



Potential Energy for the Production of Pellets of 10 Species of Forest Plantations in Costa Rica

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Introduction

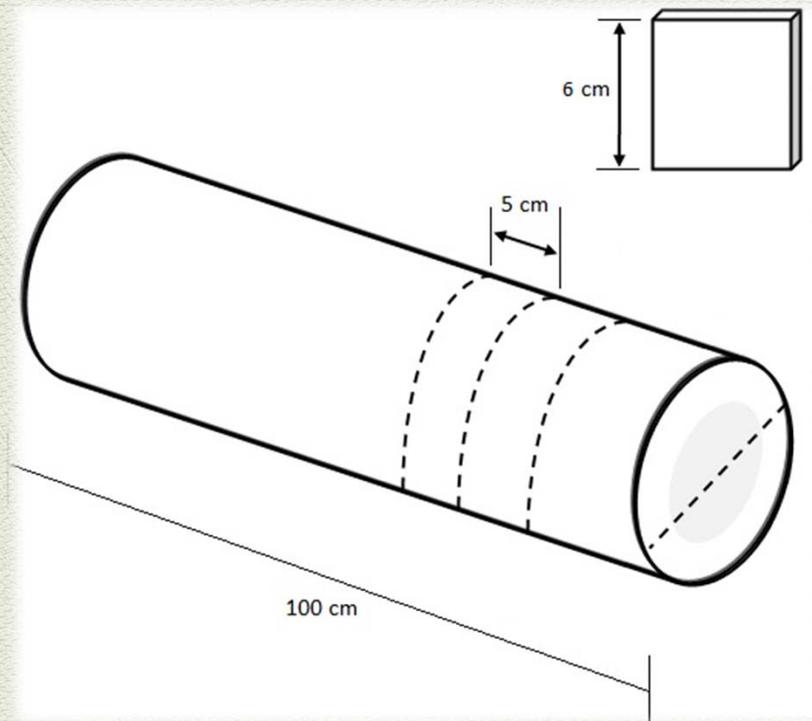
- Forest plantation species
- New materiales: Pellets
- Energy production in Costa Rica
- Energy properties of this species



METHODOLOGY

Sampling

- For each specie three trees were selected near to average diameter of the plantation.
- A log from the base was extracted.
- Each log were cut in cross sections of about 5 cm.
- Each cross-section was cut in half and five chips approximately 6 cm wide and 1 cm thick were extracted.



Sampling



Terminalia amazonia



Terminalia oblonga



Bombacopsis quinata



Vochysia guatemalensis



Alnus acuminata



Acacia mangium



Swietenia macrophylla



Tectona grandis



Gmelina arborea



Cupressus lusitanica

Properties of the species

Combustion characteristics

Calorific value

Ash content

Fuel value
index

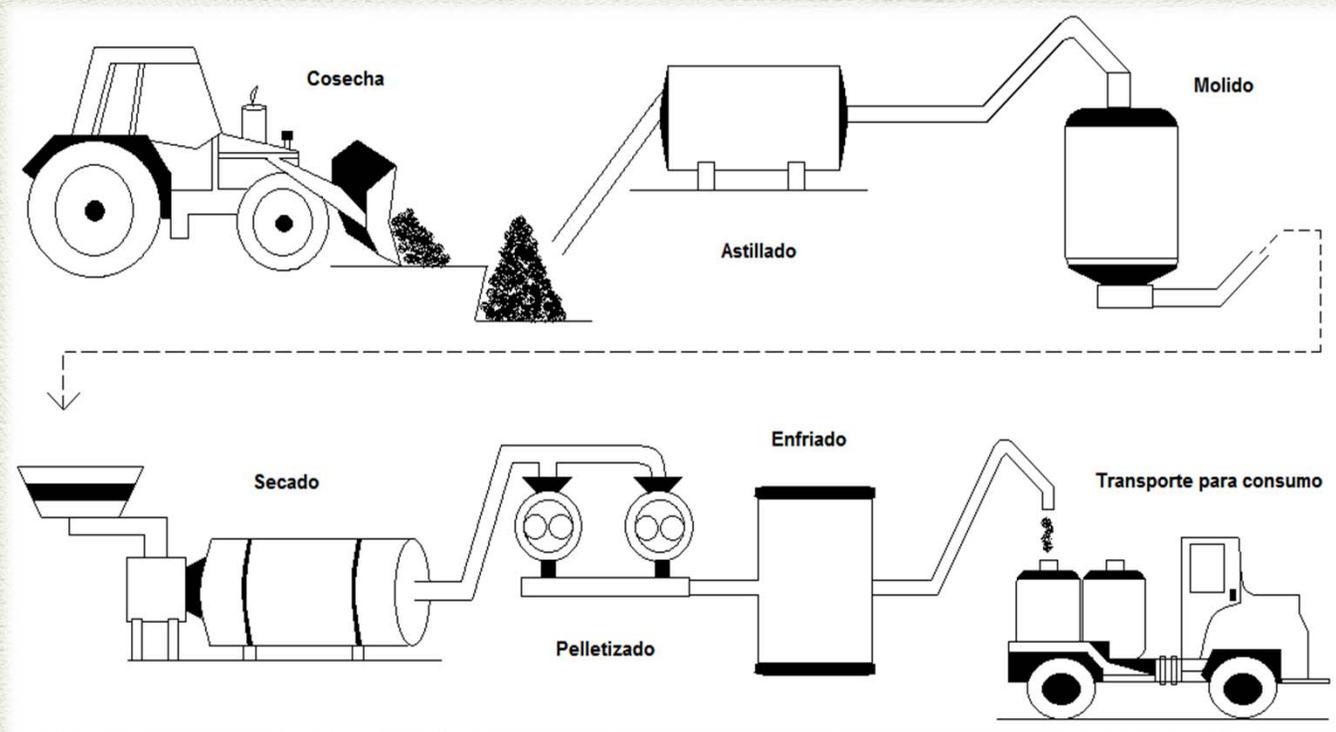
Physical characteristics

Moisture
content

Specific gravity

Green density

Pellet production process



Manufactured in the company PELLETICS

<http://pelletics.com/>

Pellets evaluation

Properties evaluated:

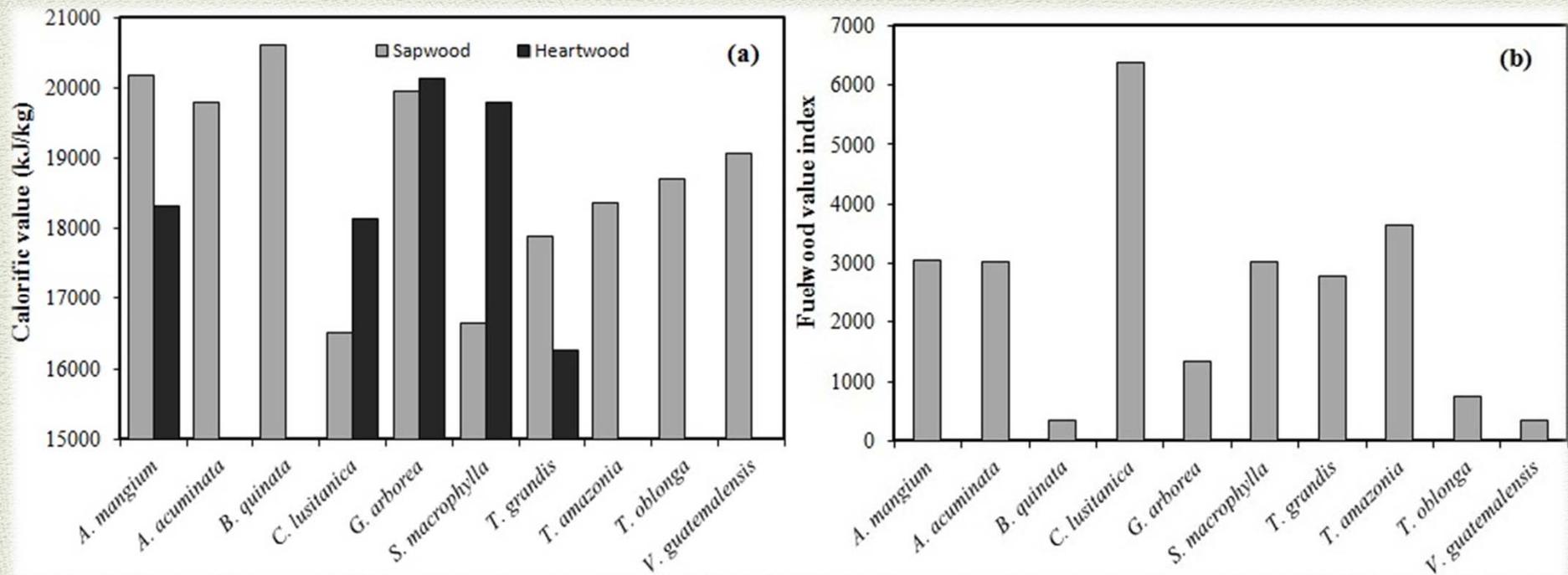
- Calorific value
- Length
- Diameter
- Density
- Bulk density
- Moisture content
- Moisture absorption
- Mechanic durability
- Compressive strength

Quality evaluation:

- Presence of cracks
- Presence of clearly zones
- X-ray images were used

RESULTS

Combustion characteristics for ten species



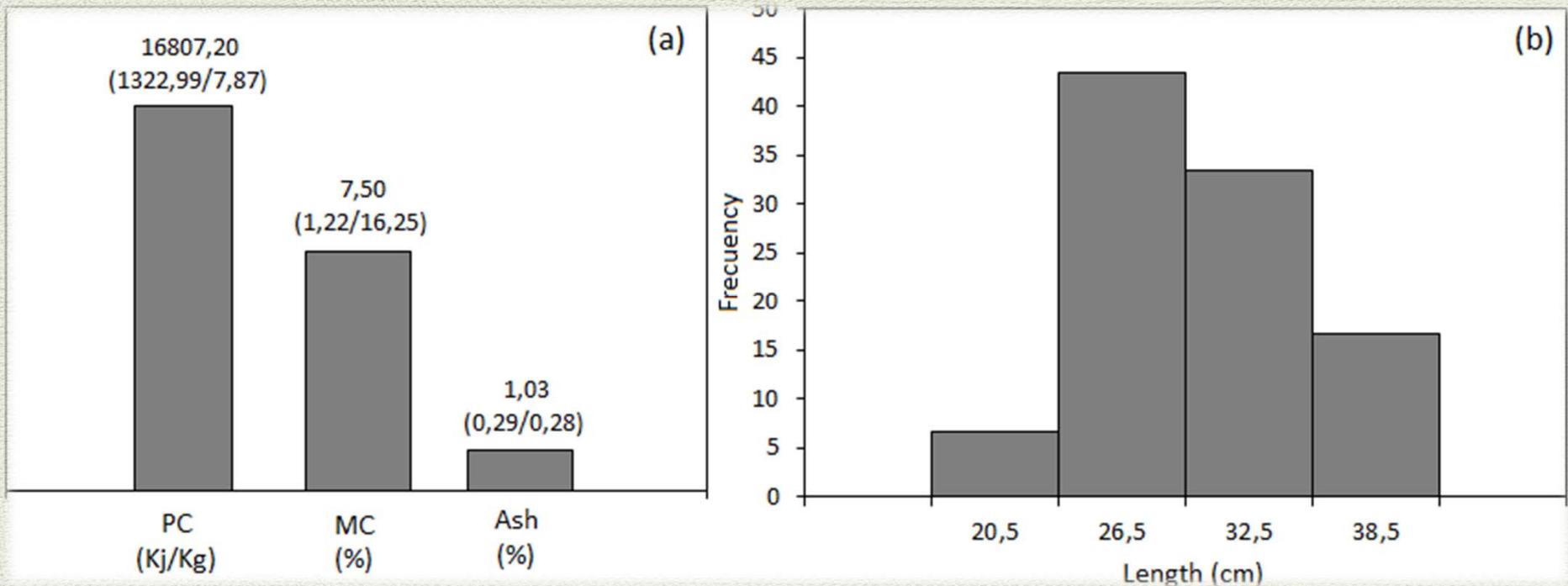
Calorific value (a), and fuel value index (b) for ten species of fast-growing tree plantations in Costa Rica.

Physical properties for the ten species

Species	Green density (g/cm ³)	Specific gravity	Moisture content (%)	Ash content (%)
<i>Acacia mangium</i>	1,08 ^b	0,37 ^g	66,72 ^a	0,58 ^{efg}
<i>Alnus acuminata</i>	0,67 ^g	0,36 ^g	46,48 ^d	0,38 ^{fg}
<i>Bombacopsis quinata</i>	0,86 ^e	0,32 ^h	63,34 ^b	3,99 ^a
<i>Cupressus lusitanica</i>	0,75 ^f	0,42 ^e	44,50 ^e	0,19 ^g
<i>Gmelina arborea</i>	0,91 ^d	0,39 ^f	56,97 ^c	0,96 ^e
<i>Swietenia macrophylla</i>	0,94 ^{cd}	0,54 ^b	41,81 ^f	0,64 ^{ef}
<i>Tectona grandis</i>	1,12 ^a	0,49 ^d	56,43 ^c	2,81 ^c
<i>Terminalia amazonia</i>	0,87 ^e	0,51 ^c	41,66 ^f	0,41 ^{fg}
<i>Terminalia oblonga</i>	0,95 ^c	0,60 ^a	37,16 ^g	1,84 ^d
<i>Vochysia guatemalensis</i>	0,75 ^f	0,26 ⁱ	65,32 ^a	3,47 ^b

Different letters for each of the features mean statistical differences at 95%, according to the Tukey test

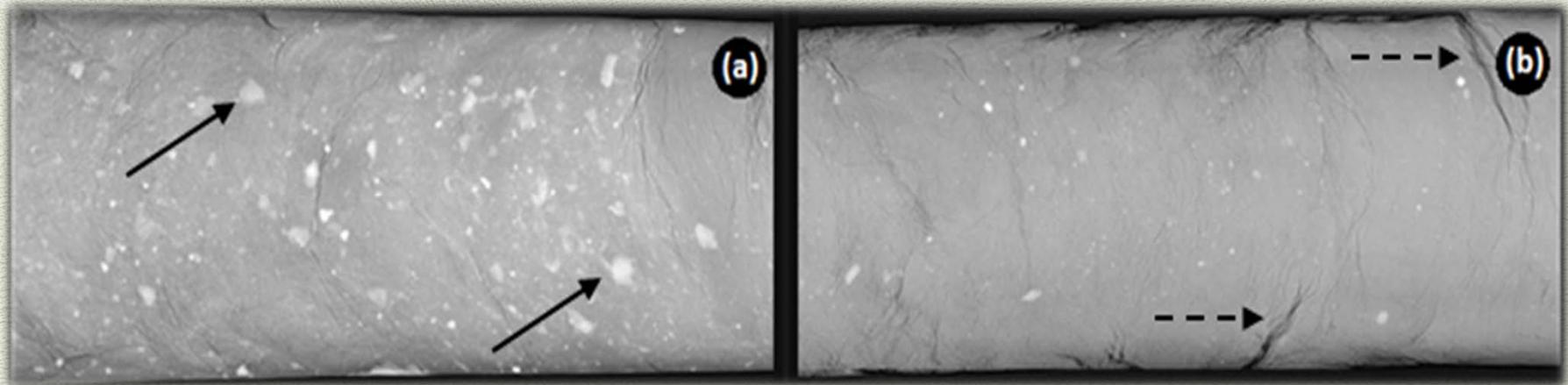
Pellets properties



Energetic properties (a) and distribution of the length (b) for pellets of *C. lusitanica*.

Note: PC = calorific value, MC = moisture content. The values in parentheses are the standard deviation and coefficient of variation respectively.

Quality evaluation for pellets



X-ray photograph (a) zones of greater clarity, and (b) pellets fissures in *C. lusitanica*.

Note: The marker \dashrightarrow indicates the presence of cracks in the surface and the marker \rightarrow indicates areas more clearly.

CONCLUSIONS

Ten species

The energy parameters showed variations between species of fast-growing plantations.

C. lusitanica was the specie with the highest potential energy due to its high values of fuel value index, calorific value and low ash content.

Other forest plantations species, have significant energy potential due to high volumes of waste obtained in different industries.

C. lusitanica pellets

The pellets manufactured with *C. lusitanica* have energetic, physical and mechanical properties similar to those made with other species and materials.

Its durability is within the range greater than 80%, so it is considered high. It is also characterized by a high quality, with few cracks and clearly areas on its surface.

The moisture content of the pellets and their moisture absorption, have an influence on its density, durability and quality.

In this case the pellets of *C. lusitanica* had a moisture content (7.50%) toward the range considered optimal (8% to 12 %).

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