Title: A METHOD TO MANUFACTURE PLYWOOD

Abstract: A method to manufacture plywood comprises the steps of: providing dried veneers derive from oil palm trunk and/or coconut tree trunk; applying adhesive on the dried veneers; pressing layers of dried veneers together to form a base board comprising laminated dried veneers; flattening the base board; cleaning surfaces of the base board; and laminating an overlay on the surface of the base board to form an oil palm and/or coconut tree trunk based plywood.
FIELD OF THE INVENTION

The present invention relates to a method to manufacture plywood. More particularly, the present invention relates to the production of plywood by using oil palm trunks (OPT) and/or coconut tree trunk as raw materials and the product thereof.

BACKGROUND ART

Due to fast depletion of natural forest, it becomes apparent that a more advance approach should be adopted to exploit what was available in the recyclable resources such as oil palm trunks in the oil palm plantation industries. Most reports and studies indicated that there would be shortages of wooden raw materials in the near future. Therefore, the need for alternative source of raw material for the field like furnishing becomes apparent. Thus oil palm biomass appears to be the one of the appropriate choice under the present circumstances.

Elaeis guineensis (scientific name for oil palm) is conventionally grown by large-scale plantation as a source material of palm oil. The oil palm trees are mostly grown in equatorial and sub-equatorial countries. During harvesting, bunches bearing the fruits are cut off and collected for processing. The purpose of cultivation of Elaeis guineensis is extracting the fruit containing oil and the biomass is then taken as incineration disposal, including the oil palm trunks (OPT). Each year, an oil palm industry produces tone of lignocellulosic biomass that comprises of empty fruit bunches (EFB), oil palm fronds (OPF), oil palm trunk (OPT), etc. There are still many parts of the oil palm, which have not been put in to good use as yet. The reason, hitherto, is mainly because of the raw condition of OPT is found to be inferior to reinforcement and it is hard and costly to process the OPT into something which has commercial value. Therefore the application of OPT from oil palm industry is
At present, annual availability of OPT is estimated to be high. Palm oil, which generates income for the industry, is only a 10% component of the oil palm. This implies that an oil palm plantation produces about 55 tones of dry matter per hectare each year compared to 5.5 tones of palm oil and palm kernel oil. Thus 90% of the oil palm is relatively unexploited. The potential of the oil palm industry has not reached its saturation. If this potential was fully exploited, the contribution of the palm industry will apparently increase in many folds.

Research and development has shown that the availability of these raw materials can be capitalized by using the available technologies. One important application of the oil palm biomass is the making of composite boards such as blockboard, particleboard, chipboard and medium density fiberboard (MDF).

Patent GB2 162554 provides a process for producing oil palm fiber from an oil palm tree bunch, comprising the steps of: (a) cutting the bunch longitudinally into small pieces; (b) opening the small pieces to provide a loose mass of fibrous material; and (c) separating said fibrous material from other materials associated with the bunch to produce said oil palm fiber. The oil palm fiber is then preferably treated with a latex mixture, which is then cured to produce rubberized oil palm fiber. The oil palm fiber or rubberized oil palm fiber may be formed into articles such as automobile seats, furniture cushions and mattresses having good properties due to the lightness, resilience and durability of the oil palm fiber.

**SUMMARY OF THE INVENTION**

Accordingly, the present invention disclose a method to manufacture plywood from oil palm trunks and/or coconut tree trunk, the process comprises the steps of: (a) peeling logs of the trunks to provide veneers, (b) drying the veneers, (c) applying adhesive materials on the dried veneers, (d) pressing to laminate layers of dried veneers with the adhesive materials to form a base board, (e) calibrating and cleaning the uneven surface of base board, (f)
laminate overlay onto surfaces of the base board, (g) pressing to laminate the overlay onto the base board to form plywood, and (h) cutting edges and sanding the plywood.

It is another objective of the present invention to provide a process whereby a useful product can be derived from oil palm trunks (OPT) biomass. The purpose is to transform the OPT that are discarded conventionally into wooden material for construction, furniture, and packing use.

The present invention consists of certain novel features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings and particularly pointed out in the appended claims; it being understood that various changes in the details may be without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

15 BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is the block diagram of method involved in the manufacturing of plywood from oil palm trunks and/or coconut tree trunk.

20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a process to manufacture plywood. More particularly, the present invention relates to a method to produce plywood by using oil palm trunks (OPT) and/or coconut tree trunk as raw materials. Hereinafter, the invention shall be described according to the preferred embodiments of the present invention and by referring to the accompanying description and drawings. However, it is to be understood that limiting the description to the preferred embodiments of the invention and to the drawings is merely to facilitate discussion of the present invention and it is envisioned that those skilled in the art may devise various modifications without departing from the scope of the appended claim.
In respond to the preferred embodiment, the present invention is a method to manufacture plywood comprises the steps of providing dried veneers derive from oil palm trunk and/or coconut tree trunk; applying adhesive on the dried veneers; pressing layers of dried veneers together to form a base board comprising laminated dried veneers; flattening the base board; cleaning surfaces of the base board; and laminating an overlay on the surface of the base board to form an oil palm and/or coconut tree trunk based plywood.

Plywood is one of the versatile wood products, which is popular among contractors and furniture makers. Because of woods and logs from natural forest are becoming scarce and costly, many of the plywood plants had to terminate their production. Other plausible reasons are the relatively low profit margin from the sale of plywood as the prices of logs are costly and tropical timber based plywood is less acceptable in the environmental friendly conscious countries.

The present invention therefore seeks to manufacture plywood by using renewable resources, like oil palm biomass, or more particularly the oil palm trunks (OPT) and/or coconut tree trunk. The invention relates to a method to manufacture plywood with the utilization of the trunks of oil palm and/or coconut tree trunk as core material.

The flow of the method to manufacture plywood from oil palm trunks (OPT) and/or coconut tree trunk is illustrated in Figure 1.

The invention produces plywood consisting of oil palm core and/or coconut tree trunk with tropical hardwood face and back veneer. The raw material, i.e. the oil palm trunks and/or coconut tree trunk used for manufacturing plywood are felled and collected during replanting. The logs are cut from the oil palm trunk and/or coconut tree trunk and selected based on the trunk straightness and uniformity of diameter between the bottom and the top end. Normally two logs can be obtained from one trunk. The cutting step can be carried out manually, for instance using a chainsaw or electric chainsaw. Alternatively, the oil palm
trunk and/or coconut tree trunk may be cut using automated machinery. For instance, the oil palm trunk and/or coconut tree trunk logs are peeled to provide veneers by using rotary peeler. The logs consist of numerous vascular bundles embedded in the parenchyma ground tissue. The parenchyma behaves like a sponge and holds high moisture content. The vascular bundles are arranged spirally along the longitudinal direction and provide the strength property of the trunk. On the outside of the trunk is the cortex, which is popularly known as the bark.

The obtained veneers are dried preferably in a dryer at temperature of 140°C to 200°C until the moisture content (m.c.) below 14%, or preferably below 10%. Generally, the moisture of the veneers before drying is in the range of 320 to 400%. As compared to wood veneer normally at between 75 to 150% m.c, the drying process for the extremely wet oil palm and/or coconut tree trunk veneers requires more energy and time. If the drying process is not properly controlled it may render the manufacture of this plywood uneconomical.

Adhesive materials, preferably glue, are subsequently applied or spread on the dried veneers using a spreader. Then layers of the glued veneers are subjected to pressing step which is carried out with cold press followed by hot press. It is important to note that the pressing step actually presses layers of dried veneers to form a base board comprises laminated layers of dried veneers. The oil palm trunk being a monocot, has high density variation in both longitudinal direction as well as the radial direction. Therefore, the purpose of this pressing step is to laminate the glued veneers and obtain minimum density variation in both longitudinal and radial directions of the laminated veneers. The glued veneers are placed either cross grained or partially cross grained before going through the process of pressing.

Cold pressing process make the glue evenly spread on the surface of the veneer and penetrate inside the veneer, at the same time hold the veneer together for ease of handling at the hot press section. Hot pressing cure the glue and hold the veneer permanently. Due to pressure is applied during this process, guide bar (thickness control bar) is applied here from preventing the over pressing of the laminated veneers. Thickness guide bar used during the
first process of hot pressing is to prevent the laminated oil palm veneer being over pressed. The laminated layers of veneers without overlay are now called base board.

Plywood produced from the abovementioned method can be characterized in that the veneers are laminated in totally cross-grained or partially cross-grained with moisture content less than 14%, wherein the said oil palm veneers are peeled longitudinally from the oil palm trunk. In one of the embodiment of the present invention, the dried veneers are laminated in totally cross-grained has the grain of each layer of the veneer arranged perpendicularly to each other. In another preferred embodiment, the lamination is done by the partially cross-grained in which parts of the layers of lamination are alternatively placed in same grained direction while the whole lamination is collectively glued together in cross-grained manner. For example the first layer (wood veneer face) - longitude, second layer (oil palm core) - latitude, third layer (oil palm core) - longitude, forth layer (oil palm core) - longitude, fifth layer (oil palm core) latitude, sixth layer (wood veneer back) - longitudinal.

A calibrating and cleaning process are carried out to sand away the uneven surfaces and remove dirt from the surface of base board. Overlay will then laminated onto the surfaces of the base board followed by the pressing process constitutes of cold pressing and hot pressing process. Optionally, the plywood produced can be put on a decorative overlay to make the surface looks attractive or provide a smoother surface. These overlay can be selected from a group consists of non-wood material such as paper, impregnated paper, phenolic film, Medium Density Overlay (MDO) paper. Besides of that, paint coating also can be used as face and back overlay for plywood

The plywood is then sized and sanded to the final product. The plywood manufactured from oil palm trunk and/or coconut tree trunk using the invention is then graded accordingly before subject to packaging department.
The present invention has successfully implemented a technological breakthrough in a process that converts oil palm trunk and/or coconut tree trunk into veneers to be used in the construction of plywood. The present disclosed process greatly reduces timber log usage and enhances forest carbon sinks which is in line with the global greenhouse gas emission reduction strategy. Environmental friendliness, lightness and easy to work with concept are the valuable commodities carried by the produced plywood.

The present invention seeks a way to utilize oil palm biomass in wood-based industries. The present invention specifically provides a process to commercially utilize the oil palm trunk and/or coconut tree trunk to produce a useful product. Moreover, the plywood produced, can be used for wood-based industry having unexpectedly and surprisingly good properties.

While in the foregoing specification this invention has been described in relation to certain preferred embodiments thereof and many details have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the invention is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.
CLAIMS

What is claimed is:

L  A method to manufacture oil palm based plywood comprising the steps of:
   a) providing dried veneers derive from oil palm trunk;
   b) applying adhesive on the dried veneers;
   c) pressing layers of dried veneers together to form a base board comprising
      laminated dried veneers;
   d) flattening the base board;
   e) cleaning surfaces of the base board; and
   f) laminating an overlay on the surface of the base board to form an oil palm based
      plywood.

2. A method according to claim 1, wherein the veneers are obtained by peeling logs of oil
   palm trunk longitudinally.

3. A method according to claims 1 and 2, wherein the dried veneers have moisture content
   below 14 %.

4. A method according to claims 1 to 3, wherein the layers of dried veneers are arranged
   cross-grained or partially cross-grained to one another.

5. A method according to claims 1 to 4, wherein the pressing process comprising the steps
   of cold pressing and hot pressing.

6. A method according to claims 1 to 5, wherein the overlay is selected from a group
   consists of wood veneer, paper, impregnated paper, phenolic film, medium density
   overlay (MDO) paper, or paint coating.
7. An oil palm based plywood manufactured from any of the preceding claims.

8. A method to manufacture plywood comprising the steps of:
   a) providing dried veneers derive from oil palm trunk and/or coconut tree trunk;
   b) applying adhesive on the dried veneers;
   c) pressing layers of dried veneers together to form a base board comprising laminated dried veneers;
   d) flattening the base board;
   e) cleaning surfaces of the base board; and
   f) laminating an overlay on the surface of the base board to form an oil palm and/or coconut tree trunk based plywood.

9. A method according to claim 8, wherein the veneers are obtained by peeling logs of oil palm trunk and/or coconut tree trunk longitudinally.

10. A method according to claims 8 and 9, wherein the veneers have moisture content below 14%.

11. A method according to claims 8 to 10, wherein the layers of dried veneers are arranged cross-grained or partially cross-grained to one another.

12. A method according to claims 8 to 11, wherein the pressing step is cold pressing and hot pressing.

13. A method according to claims 8 to 12, wherein the overlay is selected from a group consists of wood veneer, paper, impregnated paper, phenolic film, medium density overlay (MDO) paper, or paint coating.
14. A oil palm and/or coconut tree trunk plywood manufactured any of the preceding claims as in claims 8-13.
LOG CUTTING

PEELING

DRYING

GLUE SPREADING

COLD PRESSING

HOT PRESSING

SIZING/SANDING

GRADING

PACKING

Surface Calibrating

FIGURE 1
INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2007/000050

A. CLASSIFICATION OF SUBJECT MATTER
INV. B27D1/04 B32B21/14

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B27D B32B B27M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>WO 2006/130939 A (MACHADO MAIA THIAGO [BR]; DIAS FERRACIOLI BERNARDO [BR]; CARNEIRO TEME) 14 December 2006 (2006-12-14) the whole document</td>
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Further documents are listed in the continuation of Box C

See patent family annex

Special categories of cited documents

'A' document defining the general state of the art which is not considered to be of particular relevance
'Al' earlier document but published on or after the international filing date
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'P' document published prior to the international filing date but later than the priority date claimed
'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
'X' document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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'A' document member of the same patent family

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Date of mailing of the international search report
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