

## Percentage Influences of Pectin on the Friability Index of Orange Waste Charcoal Briquettes.

Vinícius de O. Concentino\*, Karine Zanella, Osvaldir P. Taranto.

### Abstract

The aim of this work was determining the friability index of charcoal briquettes, produced from the carbonization of orange bagasse and the use of pectin as binder (5, 10, 15% w/w). It was observed that the friability of the briquette decreased as the binder proportion increases in its composition, i.e, to the proportion of 5% there was a mass loss of 29.871%. For 10%, the mass loss was 13.617% and for the proportion of 15% the mass loss was 8.018%. The last one is considered as not friable.

### Key words:

*Orange bagasse, charcoal briquettes, friability index.*

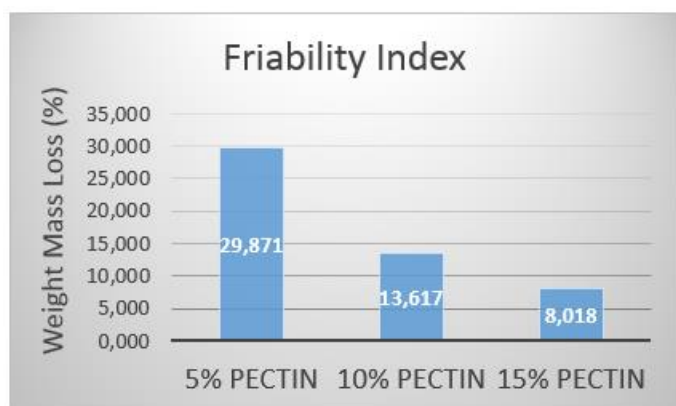
### Introduction

Brazil tops the rank among the most important countries in the production of citrus fruits. So, the search for the use of these wastes as by-products, becomes interesting. An alternative would be the application of carbonization (slow pyrolysis) in the solid waste to convert the biomass into orange charcoal<sup>1</sup>.

Charcoal particles are composed mainly of carbon, without any binding mechanism when compressed. Therefore, the greatest difficulty into the briquettes production is the search for a binder that promotes the necessary features that a charcoal briquettes should have<sup>2</sup>. The most commonly used binders is the corn starch, but other binders have been studied in order to improve the charcoal briquettes characteristics, such as the pectin. In this way, this work has as main objective the use of the pectin as binder and orange bagasse to make charcoal briquette using a manual hydraulic press, aiming the production of biofuels for combustion.

### Results and Discussion

The charcoal briquettes were produced using a unheated hydraulic press. A cylindrical mold was used and a force of 5 tons was applied for 3 minutes. To determine the friability index was used as reference the method known as "Tumbling" (NBR 8740), which evaluates the difference between the initial and final mass of a briquette subjected to a test in a rotating drum at 25 rpm for 20 minutes (500 rotations). Image 1 brings the friability index results.



**Image 1.** Friability index of charcoal briquettes with 5, 10 and 15% of pectin in its composition.

It can be seen that the percentage of weight loss decreases as the pectin mass increases. This result was expected since the addition of the binder provides greater adhesion between the charcoal particles.

The charcoal briquettes can be classified according to its friability index. This classification is shown in the Chart 1.

**Chart 1.** Classification of the charcoal briquettes.

Amount of pectin	Classification of the briquettes*
5%	Fairly friable
10%	Slightly friable
15%	Not friable

\*Classification presented by <sup>3</sup>

Among these results, the chosen amount of pectin is 10% in the briquette composition, since it is a reasonable amount to be mix with the charcoal. Also, because the briquettes produced with this percentage has a satisfactory friability index results<sup>4</sup>. Similar results can be seen in the literature<sup>5</sup>.

### Conclusions

In this study, the results showed that, within the studied domain, the orange bagasse is a biomass with a high potential for the production of charcoal briquettes using 10 and 15% of pectin as a binder. This is due to the obtained briquettes present a satisfactory results in the friability index assays.

### Acknowledgement

The authors would like to thank the National Council of Technological and Scientific Development (CNPq) and the School of Chemical Engineering (FEQ-UNICAMP).

<sup>1</sup> Tienne, L.; Deschamps, M.; Andrade, A. *Biomassa & Energia*, **2004**, v. 1, n. 2, p. 7.

<sup>2</sup> Teixeira, R., S.; Souza, A. E.; Peña, A. F. V.; Lima, R. G.; Miguel, A. G. In: MANZANERA, M. *Alternative Fuel*, **2011**, cap. 8, p.179-200.

<sup>3</sup> Oliveira, L. T.; Almeida, M. R. In: PENEDO, W. R. *Uso da madeira para fins energéticos*, **1982**.

<sup>4</sup> FAO. *Food and Agriculture Organization of the United Nations*, **1987**.

<sup>5</sup> Zanella K., Goncalves J.L., Taranto O. *Chemical Engineering Transactions*, **2016**, 49, 313-318