CHARCOAL MANUFACTURE FROM COCO-NUT SHELL.

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When coco-nut shell is heated in a closed space without the presence of air, decomposition ensues, resulting in the formation of charcoal and in the evolution of large quantities of volatile products which can be recovered only by using an efficient retort and condensing plant. If charcoal alone is required, but no volatile by-products, it is sufficient to carbonize the shells in a stack or pit.

Methods of Manufacture.

The shells used require a certain amount of selecting, as pieces with husk adhering yield a tarry or dirty product. Thin shells should be discarded and only shells from fully matured nuts, and those that have a clean bald surface selected.

The normal method of charcoal manufacture practised in Malaya is the age-old method of burning in turf or mud-sealed heaps. The enclosed heap is fired and when the shells are thoroughly burning, the supply of air is cut off, carbonization proceeding without further combustion. This primitive method is capable of producing good charcoal.

A tall stake is driven into the ground and shells are built round it to a height of about 4 feet. The pile is then covered with earth and grass which is damped. The stake is removed and fire inserted after which the heap is sealed and allowed to burn for 12 hours. In the morning the pile is doused with water and allowed to cool off.

On certain estates, the process is simplified still further by merely throwing water on a large, burning, uncovered heap of shells. This results in a charcoal which is not uniform, and which is of an inferior quality.

In Ceylon, where in coco-nut districts it is possible to excavate without reaching water, pits from 4 to 6 feet deep are filled to the top with shells which are then covered with green fronds and damp turf, sealed with earth and the shells fired.

There are two alternative methods of procedure. In one, fire of shells is started at the bottom of the pit, more shells are added until the pit is full and when these are well alight the fire is sprinkled with water until the flames have died down. The glowing mass is then covered with damp fronds, turf and earth, and left for twelve hours. Alternatively, a large pit 6 feet deep and 8 feet in diameter is dug; a hollow bamboo pipe is placed vertically in the centre and the pit is filled to ground level with shells. Paraffin is poured down the pipe and lit, after which water is sprinkled over the burning shells. They are then completely smothered with wet fronds, sacking and earth and left overnight.

Requirements and Specification.

The distillation of creosote and other by-products from the shells must be practically complete as, for use in cooking, the object is to obtain a smokeless fuel. For chemical purposes, the charcoal will not act as an absorbent if the pores

of the charcoal are clogged. In the production of producer gas for use in suction gas engines, the object is to obtain maximum gas output and to keep the fouling of the scrubbers and filters to a minimum.

A London firm of importers gave the following specifications:—

(*a*) Not more than 15 per cent. volatiles.
(*b*) Not more than 10 per cent. moisture.
(*c*) Pieces to be of a size, not less than 10 per cent., remaining in a mesh with 1-inch holes; nor more than 5 per cent. passing through a mesh with ¼-inch holes.

Requirement (*c*) is severe for there may be considerable damage and breakdown during shipment.

Properties of Coco-nut Charcoal.

An actual sample of Malayan charcoal received which contained 25 per cent. moisture, gave 5,730 calories as the calorific value. This in terms of dry charcoal is equivalent to a gross calorific value of 7,640 calories.

Pieces of charcoal of good quality are uniformly dark, and free from adherent dirt due to husk. When dropped on a stone floor such pieces emit a clear bell-like ring and the broken edges show a black lustrous surface with a sharp conchoidal fracture. A badly burnt piece will emit a dull sound, and its broken surface is dull, dirty and irregular. An overburnt piece is very thin and has a smooth wavy indented edge beginning to curl. Thin overburnt pieces are very brittle, and are therefore unsuitable for inclusion for export as they are quickly reduced to dust.

Great care, experience and skill are required if the necessary high quality is to be obtained and slight misjudgment may result in a mixed mass of woody half-burnt charcoal, as a result of incomplete combustion, or a low yield of thin brittle copra through over-ventilation or over-burning. It will be appreciated, therefore, that the training of the operators may be a lengthy process and many batches of charcoal may be spoiled before the necessary skill and judgment are acquired.

Yields.

The theoretical yield of shell charcoal is half the weight of the coco-nut shell. In practice, 25 per cent., or even considerably less, is obtained according to the efficiency of production and the thickness of the original shell.

An approximate formula for estimating the number of shells required per picul of charcoal (133⅓ lb.) is four times the number of nuts required per picul of copra, e.g., 250 nuts per picul of copra equals 1,000 shells per picul of charcoal.

If shells are also to be used as fuel in the copra kiln, it would not be safe to assume that more than 30 per cent. of the total shells would be available or suitable for conversion into charcoal.

Cost of Production.

In one instance, charcoal is now being manufactured and bagged on contract at the rate of 28 Straits cents per picul. Three bags are required per two piculs of charcoal and this together with handling and road transport brings the total cost to about 60 cents per picul f.o.b.

The conference tariff on coco-nut charcoal is about 72s. per long ton ex ocean port, less 10 per cent. deferred rebate. Cost of production, above, is equal to about 25s. per ton. Selling charge, insurance, &c., bring the total c.i.f. cost to about £5 per ton.

In view of the possible local extras not included above, an all-in cost of £6 per ton should be allowed.

The Market.

In 1931, the price offered by European buyers was between £10 and £11 per ton, but a more recent quotation was as low as £7 per ton delivered. Demand has hitherto been neither large nor sustained. In Ceylon, there is a considerable industry, the charcoal produced being either sold in the villages for kitchen use; for use in laundries; for conversion into producer gas; or for consumption in smelting works in Colombo. In Malaya, the bulk of the charcoal used for cooking purposes is obtained from baku wood and the local demand is somewhat limited.