
Board made from oil Palm Fiber and Magnesium Oxide and the manufacture process thereof

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Technical Field

10 The present invention relates to a novel board for various uses, in particular a board comprising palm fiber, MgO, MgCl₂, filler and water, and the manufacture process thereof.

Background

15 The architects, furniture producers and consumers have been puzzled for many years, as to why there is not any alternative to Fibre Cement and Medium Density Fiber (MDF) boards available in the market.

20 MDF is a type of hardboard, which is made from wood fibers glued under heat and pressure. MDF is the most widely used material and cheapest alternative to wood - but the fact is the product is getting more expensive and it is not a desirable type of material for both the producer and consumer. MDF swells and warp as easily as card board at the slightest contact with water. It contains formaldehyde, which hazardous to health.

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Fibre Cement is not environment friendly to produce and its production process creates heavy air pollution - it is a major international concern but unfortunately there is no alternative material to replace it. Governments In developed countries discourage the use cement boards in buildings. Cement board is heavy and not easy to handle.

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Despite of their shortcomings, there is heavy demand for building boards, but the output of wood related material will be restricted by the short supply of raw materials – tree.

35 Surprisingly, the inventor has developed an alternative which is

eco-friendly, cheap to produce and short of disadvantages of MDF.

Summary of the Invention

5 One object of the present invention is to provide a board for many applications including wall and roof linings, partitions, ceiling, flooring, wet room flooring overlays, it offers many advantages. The present board is tough, durable, light and delivers a superb high-quality finish. It can be nail, paint and wallpaper it and it is easy to use and handled.

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In one embodiment, the present board comprises palm fiber, MgO, MgCl₂, filler and water. Preferably, the palm fiber occupies about 5% to 50% of the volume of the board.

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In one embodiment, the palm fiber is obtained by grinding the Empty Fruit Bunch (EFB), and/or the palm fiber to an average particle size of 0.5 mm to 30 mm. In one embodiment, the palm fiber does not require removal of residual oil that exists in the oil palm material.

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In one embodiment, the filler is a lightweight material selected from coal ash, glass microspheres, nano organic material and combination thereof.

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In one embodiment, the contents of the ingredients of the board are selected from one or more of the followings:

palm fiber: 5-50 wt% of the weight of the board;

MgO: 25-49 wt% of the weight of the board;

MgCl₂: 12.5 – 24.5 wt% of the weight of the board;

Filler: 3-15 wt% of the weight of the board.

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Another object of the present invention is to provide a method for producing the present board, comprising the following steps:

a) mixing the grinded palm fiber, MgO, aqueous MgCl₂ solution, filler and further water to obtain a mixture; and

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b) curing the mixture obtained in step a).

In one embodiment, said method further comprises a step a1) prior to the step a):

a1) grinding the Empty Fruit Bunch to obtain the palm fiber;

5 and/or a step a2) between the step a) and step b):

a2) rolling the mixture to form the desirable thickness and width.

Description of the Invention

10 In one aspect, the present board comprises palm fiber, MgO, MgCl₂, filler and water. Preferably, the palm fiber occupies about 5% to 50% of the volume of the board.

15 The term "palm fiber" refers to any fiber produced from oil palm, preferably from empty fruit bunch that are considered as waste after the extraction of oil palm fruits. The oil palms (Elaeis) comprise, for example but not limited to, two species of the Arecaceae, or palm family, which are used in commercial agriculture in the production of palm oil. Any commercial available palm fiber can be used in the
20 present invention.

The palm fiber used for the present board preferably has an average particle size of 0.5 mm to 30 mm. In one embodiment, the palm fiber comprises 5-50 wt% of the weight of the board.

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Surprisingly, the present inventor discovered that the physical property of Oil Palm Empty Fruit Brunch (EFB) works well with magnesium oxide binding technique. The combination of ingredients in correct formulated process creates excellent forms of material best for
30 use in the building/construction industry. The material offers high level of stability, strength and superior resistance to water and fire when comparing with other building materials currently available in the market. More importantly, it is environmental friendly to produce.

35 The present invention makes use of the biomass created the Oil Palm

industry around the world. At present, only a small percentage of Oil Palm wastes were used for generation of power, or processed, and majority of the remains is left at plantation sites to decay or dumped into landfills. EFB is not only underutilized - it also causes pollution.

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On average, fresh EFB from mills contains 30.5% lignocelluloses, 2.5% oil and 67% water. The main constituents of the lignocelluloses are cellulose (45%), hemicelluloses (32.8%), Lignin (20.5%) of the hemicelluloses, and pentose (27.3%) (please see Malaysian Palm Oil Board). Because EFB contains residual oil, it generally requires removal of the residual oil by high temperature boiling before it can be applied for other uses in the prior art. The high temperature boiling with sodium hydroxide to remove residual oil causes pollution in rivers.

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However, the present board/process does not require removal of residual oil that exists in the oil palm material/waste. Furthermore, the residual oil actually helps strengthen the binding of Magnesium Oxide and Magnesium Chloride to form superior building materials ideal for diverse construction use.

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Magnesium oxide used in the present invention can be any commercial available magnesium oxide. Preferably, magnesium oxide comprises 25-49 wt% of the weight of the board.

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Magnesium chloride used in the present invention can be any commercial available magnesium chloride. Preferably, magnesium chloride is used in a form of aqueous solution in the present production method. In one embodiment, magnesium chloride comprise 12.5%-24.5% wt% of the weight of the board.

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The term "filler" used in the present invention refers to particles added to board to lower the consumption of more expensive material or to improve some properties of the board. One skilled person can determine the filler suitable for the present invention according to the

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prior art and the teachings in the present application, or by simple experiment. In one embodiment, the filler comprises 3-15 wt% of the weight of the board.

5 Preferably, filler is a lightweight material selected from coal ash, glass microspheres, nano inorganic material and combination thereof. Coal ash is most preferred for the present invention, since it can absorb the excess MgO remains during and after the chemical reaction. In short, coal ash helps to stabilize the chemical reaction of the ingredients of
10 the present board.

In one embodiment, the board further comprises a layer of glass fiber netting or mesh on the top and/or bottom of the board. The glass fiber netting or mesh gives the product shape, structure and support in the
15 curing step of the production of the present board. The glass fiber netting or mesh can be retained on the finished product, so the outer edges of the board are glass fiber. The glass fiber netting or mesh can also add to the strength of the board a little.

20 In another aspect, the present invention is directed to a method for producing the board comprising the following steps:
a) mixing the grinded palm fiber, MgO, aqueous MgCl₂ solution, filler and further water to obtain a mixture; and
b) curing the mixture obtained in step a).

25 The palm fiber, MgO, MgCl₂, and filler might be defined as above.

The duration of the curding step can vary according to the composition of the board. For example but not to limit, the curing step can take 1
30 day to 5 days. There is no limit for the maximum curing time.

In one embodiment, said method further comprises a step a1) prior to the step a):
a1) grinding the Empty Fruit Bunch to obtain the palm fiber;
35 and/or a step a2) between the step a) and step b):

a2) rolling the mixture to form the desirable thickness and width.

For the step a1), there is not really any limit on the size of the palm fiber particles after grinding. But in practical terms, they have to be 0.5mm-30mm due to technical limitations in the manufacturing process.

Only for illustration, the present board has the following advantages:

- The present board overcomes environmental problems/issues created by existing building materials, it helps reduce air and water pollution problems by oil palm industry;
- the production process consumes very little energy and it does not pollute water – Eco friendly;
- the present board helps absorb a certain amount of carbon dioxide;
- the present board contributes to reducing the amount of trees need to be cut to support the economical growth;
- the present board offer the much needed alternative Eco-friendly building material to markets;
- the present board is free of the undesirable by-produce and effects of MDF and Fibre Cement boards;
- the present board overcomes the application shortcomings of MDF and Fibre Cement boards.

The commercial potential of the present board is huge as there is no similar green building boards available in the market. Any consumers who care for the environment and their health will opt for the present board.

Table 1, the advantages of the present board over other materials

Material	The present Board	Cement Board	Gypsum Board	OSB/ Plywood	Plastic Panel
Flame resistance	Excellent	Good	Good	Poor	Poor
Water resistance	Excellent	Good	Poor	Good	Excellent

Fastener-strength	Excellent	Poor	Poor	Excellent	Good
Mould resistance	Excellent	Good	Poor	Poor	Good
Insect resistance	Excellent	Good	Good	Poor	Excellent
Environmental-Friendliness	Excellent	Poor	Poor	Poor	Poor

Though other agro fiber (such as saw dust) – MgO products are available in the prior art, the present board has advantage over them. The physical properties of most of the agro-fibre, like saw dust, by nature absorb water, and this means that it will be difficult to gauge the accurate level of the ingredients in the board to achieve the right chemical reaction and desirable properties. The oil residue of palm wastes do wonderful for this - the level of concentrate will not be affected. With palm fibre, the fiber length as well as the amount of fiber can be adjusted to produce different types of products. With other agro fibre (saw dust) and their limitation, it will difficult to achieve the same result.

The present board using the oil residual of palm fiber waste helps create a more stable chemical reaction. The present board also fully utilized the palm fiber strength which other agro source does not offer – it is stronger and more stable, and offers greater flexibility in the use of natural fiber of $\pm 30\%$ over other agro fiber MgO products.

Examples

Empty Fruit Bunch (EFB, purchased from traders in open market) was laid out on driers to remove most of the moisture until the water content level is below 15%. The dried EFB then was shredded and grinded into the required fiber sizes of 0.5mm to 30mm, depending on the type of products to be manufactured.

Magnesium Chloride was dissolved in water to form a solution. Magnesium Oxide powder (Magnesia) was added to the Magnesium Chloride solution together with the grinded palm fiber, and coal ash.

They were then mixed well in electric mixer until a rich mixture was formed. The resulting mixture was then conveyed to a funnel and laid out on a PVC mould sheet with layers of glass fiber.

5 The mixture was then passed through a series of rollers until it reaches the desired thickness and width, it was then cut in according to the desired length. The resulting mixture was then left in a room for curing naturally for 5 days regardless of the weather condition.

10 The present board with the desired strength was completed after curing.

15 The features described herein in each aspect of the embodiments can be combined in any way, as long as the present board can be obtained. All the combinations are included in the present invention.

20 While the preferred embodiments of the present invention has been disclosed herein, it is understood that the present invention is not limited in any way by the preferred embodiments or examples in the specification, but only limited by the accompanying claims. Various modifications can be made by one skilled person in the art without departing from the scope of the presently claimed invention.

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Claims

What we claim:

- 5 1. A board, comprising palm fiber, MgO, MgCl₂, filler and water, wherein the palm fiber does not require removal of residual oil that exists in the oil palm material, and the palm fiber is obtained by grinding an Empty Fruit Bunch (EFB).
- 10 2. The board of claim 1, wherein the palm fiber occupies from about 5% to 50% of the volume of the board.
- 15 3. The board of claim 1 or 2, wherein the palm fiber has an average particle size of 0.5 mm to 30 mm.
- 15 4. The board of claim 1 or 2, wherein the filler is a lightweight material selected from coal ash, glass microspheres, nano inorganic material and combination thereof.
- 20 5. The board of claim 1 or 2, wherein the contents of the ingredients are selected from one or more of the followings:
palm fiber: 5-50 wt% of the weight of the board;
MgO: 25-49 wt% of the weight of the board;
MgCl₂: 12.5 – 24.5 wt% of the weight of the board;
25 Filler: 3-15 wt% of the weight of the board.
- 30 6. The board of claim 1 or 2, wherein the board further comprises a layer of glass fiber netting or mesh on the top and/or bottom of the board.

7. A method for producing the board, comprising the following steps:
a) mixing the grinded palm fiber, MgO, aqueous MgCl₂ solution, filler
and further water to obtain a mixture, wherein the palm fiber does not
require removal of residual oil that exists in the oil palm material, and
the palm fiber is obtained by grinding an Empty Fruit Bunch (EFB); and
b) curing the mixture obtained in step a).

8. The method of claim 7, wherein said method further comprises
a step a1) prior to the step a):
a1) grinding the Empty Fruit Bunch to obtain the palm fiber;
and/or
a step a2) between the step a) and step b):
a2) rolling the mixture to form the desirable thickness and width.