VILLAGE-LEVEL ENERGY UTILIZATION OF COPRA PRODUCTION BY-PRODUCTS IN EASTERN VISAYAS, PHILIPPINES

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INTRODUCTION

Coconut is one of the important crops of the farmers in Eastern Visayas. Forty-two percent of the agricultural land of Eastern Visayas is planted to coconut. Coconut farmers are earning money mainly from the main product of coconut which is copra. The price of copra is fluctuating. Hence, there is a need for the farmers to utilize the by-products of copra production to augment their income. The by-products depend on the copra making practice of the farmers. For the direct splitting method where the nut with husk is split directly with an axe, combined husk with shell locally known as "binuongan" or "bukong" and water are the by-products while the husking method has the byproducts of separate husk, shell, and water.

This paper covers only the utilization of the "binuongan", husk and shell. The water is excluded. Paper also describes the utilization of copra making by-products practiced by farmers and developed at the Regional Coconut Research Center, VISCA, Baybay, Leyte.

UTILIZATION OF THE COPRA PRODUCTION BY-PRODUCTS PRACTICED BY THE FARMERS

A) Coconut Shell

Figure 1 shows a picture of the coconut shell. Farmers use the coconut shells as fuel in the kitchen. Some use them as fuel in copra making, in bakeries, and in metal works. Others make charcoal out of the coconut shells using pit and drum methods and sell them. Aside from selling the charcoal, farmers use it for cooking, ironing, barbecuing, and other household uses.

B) Coconut Husk

Figure 2 shows the appearance of the coconut husk. This is used as fuel for copra making especially when the demand for the coconut shell charcoal is high. Most of the time, coconut husks are wasted. They are left unutilized in the field and are potential breeding sites of plant pests.

C) Combined Coconut Husk and Shell (Binuongan)

Figure 3 shows the picture of the "binuongan". Since this is the only solid-product of the direct splitting method, these were used as fuel for copra making. These were also used by the farmers for kitchen use. They were split into 3 to 4 pieces, and dried prior to its utilization in the kitchen.

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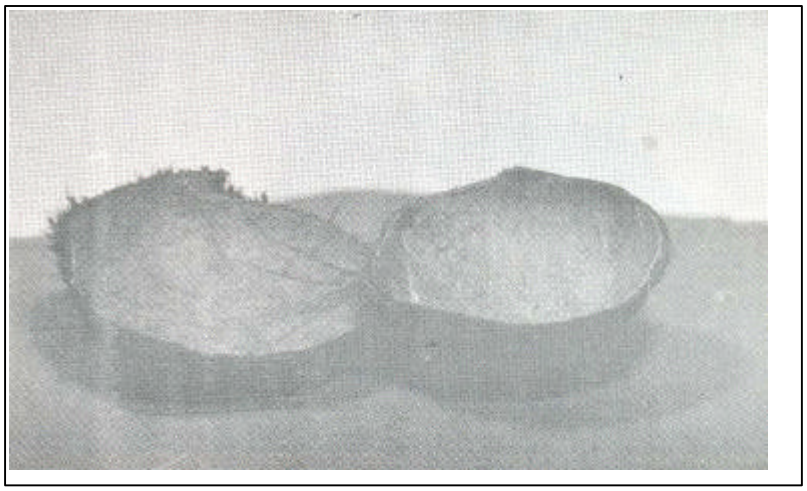

Figure 1. Raw coconut shell

Figure 2. Raw coconut husk

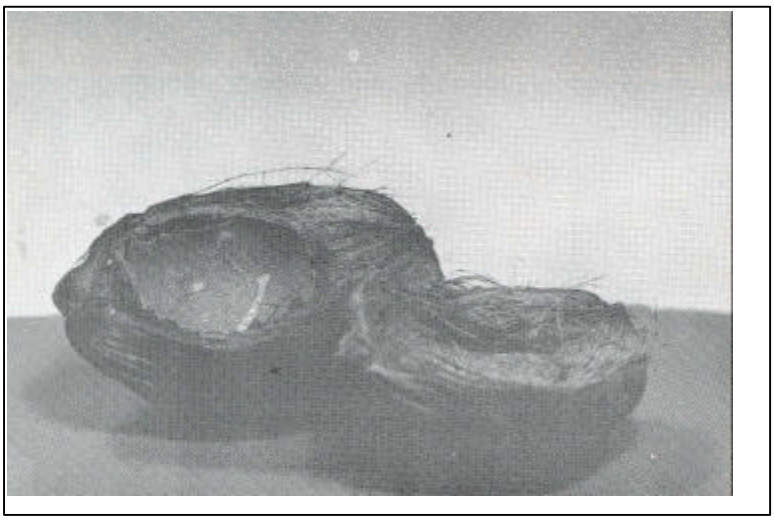

Figure 3. Raw “binuoangan”

UTILIZATION OF COPRA PRODUCTION BY-PRODUCTS AT THE REGIONAL COCONUT RESEARCH CENTER, VISCA

The utilization of by-products from copra production was studied so that the farmers could eam additional income from coconut. Researches were conducted to convert the raw byproducts into charcoal. Charcoal utilization was also studied for farmers' benefit.

A) Charcoal making from coconut by-products using pit method.

The charcoal making technology developed at the Regional Coconut Research Center (RCRC), VISCA was an improvement of the farmer's practice. With the technology developed at RCRC, the coconut shell charcoal (Fig. 4) recovery was 27.23% compared to the below 20% recovery using farmer's practice. Charcoaling husks and "binuongan" was not possible using the farmer's practice since combustion is not controlled thus turning them into ash. On the other hand, the charcoal making technology developed at RCRC could produce charcoal from coconut husk and "binuongan" with charcoal recoveries of 25.23% and 26.29%, respectively. Furthermore, RCRC's charcoaling pit was provided with a shed thus the operation can go on even on rainy days. The difference between the farmer's and RCRC's charcoaling practice lies only on the charcoaling pit configuration and procedure used.

The charcoaling pit measures 75 x 150 cm with 90 cm center depth. The bottom perimeter was curved. The cover of the pit was a flattened oil drum (55 gal capacity). The charcoaling procedures were as follows:

1) The dried charge (charcoaling materials) were piled near the pit prior to charcoaling.
2) Preparation of kindling materials prior to ignition varied according to the charge;
2a) For coconut shell, around 100 halves of coconut shells were dropped into the pit.
2b) For husk, dry coconut leaflets from two coconut leaf petioles were spread on the pit bottom and around 30 pieces of husks (one piece considered from one whole nut) were placed over the spread leaves.
2c) For combined husk and shell, dry coconut leaflets from two coconut leaf petioles were spread and around 50 halves of "binuongan" were placed over the spread leaves.
3) Ignition was done by introducing lighted coconut leaves or shells into the 3 equidistant points along the length of the pit.
4) Gradual addition of charge was made until the pit was filled.

Figure 4. Coconut shell charcoal in pit

5) When the combustion was well underway, the flattened drum cover was placed over the pit elevated by stones (roughly 5 cm dia.). This clearance serves as air inlet and smoke outlet.

6) Addition of charge was made when the charge sank and was repeated until the charge did not sink.

7) When the smoke became transparent or thin white (a sign that the charge has turned into charcoal), the stones were removed, and banana bracts were placed along the edge of the cover. Then soil was placed over it.

8) The pit was allowed to cool overnight before removing the charcoal.

B) Gadgets developed utilizing charcoal from copra production by-products.

1) Oven fueled by charcoal from combined husk and shell.

Figure 5 shows the appearance of the oven. This was developed to make use of the charcoal from "binuongan" and principally to produce cake in the barangays where electricity is not yet available.

The oven was 80 cm high and 60 cm wide. It was made of steel plate, GI sheet, angle bars, flat bars, lumber, and plywood for outside walling. The burner was made of clay and has a capacity of 1.8 to 2.8 kg of pulverized husk with shell charcoal. The charcoal in the burner could last for 21 hours with a temperature range of 130 - 150 C obtainable from the beginning of the fourth to the end of the twelfth hour of burning (Fig. 6).

2) Indoor multi-crop dryer fueled by charcoal from coconut husk, and combined husk and shell.

The dryer was 156 cm high and 66.5 cm wide. There were 6 trays on which materials to be dried would be placed (Fig. 7). It was made of lumber, plywood, and GI sheet as inner walling. The burner was made of clay and was as big as one gallon paint can. An empty paint can could be modified to serve as burner. Materials that could be dried were fish, chips or grated root crops, banana chips, cacao, coffee, and many others. The burner capacity was 625 g of pulverized "binuongan" charcoal and 375 g of pulverized husk charcoal. The combustion characteristic of the different kinds of charcoal is shown in Fig. 8.

Figure 5. Oven fueled by “binuongan” charcoal

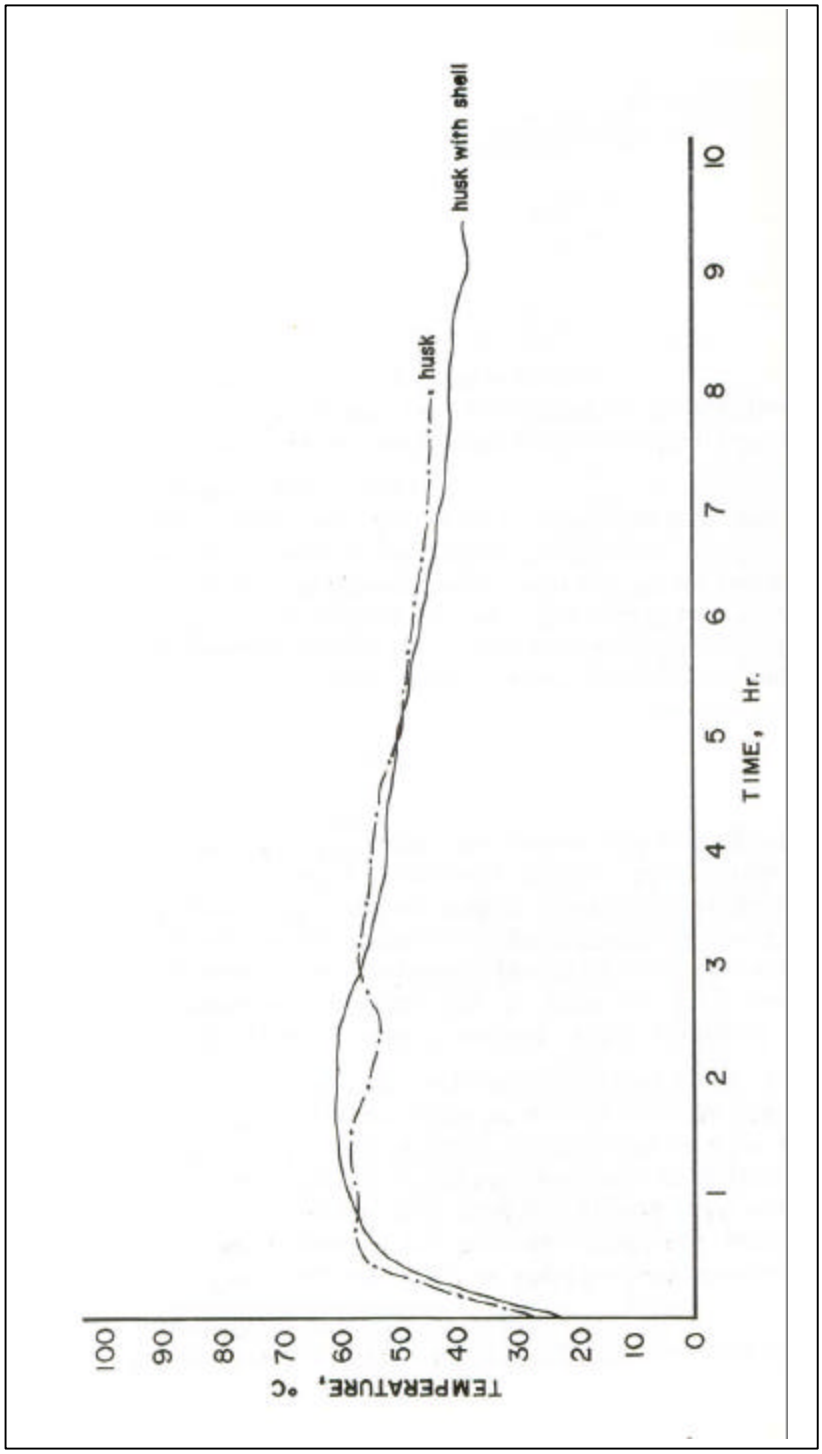

Fig. 8. Temperature generated in the indoor multi-crop dryer using charcoal from coconut Husk and “binuongan”.

3) Densification molder for making briquette from coconut husk charcoal.

This, order was made of wood for easy manufacturing by the farmers in the barangay. Only one person was, needed to operate it. It produced around 1,000 briquettes per hour. The size of the briquettes was cylindrical (2.5 X 2.5 cm dia.). The briquette size was, intencled for kitchen use. This briquette could be used in any charcoal, stove. The molder and the briquettes are shown in Fig. 9.

Moreover, another molder which produced bigger cylindrical briquettes (10 X 10.6 cm dia.) was also designed. The briquettes produced were, intencled for furnaces which contained bigger briquettes such as those of bakeries. The average weight of one dried briquette was 147.69 g with 3% moisture content. This molder has a capacity of 39.03 kg/hr. The molder and its briquettes are shown in Fig. 10.

4) Charcoal -wood stove.

The charcoal wood stove (Fig. 11) was developed for efficient utilization of the coconut shell charcoal and dried coconut petioles as fuel. Using this stove, one liter of water boiled at an average time of 7 min and 13 sec using 250 g coconut shell charcoal and 6 min and 46 sec using 250 g dried coconut petioles. Only 27.59% and 18.33% of fuel were consurned for coconut shell charcoal and dried petioles, respectively.

The common tripod stove consurned about 66% of fuel to boil a liter of water in 7 min and 51 sec. Hence, this stove was more efficient in conserving fuel.

Figure 9. Densification molder for small coconut charcoal Briquettes production

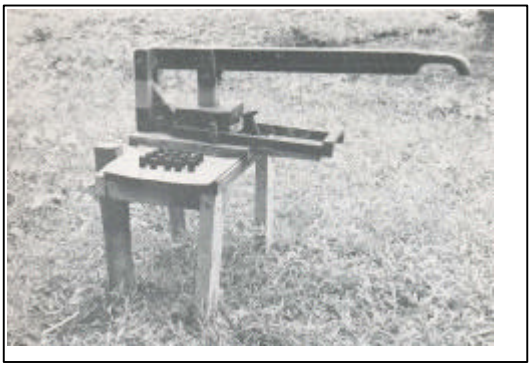

Figure 10. Densification molder for bigger size coconut husk

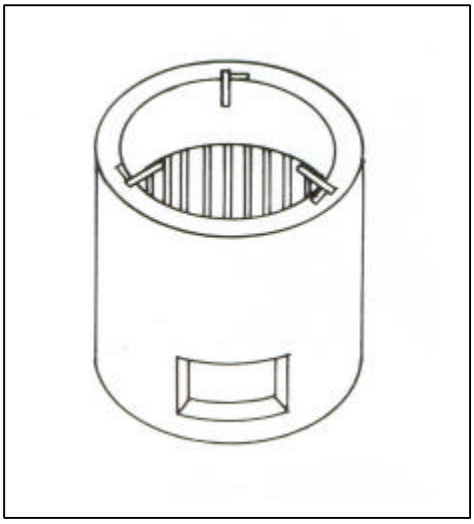

Fig. 11. Charcoal-wood stove