



Title: Mechanical characterization of spent- coffee-grounds briquettes

Authors: CHAMARRAVÍ-GUERRA, Oscar and MORENO-ARIAS, Claudio Alberto

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ECORFAN-México, S.C.
143 – 50 Itzopan Street
La Florida, Ecatepec Municipality
Mexico State, 55120 Zipcode
Phone: +52 1 55 6159 2296
Skype: ecorfan-mexico.s.c.
E-mail: contacto@ecorfan.org
Facebook: ECORFAN-México S. C.
Twitter: @EcorfanC

www.ecorfan.org

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Introduction

In this project, briquette production from spent coffee grounds and newsprint as a binder is an alternative to firewood and mineral coal.

The briquetting press is a device that produces samples in the form of briquettes (usually as a cylindrical block) to evaluate their mechanical properties such as compression strength, shatter and abrasive resistance.



Introduction

The mechanical properties of briquettes guarantee adequate performance as fuel. Also, they offer optimal integrity and appearance in transport, storage, and distribution.

The main objective is to characterize the briquette of SCG (spent coffee grounds) and RNP (recycled newspaper or newsprint) based on the use of devices such as the briquetting press, the universal testing machine and a rotary drum, to evaluate the mechanical performance of the composite material.



Methodology

1. Design and construction of a Peterson type briquetting

press.

Briquette Machine Features	
Denomination	Value
Maximal compaction force (kgf/cm ²) – (kN/m ²)	69.299 – 6796
Dimensions (mm)	22 x 10 x 95
Weight (kg)	9.87
Nominal production (briquettes/test)	3
Average product density (g/cm ³)	0.36
Briquetting process performance	Manual and intermittent
Dimensions of hollow cylinder briquette	Diameter = 64.4 mm, thickness = 21.34 mm, and average height = 49 mm

Methodology

2. Manufacture of briquettes

2.1 Mixture preparation (SCG-RNP compositions of 50-50, 70-30 and 80-20).

2.2 Compaction of mixture (The manually operated hydraulic jack puts the mixture under pressure of 6.796 Mpa).

2.3 Drying process: Are exposed directly to sunlight.



Methodology

3. Mechanical characterization of briquettes

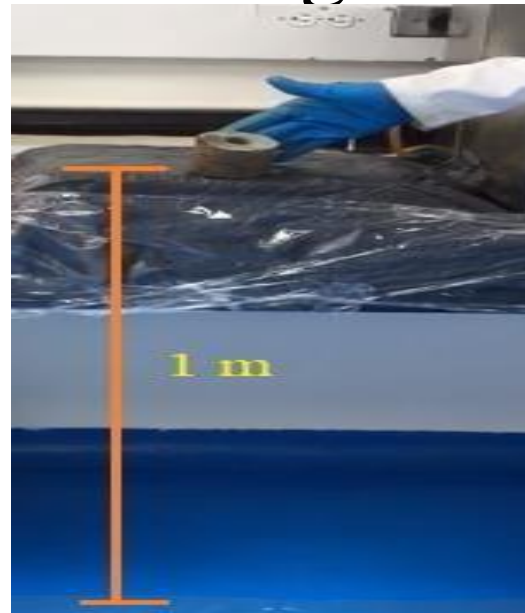
3.1 Compression strength test: SHIMADZU E-50 Universal Testing Machine for eight samples of each composition.



Methodology

3. Mechanical characterization of briquettes

3.2 Shatter resistance test: Dropping them in free fall from a height of 1 m, The initial weight of the entire briquette and the weight of the largest piece were measured.



Methodology

3. Mechanical characterization of briquettes

3.3 Abrasive resistance: Were subjected to a rotating drum of 20 cm in diameter, 30 cm in length, for 5 minutes by rotating it at 25 rpm, a sheet of sandpaper 100 was placed on the inner walls to provide the abrasive medium.

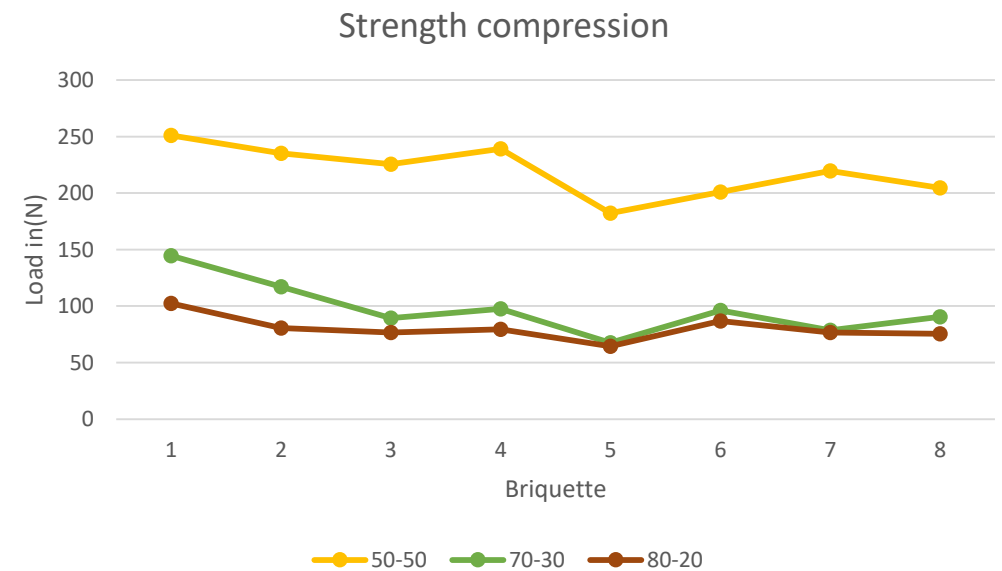


Results

Parameters in the Colombian Technical Standard NTC 2060.

1. Compression strength tests:

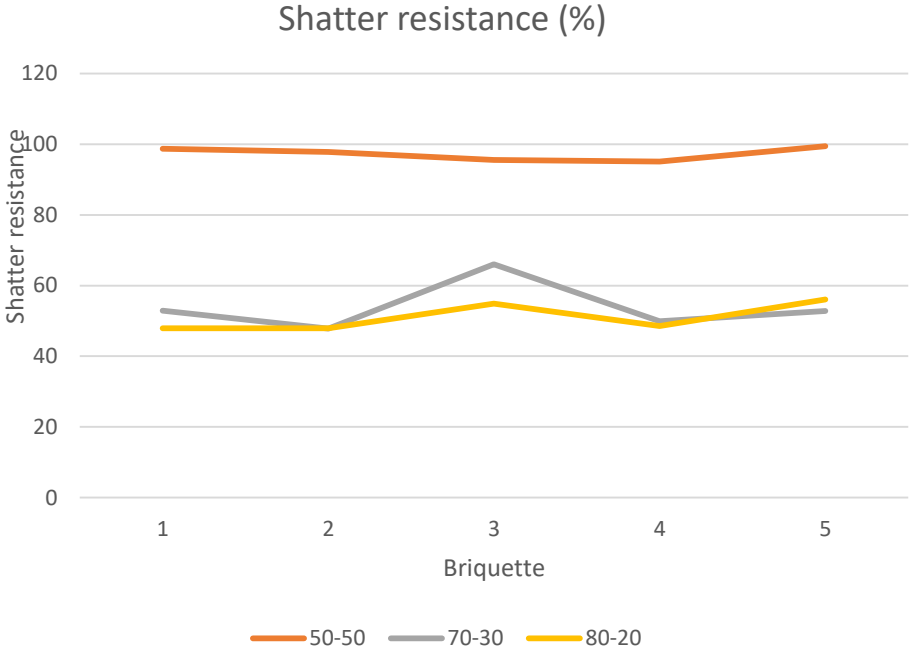
Briquette Composition	Average load (N)	Standard deviation
50:50	219,78165	22,7965282
70:30	97,683925	23,8226605
80:20	80,269138	10,9332847



Results

2. Shatter resistance tests:

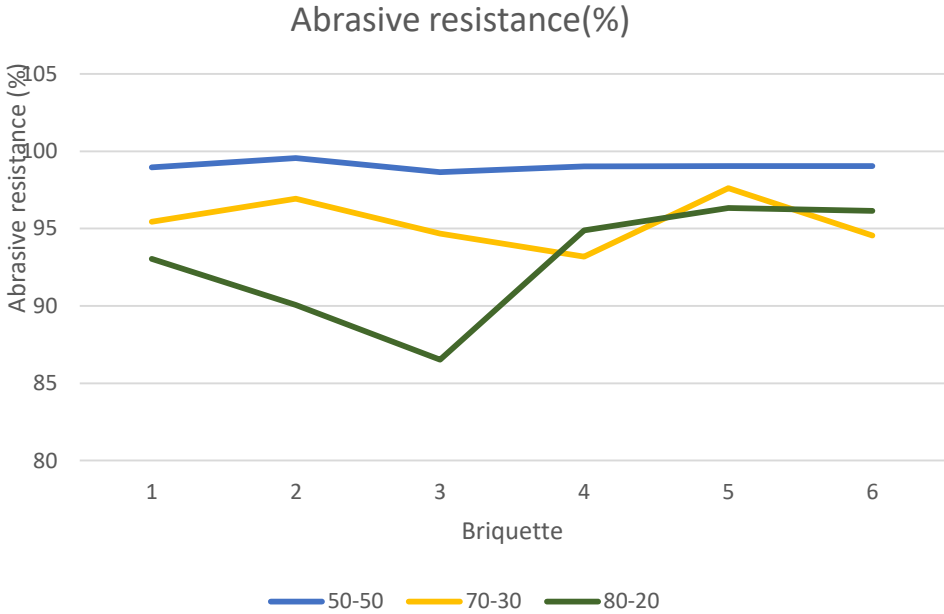
Briquette Composition	Average values (%)	Standard deviation	Number of launches in the free fall
50:50	97,347	1,93143794	20
70:30	53,909	7,12501966	7
80:20	51,069	4,04252242	4



Results

3. Abrasive resistance tests:

Briquette Composition	Average values (%)	Standard deviation
50:50	99,0436833	0,29385645
70:30	95,4105000	1,65221905
80:20	92,8270833	3,86789073



Conclusions

- Despite not having reached the compressive strength limit, the briquettes showed high axial load support values, and can support a considerable quantity of briquettes stacked on top of each other.
- Briquettes, whose composition was 50-50, showed a high resistance to impact. They required several launches to show material detachment which was less than two percent.

Conclusions

- Briquettes, whose composition was 50-50, showed good abrasion resistance when rotated against sandpaper covered walls, Detached material was less than two percent.
- These mechanical tests showed that RNP, contributes significantly to improve mechanical properties of briquettes based on coffee grounds. In addition to being a readily available material.

Conclusions

- In terms of mechanical behavior, the briquettes with a 50:50 composition showed better resistance to compression or crushing, impact and abrasion than the 80:20 and 70:30 briquettes.
- The production of briquettes based on biofuels, encourages research for clean and renewable energy sources.

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