

# Densification of by products coffee for energy uses

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## Introduction

The processing of coffee pulp to be used as a biomass fuel in thermal or electrical uses was studied, including all the operations necessary to reduce its moisture content, determine mixtures with husk that allow adequate pelletization that favors its storage for distributed uses by year is an opportunity to reduce cost and storage space in the industrial coffee processing.

## Materials/Methods

For the development of the analysis, we used a pelletizer model ZLSP300B from the manufacturer Anyang GemCo, with a nominal power of 22 kW and a nominal processing capacity of 250 kg / h to 350 kg / h.

The pelletizing process consists of a roll-forced extrusion of coffee pulp into molds with 8 mm holes and an average dimension of 25 mm long.

Previously, the coffee pulp had been dried at levels of 40% humidity and with different levels of mixing with husk from 50 to 30% of coffee husk.

## Conclusion/Perspectives

Is possible to form coffee pulp pellets without binders and the maximum proportion of husk is 30% in a mix process.

Recommended moisture of the pulp to facilitate the formation of pellets is 30 to 50%. Higher humidity levels generate a coffee pulp paste. Lower moisture levels require more investment in pulp drying.

It is recommended to carry out the pelletizing in a double pass through the equipment. The first pass causes a reduction in size and increases plasticity and biomass flow to the next pass.

There is moisture loss during pelletizing, but an additional drying of the pellet formed up to 15% on a moisture basis is recommended to improve the physical consistency of the final pellet.



**Figure 1: 8 mm pellets from 100% coffee pulp**

Data 100% coffee Pulp pellets	Value
Mass lost (% mass loss / initial mass)	5-6
Pellets production by dry base (kg/h)	157,0
Flow biomasa (kg/h)	314,0
Initial moisture (% WB)	30-50
Final moisture (% WB)	25-45
Average power consumed (kw)	16,3
Average power pellets consumed (kw)	19,5

**Chart 1: Pellet´s Characteristic**

## Results/Discussion

The coffee pulp contains between 80-85% moisture (WB), after the pulping process of the coffee fruit. It was found that the pressing process with a helical press reduces the water content (WB) by 10%, but also removes mucilage, some dissolved and suspended solids. This pretreatment implies a significant reduction in mass rather than moisture, but the most important aspect is that it seems to have an effect on the breaking of the brush fibers. However, to know the scientific reasons why the drying time of unbound moisture decreases, which does not seem to be affected by pressing, and it is unknown whether the critical moisture or the drying speed is different in later stages. The measured energy consumption that is invested in said pretreatment was 4.2 kWh per ton of pulp in a unit with a 10 Hp motor.

The solar pulp drying process allows low humidity levels of up to 10% or less to be reached without the need to spend on fuel or electricity, obviously, the area-thickness ratio of the drying bed limits the volume to be processed in this other pretreatment. Likewise, it is important to note that it is not required to reach such low humidity values, but rather that to densify the pulp, it is required that it be in a humidity range between 40% to 50%, which have been shown to be convenient for carry out the subsequent pelletizing work.

The pelletizing process was studied. Pulp with humidity values below the indicated range are not stable and tend to lose their initially densified characteristics, while pellets with humidity levels above 50% tend to form a paste in the pelletizer and break down mechanically.

The best pelletizing results with respect to the mechanical consistency of the final product correspond to a two-pressing process prior to final drying.

## References:

*Escuela de Ingeniería Química Universidad de Costa Rica. Informe técnico. Densificación de residuos de café para su uso en gasificación . Costa Rica Noviembre 2016.*