# Anaerobic Digestion of raw and briquetted lignocellulosic compounds

M. Imeni[1], B. Puyelo[1], J. Bartroli[2], N. Puy[2], L. Llenas[1], E. Martí[1], S. Ponsá[1] and J. Colón[1]

[1] BETA Tech. Centre. (TECNIO Network), U Science Tech., University of Vic-Central University of Catalonia, C/ de la Laura 13, 08500 Vic (Spain)
[2] Department of Chemistry, Universitat Autònoma de Barcelona, Edifici Cn — Campus de la UAB, 08193 Cerdanyola del Vallès, Barcelona, Spain

Presenting author email: joan.colon@uvic.cat

Anaerobic digestion (AD) is a common treatment for animal manure, however, using only animal manure produces a low $CH_4$ yield. To make this technology more attractive to farmers, an increase in $CH_4$ yield can be achieved by co-digesting animal manure with inexpensive and easy accessible agricultural by-products (Xavier et al., 2015). Lignocellulosic biomass (2$^{nd}$ generation raw materials such as agricultural residues, energy crops) is a promising energy source, because it is available in large quantities that will not conflict with food production and may contribute to environmental sustainability (Demirbas, 2009). However, due to its high lignocellulosic content, these by-products present a low biodegradation degree (Pohl et al., 2013). Moreover, low bulk density of these residues significantly increase the handling, storage and transportation costs (Rijal et al., 2012). Densification technologies such as pelleting and briquetting of lignocellulosic wastes has been suggested as potential processes to solve these logistic issues.

Briquetting is a mechanical process, in which biomass is first shredded with a low initial density and then submitted to high pressure, promoting its agglomeration and densification. During densification, the moisture in the biomass forms steam under high pressure and temperature, which may hydrolyse the hemicellulose and lignin into lower molecular carbohydrates, lignin products, sugar polymers and other derivatives (Grover and Mishra, 1996). Therefore, particle size reduction through shredding and the application of high pressure and temperature during briquetting process could both accelerate the hydrolysis and acidogenesis of the biomass, achieving a faster and higher $CH_4$ yield. However, to our knowledge, the effect of briquetting as pre-treatment for lignocellulosic by-products in AD processes has been scarcely studied, especially in by-products different from straw. Thus, the aims of this study are (i) to evaluate and compare the methane yield of straw, sarment, poplasr and saw dust in raw and briquettes forms and (ii) to evaluate the AD co-digestion performance of raw and briquetted lignocellulosic by-products with animal manures.

Maximal biogas and $CH_4$ production were determined in batch experiments at mesophilic temperatures (37ºC) and retention times ranging from 21 to 50 days. Inoculum:substrate ratios of 1:1 was used in these tests. The results are expressed in terms on $NL_{biogas}$ $kg^{-1}$ VS. As an example, Figure 1 shows the results obtained from raw and briquetted straw and sarment. These experiments show that briquetting process does not contribute to higher biogas yields, and in the case of sarment, the briquetting process inhibits the biogas production.

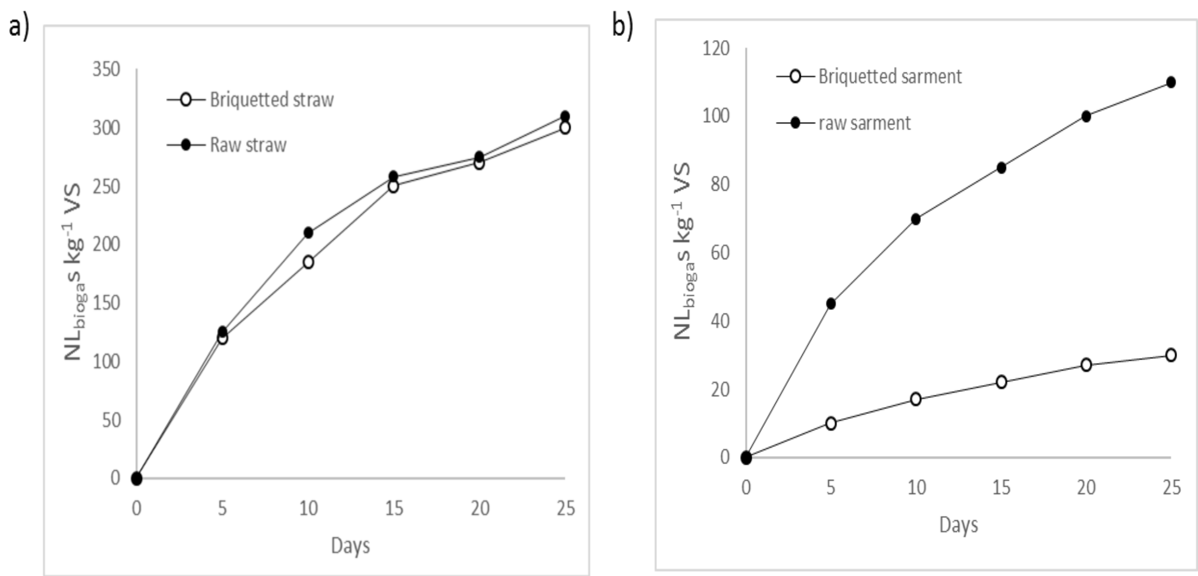


*Figure 1. Cumulative biogas yield form a) straw and b) sarment.*

Although briquetting process may be an effective way to solve logistic issues (e.g. storage and transport of lignocellulosic by-products) it is not clear that this pre-treatment can boost the biogas production of lignocellulosic wastes. Further research is needed (i) to fully understand the physic-chemical changes when briquetting lignocellulosic by-products and (ii) to optimize its use in AD processes.

**References**

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