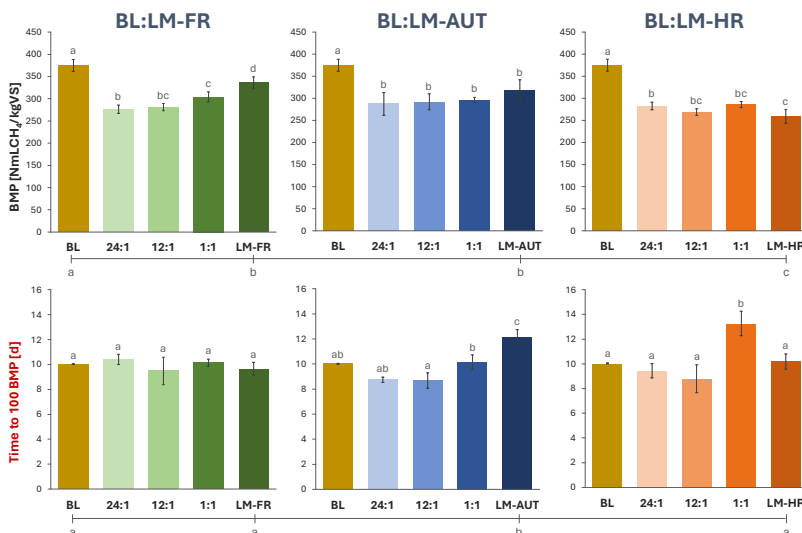


Figure 4. Above: BMP of wastes and mixtures BL:LM. Below: Time at the end of BMP test, 100% of methane production. Tukey's multiple comparison test, different letters indicated significative difference ($p < 0.05$).

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No puedo decir nada de la reducción de tiempos.

