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Evaluation Of The Methanogenic Potential Of Two Lignocellulosic Crops

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Giorgio Testa, Alessandra Piccitto, Danilo Scordia, Sebastiano Andrea Corinzia, Silvio Calcagno, Salvatore Luciano Cosentino

Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Univ. Catania, Autore corrispondente: gtesta@unict.it

Introduction

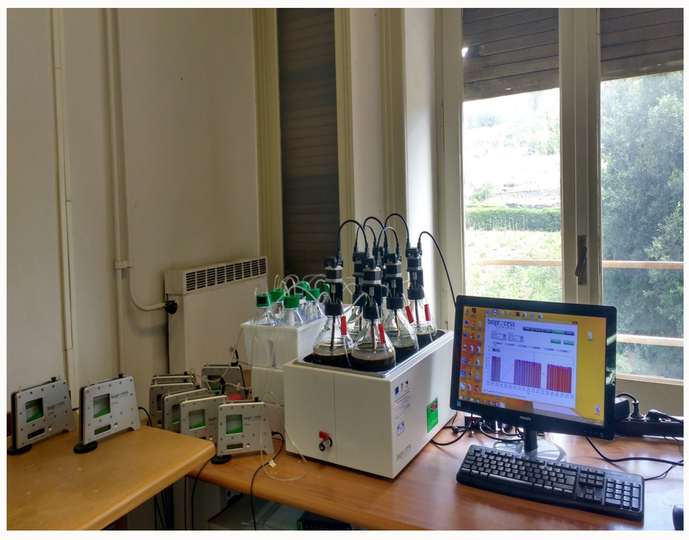
Biogas production can be considered an important technology for the sustainable use of agricultural biomass as a renewable energy source even more when the substrates for anaerobic digestion are crop residues, livestock residues or energy crops that don't compete with food crops for land use.

The aims of this study were to evaluate the production of biogas and biomethane from two lignocellulosic crops suitable for the Mediterranean environment (*Arundo donax* L. and *Saccharum spontaneum* subsp. *aegyptiacum* (Willd.) Hack) and the efficiency of a thermal pretreatment to increase the biomethane production. The purpose of the pretreatment is to break the recalcitrant lignin layer, so that the cellulose and hemicellulose present in the biomass are hydrolyzed by microorganisms and converted into simple sugars to achieve greater energy yield.

Materials and Methods

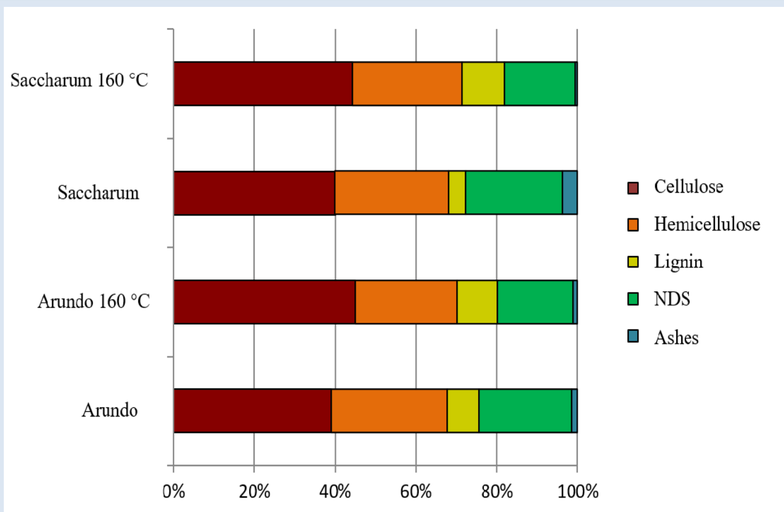
The qualitative analysis of the biomass was carried out through the extraction unit Fibertec Velp Scientifica, FIWE model using the Van Soest method which allows to determine the composition of the fibrous fraction of any vegetable matrix. A physical pretreatment of thermal type was carried out using an autoclave (model 1000 ML Zipperclave Assembly, Parker) at 160 °C for 10 minutes, distilled water as catalyst stirring at 160 rpm. For the estimation of the methanogenic potential of the different vegetable matrices (*Arundo* and *Saccharum*) was used the BMP test (Biochemical Methane Potential), and every BMP test lasted 30 days. The experiment was carried out using an automatic methanogenic potential detection system (AMPTS, Automatic Methane Potential Test System) of the different organic matrices.

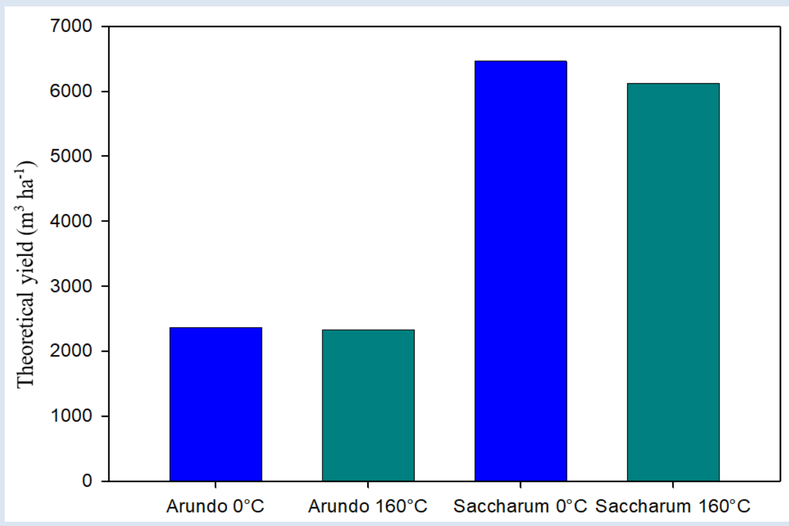
Dry and volatile solids were determined both for the organic substrate and the inoculum in order to obtain an inoculum/substrate ratio equal to 3 inside the batch. The dry weight was obtained drying the biomass in a ventilated oven at 105 °C until constant weight. For the estimation of the volatile solids the dried samples were placed in a muffle furnace at 550 ° C for 5 hours



Results

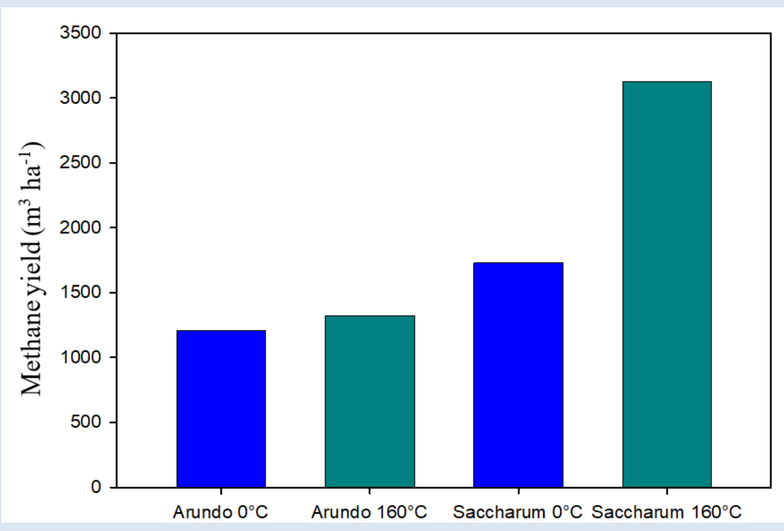
Fibre fractions in relation to the different treatments (species and temperature) determined by the Van Soest method. 160°C refer to pretreated biomass.





Theoretical methane yield (m^3 ha^{-1}) in relation to the different species and thermal pretreatment studied.

Methane yield (m^3 ha^{-1}) in relation to the different species and thermal pretreatment studied.



Conclusions

The experiment confirms the aptitude of *Arundo donax* and *Saccharum spontaneum* to different energetic exploitation. These two species show, in relation to their needs respect to the climate, environment and agronomic input, the traits of the ideotype biomass crops suitable to the cultivation in marginal Mediterranean semi-arid environment.

All the substrate under study highlighted high methanogenic potential that were confirmed by biomethane production tests (BMP test) carried out in laboratory.

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