● *A lucrative fiber board industry can be set up from coconut fibers.*

FIBER COCOTEX FROM COCONUT HUSK

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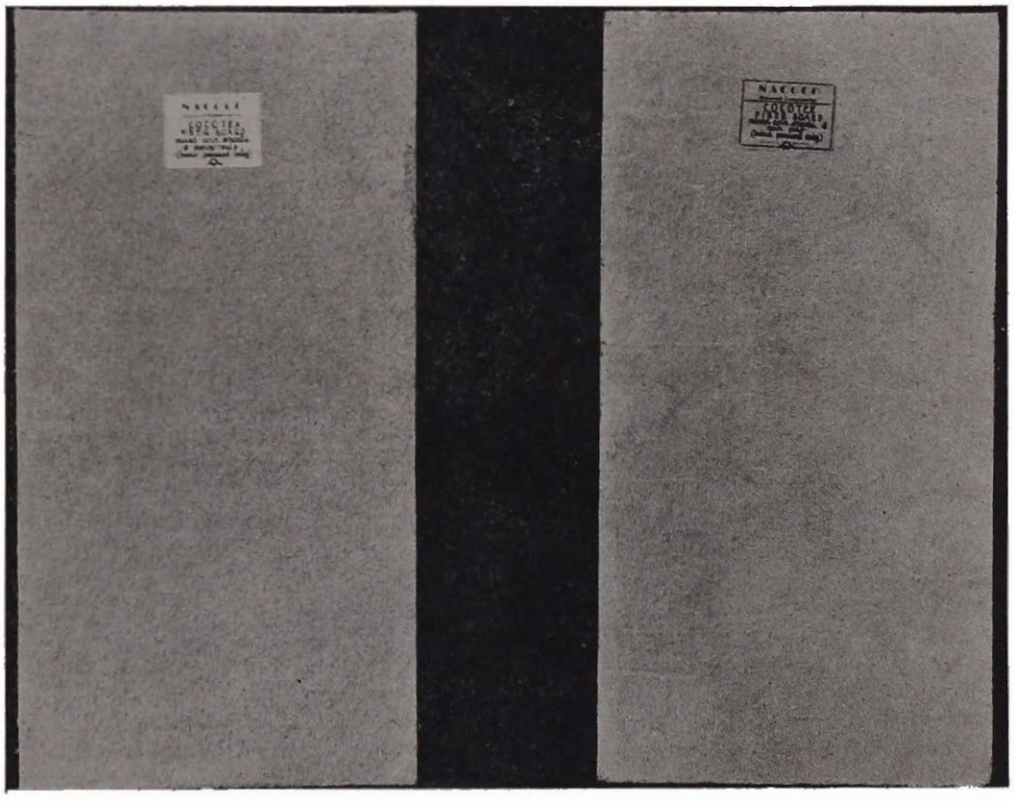
THE utilization of agriculture waste as raw material for manufacturing processes with the aim of eliminating and converting it into commodities of great economic value has attracted much atention in recent years. Disposal of these wastes, long considered worthless, or practically so, and whose accumulation presented oftentimes an unsightly situation, has challenged our men of science and engineering skil. And today, thanks to the tenacity of these men, many of such waste products are now being transformed into articles of surprising value and usefulness.

Almost all waste products today, whether from industrial or agricultural processes, are subjected to close scrutiny. One such class of waste materials is the woody and fibrous structure of plants. This is particularly noticeable in the fiber, wallboard and insulation board industry which utilizes as raw materials the surplus mill bagasse, corn stalks, straws, eel grass and wood wastes. In fact, almost any fibrous waste material which could be obtained in fairly large quantities and under steady supply is now being industrialized.

In keeping up with this trend of science to uncover suitable and marketable forms with which the by-products of the coconut industry can be disposed of, it is only natural that the coconut husk, an economic waste and a poor sort of fuel, should be tried as raw material for fiber board manufacture. The necessity of putting up a fiber board industry of our own becomes more imperative when we realize that our import of this product, classified as wallboard and corkboard, amounts to hundreds of thousands of pesos annually. The following data will give a better idea of the flow of this material into the local market:

Year	*Wallboard*	*Corkboard*	*Total*
1935	₱ 98,869	₱19,780	₱118,649
1936	207,017	6,233	213,250
1937	327,319	18,848	346,167
1938	298,734	29,525	328,259
1939	421,328	12,944	434,272
1940	291,566	33,086	324,652

The above figures illustrate that the importation of these products which could be wholly manufactured locally out of our abundant raw materials is on the increasing trend except for abnormal times as in 1940. The acceleration with which the Philipines adopts modern living conditions, such as protection from cold, heat and noise, relays a correspondingly increasing demand for this structural insulating materials. The development of this fiber board industry promises, therefore, a bright aspect.



Nacoco Finished wallboard from coconut fibers

What Fiber Board Is

Before we embark on a conscientious study of the suitability of coconut fiber and pulp as raw materials for board making, a thorough knowledge of this material and the industry itself is essential.

Fiber board is not paper, nor can it be termed

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the period from January 1, 1946, to July 3, 1946, the *annual* quota shall be one-half of the corresponding quota specified for the calendar year 1945.

Act Establishing the National Coconut Corporation

The following year, the National Coconut Corporation was created by Commonwealth Act No. 518, approved by the National Assembly on August 7, 1940. It is subject to the provisions of the Corporation Law in so far as they are compatible with the provisions of Act No. 518, and enjoys the general powers mentioned in the said Corporation Law in addition to the specified powers mentioned in Act No. 518. The National Coconut Corporation is managed by a Board of Directors appointed by the President of the Philippines with the consent of the Commission on Appointments of the National Assembly.

According to this Act, the National Coconut Corporation shall have the following objects: (a) to establish, keep, maintain, and operate, or help establish, keep, maintain and operate drying plants, or copra driers, or coconut centrals with a view to adjusting the coconut industry to a position independent of trade preferences in the United States and to provide facilities for the better curing of copra products and the proper utilization of coconut by-products, provided, that no subsidy, direct or indirect, shall be paid to producers or processors of copra, coconut oil, or allied products; and (b) to afford facilities for bona fide production loans to Philippine coconut planters and copra producers.

To carry out the foregoing purposes, the aforesaid corporation is empowered and authorized: (a) to grant bona fide production loans to Philippine copra producers upon the security of coconut crops or products; and (b) to buy, sell, assign, establish or operate rent or lease presses, warehouses, buildings, and any other equipment and materials necessary and proper to carry out its purposes. In accordance with the Tydings-Kocialkowski Act, a special fund known as the "Coconut Industry Fund" was created by appropriating a certain amount out of the Coconut Oil Excise Fund collected on and after January 1, 1939. The total sum available to the corporation for the accomplishment of its undertaking shall not exceed ₱20,000,000.-00.

The Coconut Products Board and the National Coconut Corporation Compared

It is significant to note that the purposes for which the National Coconut Corporation has been organized are in general parallel to those of the Coconut Products Board of 1916. A notable divergence, however, lies in the fact that in the former organization the principal objective was superiority of coconut production, while the one recently established, while not neglecting to place emphasis on the quality of production aims principally at securing for the industry a position independent of trade preferences in the United States.

FIBER FROM . . .

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a pure building board, although it resembles lumber wallboard in many respects. It is a composition board made essentially from wood or any other vegetable fibers by a process of felting in which countless fibers are interwoven and matted to form a rigid product. In other words, it is a synthetic lumber in which strength, resistance to moisture and fire, insulating and acoustical properties have been built in. It is a new material, an insultaing lumber, rather than a mere substitute for wood.

Millions of square feet of it are produced annually to satisfy demands that its originators never foresaw. It has been given qualities in a wide variety of combinations to serve specific purposes. It enters primarily in the manufacture of cabinets, marine partitions, railroad coaches, toys, in trailers and motor vehicles, air-conditioning, refrigeration, theaters, etc. As a building material, fiber board is notable in its handiness and ease of application. It presents no waste, since they are delivered in specific sizes and contains no knots, sappy pieces or cross-grains. Moreover, its close texture renders it resistant to attacks from insect vermin.

Two distinct objects of paramount importance are solved in the fiber board industry, namely: (1) the manufacture of a substitute building board material having a large unit surface area which consequently reduces handling and installation costs, and (2) the utilization of waste fibrous products.

Fiber boards can be classified into two different groups—(1) the homogenous and (2) the laminated. Under the former class, sometimes called the uniform consistency board, are found the insulation and acoustical boards. The latter class which is a board built up from several layers to impart strength includes the composition boards used for flooring, cabinets, railroad coaches, etc.

Manufacturing Process

The process of board making as practised by many manufacturers today, is based upon the principle of "felting" or the production of a rigid board of interlaced fibers. The treatment, however, is sometimes modified according to the kind of raw materials used and products desired.

Generally, the raw material is subjected to a mechanical or chemical pulping process sufficient to loosen incrusting casing materials for the fibers, but not to reduce the fibers into pulp. The fibers are recovered, washed, refined and finally pumped into a stock chest which feeds the molding machine.

From the board machine, the wet board formed passes thru a series of rollers, suction boxes, and finally under powerful presses, whence it is taken to a long continuous drier. Sometimes, however, instead of the long continuous drier, the wet board is cut to specific sizes and loaded into a platen-press, the number of plates varying as to the number of boards pressed at one time. The driers deliver boards which are nearly bonedry and are, therefore, either treated in a humidified or simply sprayed with water to bring its moisture content in equilibrium with the moisture content of the air, thus insuring minimum of swelling and shrinking. The finished boards, after rigid inspection, are stored away ready for delivery.

Basis Of Study

The technique involved in the manufacture of this insulating fibrous product is to felt the fibers and to subject it only to such pressure as to entangle minute air cells which secure the insulating value and lightness of the board. The idea is to entrap in each square foot of board millions of sealed air-cells which are held captive in the fibers themselves and in the interstices between fibers. It is these cells which inhibit the insulating property of high efficiency. Formerly, air spaces between walls were regarded as the best possible insulator of heat and cold (air having a thermal conductivity constant of 0.24 B.T.U. per pound much more efficient than cork) Science has proven, however, that this holds true only, and this air is efficient merely, if it can be securely confined or rendered "dead."

Experimental Procedure And Results

With the foregoing fact as a working guide, together with the recent findings that coir pulp or dust exhibits properties similar to cork, that is, it shows excellent insulating quality, is soft, light and compressible, plus the merits of the coconut fiber or coir for being long, tough and springy, experiments were conducted to determine the suitability of these waste materials for making fiber boards.

Unfortunately, the work was not as easy as was predicted. It was fraught with difficulties. In fact as early as the experiments were started, problems presented themselves. For instance, it was found out that, unlike the bagasse fibers with its serrated saw-tooth surface and the presence of microscopic hooks which give to it its tenacious ability to cling to each fiber and which qualities facilitate its felting to a great extent, the coconut fibers on the other hand are devoid of these hook-like structures, has a smooth surface, and are decidedly rounded in cross-section. Moreover, unlike the abaca fibers which can be shredded to its fine, filmy original minute fibers, the coconut fibers, once defibered, can not be shredded to any further extent. That is, each individual fiber is already the ultimate fiber itself. In structure, it resembles a short ordinary wire and no pounding action could give any shredding effect. Instead, it merely flattens the rounded fiber. A careful study was therefore necessary to overcome these drawbacks as well as to evolve, if possible, a process of board manufacture suitable to the use of coir as raw material.

Working on coir shorts, the first step was the mechanical preparation of the fibers. This consisted, primarily, of cutting the fibers in a fiber mill of the blade type, thus reducing the length of the fibers to one-fourth or about three-fourth inch long. To compensate for the absence of hairlike hooks and to offset the objectionable smooth surface of the rounded fibers, the cut fibers were given a permanent curl or a sort of wave in another mill of the hammer type which also broke up any bundle of fibers that might have been left. By virtue of the hammering action of this mill, the desired effect was produced which evidently helped in the interlacing and interweaving of the fibers into a greater degree than if the fibers were allowed to remain as short, straight ones.

The mixture of fibers used comprised of primary fibers from (½ to ¾ inch long) which were interlaced to form the framework and secondary (shorter fibers) which give rigidity. The space between the fibers were then filled with coir pulp or the pith-like particles to increase the insulating quality. Finally, a little paper pulp from old newspapers, previously beaten in a separate beater was added to hold the coir pulp and other fibers in place, besides, supplying the necessary fine aggregates.

The above mixture in exact proportions was delivered to a beater. Additional water and waterproofing materials made up of rosin and alum, as well as insecticides to render them resistant to dry rot and termites were mixed at this point. Two desirable effects obtained in the beating process were:

1. Shortening of the fibers necessary for ease of uniform distribution. This was purely a mechanical process which further refined the mixture of fibers in the stock.
2. A change in the character of the stock, resulting in increased density and tensile strength. This property appeared as the feel and appearance of the stock became more and more slimy and soft, an effect produced by the rubbing and pounding action of the beater

After 30 to 45 minutes in the beaters or after such time when the feel become slimy and the individual fibers were thoroughly coated with the waterproofing and termite-proofing materials, the stock was transferred to the wooden press-molds. Care was taken that the wet mixture was evenly distributed. The bulk of the water was extracted by pressing down a wire screen which left a wet lap of the material. This was finally pressed down by a wooden plate to the desired thickness. After the board has set, usually from 4 to 7 hours, it was taken out of the press to dry.

The drying process (air drying in this case) took from 3 to 6 days. This was the best that could be done under present conditions although the drying operation could be greatly facilitated by the use of steam heated hydraulic platen-press as previously mentioned. This appartus has the advantage of taking care of two steps of the process in one operation, namely, the drying and the pressing operations, besides imparting a glossy finish to the surface of the board.

Boards made by the above developed process has a smooth surface, which indeed is a decided improvement over boards previously made by the dry method that employed different kinds of binders. It has the desirable properties of taking on paint economically, and can be sawed or nailed, just like ordinarly lumber. The fact that the above wet process does not employ any kind of adhesive has tremendously lowered the cost of production.

Acknowledgement

The author deeply appreciates the cooperation rendered him by both the Industrial Engineering Division and the Wallboard Sections of the Division of Tests and Standards of the Bureau of Science, and is especially indebted to Mr. F. D. Maramba, Chief of the Industrial Engineering Division, and Mr. Moises Lucas for their valuable and helpful suggestions. He is likewise grateful for the constructive advices received from Mr. R. Aguilar, Chief of the wallboard Section.