

ELABORATION OF CHARCOAL BRIQUETTES, FROM EUCALYPTUS VEGETABLE CHARCOAL (*Eucalyptus globulus*)

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Abstract

Charcoal char is a fine residue of coal, which has no commercial value. This charcoal can be used to convert it into a type of charcoal, called briquettes. These have the same function as traditional charcoal, however, due to their composition and elaboration process by which a product of equal size and weight is obtained in each type of briquette "compact charcoal", they have the capacity to maintain a more homogeneous temperature compared to traditional charcoal, which due to its irregular sizes tends to vary in its temperature and duration time. Based on this problem, an enterprise called "Golden Fire" has been created to start a production line of charcoal briquettes, with quality studies, business model and proposal of a functional production chain. In order to guarantee the quality of the product, different tests and laboratory analyses have been carried out, all of this so that the quality of the final product is as expected and guarantees a position in the national market, at a price convenient for the average consumer. Through the financial study it was determined that the suggested price of the product will be \$3.50 per 3kg of briquettes, in

order to have a chance of success in the domestic market.

Keywords: Sexual rights, reproductive rights, educational program

Resumen

La carbonilla es un residuo fino del carbón, que no tiene un valor comercial. Esta carbonilla puede ser utilizada para convertirla en un tipo de carbón, llamado briquetas. Los cuales tienen la misma función que el carbón tradicional, sin embargo, debido a su composición y proceso de elaboración mediante el cual se obtiene un producto de igual tamaño y peso en cada tipo de briqueta “carbón compacto”, tienen la capacidad de mantener una temperatura más homogénea a comparación del carbón tradicional, el cual debido a sus tamaños irregulares tiende a variar en su temperatura y tiempo de duración. A partir de esta problemática se ha creado un emprendimiento llamado Golden Fire, con el cual se pretende comenzar una línea de producción de briquetas de carbón, con los estudios de calidad, modelo de negocio y propuesta de una cadena productiva funcional. Para garantizar la calidad del producto se han realizado diferentes pruebas y análisis de laboratorio, todo esto a fin de que la calidad del producto final sea la esperada y garantice un puesto en el mercado nacional, a un precio conveniente para el consumidor promedio. Mediante el estudio financiero se determinó que el precio sugerido del producto será de \$3.50 por 3kg de briquetas, para tener posibilidad de éxito dentro del mercado nacional.

Palabras clave: briquetas, carbón, emprendimiento, carbonilla

INTRODUCTION

The waste of different materials causes a problem for the environment, due to the negative aspects that they cause in the ecosystem. One of these little or no used residues and that could easily be recycled to create new products, is char, which is a fine sand that results from the residue of traditional charcoal casing and is also found in ovens for the production of coal where it is common to agglomerate these grits and leave them outdoors without using them due to ignorance of the applications of this material. A simple example of the waste and generation of contamination of this product occurs in the city of Riobamba on the road to Ambato, exiting northeast. Here there are around 15 artisanal charcoal factories, where charcoal is obtained as the main product and the residual carbon produced by burning wood is disposed of.

It is intended to use residual charcoal for the generation of a new and innovative product that has the possibility of entering the national market, the product will have a composition based on charcoal, sawdust wood, smoking wood and a binder, it should be specified that all This process and materials used will generate a positive impact on the environment due to the recycling of the coal grits with which we work and the null use of toxic additives in the manufacturing process, to prevent them from negatively influencing health. of people using this product.

DEVELOPMENT

Fine char is different from conventional coal in terms of its combustion, this process is difficult, if not impossible. In addition to the low profitability of this material on the market, the pollution generated to the environment by disposing of the carbon is worrisome. This char can be used in such a way that it can be used for combustion as an alternative source of energy, however, it must first be treated through a process in which adhesives are used to create a type of homogeneous mass of carbon in the form of briquettes. During this treatment, due to the amount of binder that is used and the pressure that the briquettes are subjected to at the time of their compaction, the result of these is considerably improved, in terms of transport, storage and handling of these at the time of being used. Through the present, it is intended to give a second opportunity to the waste generated in the "ARIEL" hardware store located in the city of Ambato during the packaging for the sale of eucalyptus charcoal, thus being able to have a new product, with added value and that allows reduce the environmental impact generated by this waste. The final objective is to develop a product that can be easily marketed due to the studies that support its quality, for this the experimental design of the product will be essential, thus being able to take into account its control variables such as: calorific value , percentage of ashes, percentage of volatility, humidity and other necessary studies to have a quality product. In order to generate a venture that has a strategic management system, it is intended to adopt the CANVAS model to recognize the key aspects of the business, as well as to have a clearer and more direct structure of how the charcoal briquettes are going to be produced for the "ARIEL" hardware store. A structured business model will allow to generate the favorable impact in the current market and a future expansion through innovation, new ideas and operational changes in the production process if necessary.

Methodology

Within the experimental design for the elaboration of briquettes, organic materials such as sawdust, charcoal and binders were used in different proportions in order to determine the perfect mixture of the components. 3 compositions for the briquettes were prepared using wood sawdust and charcoal with a particle size of 2.6 mm and varying the binder based on cassava starch and corn starch; The following factorial design was carried out.

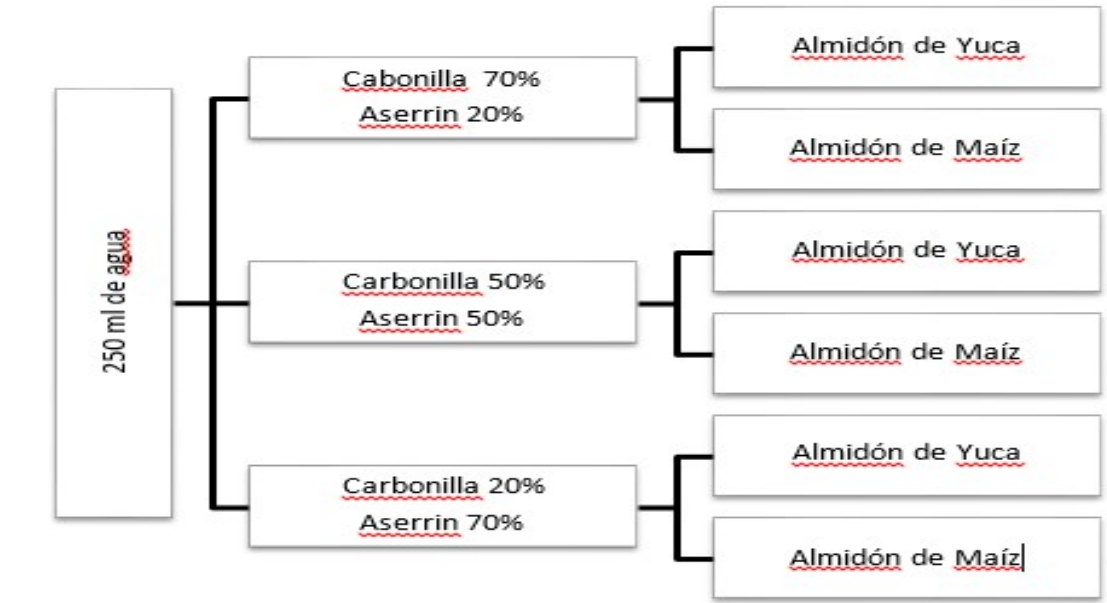


Figure 1
Factorial design for experimentation

It can be seen that for the experimental design we worked with 250 ml of water for each sample and different percentages of carbon and sawdust, all this will be analyzed later through analysis and data collected from the experimentation. The experiments will be carried out according to the needs that the company seeks in its product, such as calorific value, resistance, humidity, etc.

Below is a flowchart on which the process for making "Golden Fire" coal briquettes will be based at the experimental and functional level of the plant, aspects that will be expanded as the research progresses.

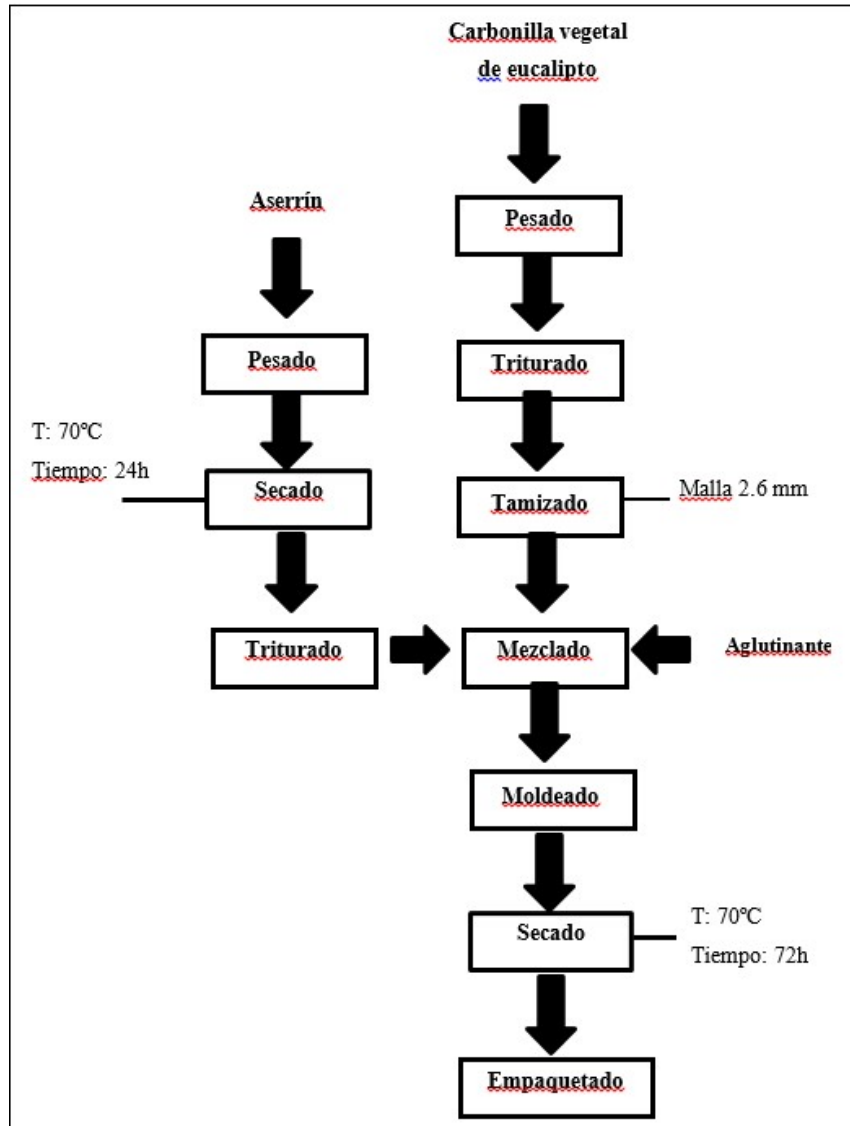


Figure 2
Flowchart

Briquetting process

The production of briquettes from charcoal and sawdust was carried out through the application of the processes mentioned below, in addition, analyzes of properties and physical characteristics of the briquettes were carried out to support the quality of the product.

Preparation of raw materials

- Weigh the carbon and sawdust according to the percentage necessary for the sample to be carried out.
- Carry out an inspection to discard elements foreign to the samples such as sticks, stones, etc.

- The sawdust must be dried at a temperature of 70°C for 24 hours, to eliminate all moisture present in it.

Preparation of binders

- Place 250ml of water in the beaker
 - Weigh 80 g of starch (cassava or corn) and add it to the beaker along with the water.
 - Using a stirring rod, stir the mixture until it reaches a homogeneous point.
 - Once homogeneous, place the glass on the stove and keep stirring constantly until the mixture changes its texture to a type of glue, it can take 5 to 7 minutes over medium heat.
 - Sieved
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- Charcoal and sawdust will be sieved using a 2.6 mm mesh to separate particles larger than this size.

1. Mixing and compaction

- Mix the charcoal and sawdust at the indicated concentrations until a homogeneous mixture is obtained.
- Once the mixture is obtained, add the binder and mix again for about 5 minutes or until a pasty mass is obtained that maintains its consistency when pressed by hand.
- Of the sample obtained, 50 g will be weighed and placed in the briquette mold, to then be compacted using a screw press.

Briquette drying

- Once the briquettes have come out of the mould, let them rest for a day and then place them in a tray oven at 70°C for 72 hours.

Results

Table 1

Determination of moisture percentage

Muestra	Temperatura de secado (°C)	Tiempo de secado (h)	%Humedad	Promedio %Humedad
	70	72	56,448	

M1	70	72	61,456	58,952
M2	70	72	56,1	56,985
	70	72	57,87	
M3	70	72	61,16	60,592
	70	72	60,024	
M4	70	72	51,074	51,919
	70	72	52,764	
M5	70	72	47,404	47,048
	70	72	46,692	
M6	70	72	57,242	56,534
	70	72	55,826	

It can be noted in the results obtained that the samples M1 and M3 have the highest percentage of moisture and the sample M5 contains a lower % moisture than all the other samples, it can be noted that the amount of binder does not influence the result of humidity percentage, as on the contrary if the amount of charcoal and sawdust used to make the samples does, the drying time was 72 hours at a temperature of 70°C.

Table 2

Friability index

Muestra	Índice de friabilidad	Grado de aglomeración de las partículas
M1	250	Bajo

	250	Bajo
M2	167	Bajo
	250	Bajo
M3	250	Bajo
	250	Bajo
M4	250	Bajo
	250	Bajo
M5	250	Bajo
	250	Bajo
M6	250	Bajo
	250	Bajo

It can be observed that the friability index is 250 in most of the samples analyzed, so it can be said that its degree of agglomeration of the particles is low, this is due to the fact that the hygroscopicity of the char is low, which It allows the briquette to gain weight because it does not retain moisture and therefore makes it more resistant.

Table 3

Amount of ashes

Muestra	% de cenizas	Promedio
M1	77,6	81,2
	84,8	
M2	75,7	71,3
	66,9	
M3	84,2	77,7
	71,3	
M4	65,3	65,0
	64,7	
	53,2	

M5	60,0	56,6
M6	68,7	69,2
	69,7	

It can be seen from the results that sample M1 is the one that produces the highest amount of ash with 81.2%, while sample M5 is the lowest, producing an average ash of 56.6%. It could be said that sample M5, composed of charcoal and sawdust in equal percentages, is

Table 4

Hhigher calorific power

Muestra	Peso inicial de la briqueta (Kg)	Poder calorífico superior (Kcal)	Promedio
M1	0,021776	37759,82458	40212,9
	0,019272	42665,93711	
M2	0,02195	37460,49841	38247,4
	0,021065	39034,31949	
M3	0,01942	42340,77961	41739,2
	0,019988	41137,57955	
M4	0,024463	33612,31002	34213,6
	0,023618	34814,88441	
M5	0,026298	31266,93817	31058,1
	0,026654	30849,32618	
M6	0,021379	38461,01034	37844,6

	0,022087	37228,14054	
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It can be seen in the results that samples M3 and M1 are the ones with the highest calorific value, being able to deduce that due to the composition of the briquettes it is more favorable to elaborate them with a higher percentage of char as in sample M3, which has 70% sawdust and 20% carbon.

Conclusions

Coal briquettes can become a commonly used product in the Ecuadorian market, as long as they are offered at a reasonable price and have a good production quality. Once the experimental design with different proportions of raw material has been carried out, it has been concluded that the M3 sample made up of 70% sawdust and 20% wood has been the one that shows the highest performance with respect to calorific value, therefore, it will be the one indicated. to continue with the process of elaboration of the Golden Fire briquettes.

The national market does not have a production of charcoal briquettes, and the very few brands that exist of this product within the country are imported, which increases its value at prices that do not adjust to the national market. It is for this reason that Golden Fire charcoal briquettes may have an opportunity to position themselves, since, due to their national production, innovation and commitment to the consumer to offer fair prices, they make the product attractive and affordable. All this based on the results obtained from the surveys where 48% of the people surveyed would agree to give the product a try and 65% would recommend the product to their acquaintances in case of obtaining a positive user experience.

For the production of the briquettes, different equipment is required, which were studied and specified herein. Through a technical and financial analysis, it was possible to conclude that an investment of around \$11,871.68 is required to start the company. . Which can be recovered through the production and sale of briquettes, the project has an IRR (Internal Rate of Return) of 163%, which gives us to understand the positive side of it. This project can be sustained as long as the price of the briquettes is established at \$3.50 per 3 kg of product, in addition production is estimated at 2000 units per month, obtaining a net profit in the first year of \$6,023.81.

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