**PCT** WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| (51) International Patent Classification 6 : E04B | A2 | (11) International Publication Number: **WO 97/04184** |
|---|---|---|
| | | (43) International Publication Date: 6 February 1997 (06.02.97) |

(21) International Application Number: PCT/KR96/00109

(22) International Filing Date: 13 July 1996 (13.07.96)

(30) Priority Data:

| | | |
|---|---|---|
| 1995/20835 | 14 July 1995 (14.07.95) | KR |
| 1996/27258 | 5 July 1996 (05.07.96) | KR |

(71) Applicant *(for all designated States except US)*: KOREEN INDUSTRIAL DEVELOPMENT CORP. [KR/KR]; 419 Yonggye-ri, Keumwang-eup, Eumseong-gun, Chungcheongbuk-do 369-900 (KR).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: KIM, Jeong, Man [KR/KR]; 189-10 Shinwol-3-dong, Yangcheon-gu, Seoul 158-093 (KR).

(74) Agents: KIM, Byung, Jin et al.; 201 Hwajin Building, 828 Yoksam-dong, Kangnam-gu, Seoul 135-080 (KR).

(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

**Published**

*Without international search report and to be republished upon receipt of that report.*

(54) Title: A METHOD FOR MANUFACTURING INTERIOR PLATE BOARDS FOR CONSTRUCTION

(57) Abstract

The present invention relates to a method for manufacturing interior plate boards for construction comprising the steps of cutting 30-55 % by weight of waste pulp, 20-35 % by weight of waste polyester fibers and 20-35 % by weight of waste polypropylene fibers by predetermined length to make a material mixture, homogeneously mixing the material mixture with 2-9 % by weight of filler and water, dehydrating the homogeneous mixture while uniformly distributing and removing the homogeneous mixture on a network-structured belt and passing through a pair of rollers to form a plate board precursor, spraying a thermosetting resinous solution on the plate board precursor, drying the plate board precursor at temperataures of 60-90 °C to form a plate board until the moisture content of the plate board becomes 5-20 %, cutting the plate board in specified shapes, spraying water onto the surface of the plate board, and compressively molding the plate board into interior plate boards having respective shapes at temperatures of 180-200 °C and under the pressures of 120~150 Kg.f/cm$^2$. According to the invention, the interior plate boards have excellent form-maintaining property and workability as well as superior tensile strength and breaking strength, and the manufacturing cost and the environmental pollution can be reduced by using waste resources.

*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | |
|---|---|---|---|---|---|
| **AM** | Armenia | **GB** | United Kingdom | **MW** | Malawi |
| **AT** | Austria | **GE** | Georgia | **MX** | Mexico |
| **AU** | Australia | **GN** | Guinea | **NE** | Niger |
| **BB** | Barbados | **GR** | Greece | **NL** | Netherlands |
| **BE** | Belgium | **HU** | Hungary | **NO** | Norway |
| **BF** | Burkina Faso | **IE** | Ireland | **NZ** | New Zealand |
| **BG** | Bulgaria | **IT** | Italy | **PL** | Poland |
| **BJ** | Benin | **JP** | Japan | **PT** | Portugal |
| **BR** | Brazil | **KE** | Kenya | **RO** | Romania |
| **BY** | Belarus | **KG** | Kyrgystan | **RU** | Russian Federation |
| **CA** | Canada | **KP** | Democratic People's Republic of Korea | **SD** | Sudan |
| **CF** | Central African Republic | | | **SE** | Sweden |
| **CG** | Congo | **KR** | Republic of Korea | **SG** | Singapore |
| **CH** | Switzerland | **KZ** | Kazakhstan | **SI** | Slovenia |
| **CI** | Côte d'Ivoire | **LI** | Liechtenstein | **SK** | Slovakia |
| **CM** | Cameroon | **LK** | Sri Lanka | **SN** | Senegal |
| **CN** | China | **LR** | Liberia | **SZ** | Swaziland |
| **CS** | Czechoslovakia | **LT** | Lithuania | **TD** | Chad |
| **CZ** | Czech Republic | **LU** | Luxembourg | **TG** | Togo |
| **DE** | Germany | **LV** | Latvia | **TJ** | Tajikistan |
| **DK** | Denmark | **MC** | Monaco | **TT** | Trinidad and Tobago |
| **EE** | Estonia | **MD** | Republic of Moldova | **UA** | Ukraine |
| **ES** | Spain | **MG** | Madagascar | **UG** | Uganda |
| **FI** | Finland | **ML** | Mali | **US** | United States of America |
| **FR** | France | **MN** | Mongolia | **UZ** | Uzbekistan |
| **GA** | Gabon | **MR** | Mauritania | **VN** | Viet Nam |

# A METHOD FOR MANUFACTURING INTERIOR PLATE BOARDS FOR CONSTRUCTION

## Field of the Invention

The present invention relates to a manufacturing method of interior plate boards for construction and, more particularly, to a manufacturing method of reinforced interior plate boards for construction which have light weight and excellent heat-resistance and thermal moldability, and contribute greatly to the reduction of environmental pollution.

## Description of the Prior Art

As for the conventional interior boards for walls or ceilings, veneer boards or synthetic lumbers which are high-qualified by being patterned or coated are used. Even though these conventional boards have light weight, good appearance and wide applicability, they are easily vibrated and damaged by external force since their strength and heat-resistance are not good.

Natural lumbers are desirable in the aspect of high elegance, but not desirable in the aspects of economy and the protection of natural environment.

Plaster boards have been proposed as another construction material. However, they have disadvantages that they are heavy and apt to be damaged easily by a slight force. Further, the plaster boards are harmful to humans since they are composed of cancerogenic substance such as asbestos.

Further, plate type materials combined with adhesives, inorganic materials such as cement, glass fiber and vermiculite, or cured with organic reinforcement materials are adopted for the interior wall boards, partitions and ceiling boards. However, the interior materials formed in such ways have also disadvantages, in spite of their good physical properties such as heat-resistance, bearing power and surface intensity, that they can not follow the recent tendency towards the light-weight at a low cost.

Furthermore, synthetic resin plates have been proposed as the interior materials but they have large thermal expansion coefficient causing torsion, excessive elasticity causing gaps in connection parts and weak heat-resistance causing deformation.

Accordingly, after research and development of constructional interior materials by use of waste pulp and waste fibers of polyester and polypropylene discarded from factories in lieu of the synthetic lumbers, plaster boards, and synthetic resins, the inventor of the present invention has found that interior plate boards for construction can be manufactured which are light and strong for the external shock, and have good physical properties such as soundproofing, heat-resistance, thermal moldability, and contribute to the reduction of the manufacturing cost and the environmental pollution.

Meanwhile, as the social interest in environmental problems increases and researches in the recycling of resources and the effective ways of disposal are activated, patent applications using waste resources have increased.

For example, Korean patent application no. 92-13401 (filed on

on July 27, 1992 and entitled "a method for manufacturing synthetic lumbers by use of waste resources") discloses a manufacturing method of synthetic lumbers having higher tensile strength than conventional one, which comprises the steps of mixing 10g of urea resin adhesives with a mixture including 45g of rice straw (or barley straw) cut by the length of 3.5cm, 33g of waste paper (or paper sludge) cut by the length of 0.1-0.5cm and 22g of sawdust (or waste lumbers) pulverized in the meshes of 70-80, standing the mixture in the air for 20 to 30 minutes, and molding the mixture compressively at temperatures of 150 to 200 ℃ under the pressures of 150 to 200kg/cm$^2$.

However, even though the above manufacturing method can contribute to the recycling of resources and the prevention of the environmental pollution at a low cost, the synthetic lumbers manufactured by the method can not be closely packed, and they have limitation in their decoration effect from the appearance and the applicability since the raw materials such as the rice straw and the sawdust have poor thermoplasticity and thermal moldability.

Accordingly, the inventor of the present invention has disclosed a manufacturing method of interior plate boards for construction to overcome the above problems encountered with the prior arts in the Korean patent application no. 95-20835 filed on July 14, 1995 (entitled "a method for manufacturing reinforced interior plate boards for construction"), thus providing a method for manufacturing reinforced interior plate boards which are lighter than and as strong as the conventional ones and have

excellent moldability, and reducing the manufacturing cost and the environmental pollution. The manufacturing method of the reinforced interior plate boards for construction comprises the steps of: homogeneously stirring a material mixture comprising 50% by weight of waste pulp, 20% by weight of polyester fibers and 30% by weight of polypropylene fibers in an aqueous solution containing 20-30g/ℓ of filler; uniformly distributing the homogeneous mixture onto a network-structured belt and removing the mixture along the belt, to form a paperboard precursor; firstly squeezing moisture from the paperboard precursor by passing the paperboard precursor through a pair of rollers; drying the squeezed paperboard below the melting point of polypropylene until the moisture content of the paperboard becomes 20% or less; immersing the dried paperboard in thermosetting resinous solution; secondly squeezing moisture from the immersed the paperboard between a pair of rollers; and drying the secondly squeezed paperboard through a drying drum at temperatures of 180-200℃.

According to the above patent application no. 95-20835, the reinforced paperboard itself may stand in the air for a long time. However, it has to be cut immediately on secondly drying and then compressively molded to form a secondary molding product having various concave and convex patterns in order to prevent the degradation of the thermal moldability of the board due to the thermosetting of the thermosetting resins.

## Summary of the Invention

The inventor of the present invention, therefore, has completed a manufacturing method of reinforced interior plate boards for construction which is more economic and the product by which has excellent moldability and strength while resolving the conventional disadvantages as above, through repeated experiments and researches.

It is an object of the present invention to provide a manufacturing method of interior plate boards for construction using waste pulp and waste fibers to maximize the practical use of waste resources and to contribute to the prevention of the environmental pollution.

It is another object of the present invention to provide a manufacturing method of interior plate boards for construction having good heat-resistance and moldability, so that the applicability and decoration effect of the products can be maximized by realizing the various concave and convex patterns.

It is still another object of the present invention to provide a manufacturing method of interior plate boards for construction using waste pulp and fiber which are accessible and economic and can reduce the manufacturing cost.

It is a further object of the present invention to provide a manufacturing method of interior plate boards for construction which are strong for the external shock and particularly have good soundproofing.

## Detailed Description of the Invention

According to the present invention, the manufacturing

method of interior plate boards for construction comprises the steps of:

cutting 30-55% by weight of waste pulp, 20-35% by weight of waste polyester fibers and 20-35% by weight of waste polypropylene fibers by a predetermined length to make a material mixture;

homogeneously mixing the material mixture with 2-9% by weight of filler and water;

dehydrating the homogeneous mixture while uniformly distributing and removing the homogeneous mixture on a network-structured belt and passing through a pair of rollers to form a plate board precursor;

spraying a thermosetting resinous solution on the plate board precursor;

drying the plate board precursor at temperatures of 60-90℃ to form a plate board until the moisture content of the plate board becomes 5-20%;

cutting the plate board in specified shapes;

spraying water onto the surface of the plate board; and

compressively molding the plate board into interior plate boards having respective shapes at temperatures of 180-200℃ and under the pressures of 120~150kg·f/cm$^2$.

The waste polyester and polypropylene fibers of the present invention are obtained by swelling small pieces of cotton cloth in an aqueous sodium hydroxide solution or obtained from a waste solution after manufacturing paper, for example, cotton pulp, linen pulp, flax pulp, paper mulberry pulp, jute pulp, manila pulp and

so on. It is preferable to use the cotton pulp which has excellent strength, durability and soundproofing. It is also preferable to use the waste solution after the manufacturing paper where the waste polyester and waste polypropylene fibers are used after being cut and swollen.

The waste polyester and polypropylene fibers of the present invention are obtained by swelling in a solution and cutting the fibers discarded from factories by a predetermined length, though such elaborate treatments as in general paper-manufacturing processes are not necessary. If polyester mixed with cotton is used, the weight percentage of the waste pulp including cotton pulp may be reduced. That is, if the mixture percentage of the cotton in the polyester fibers is high, the percentage of the waste pulp may be lowered.

The strength and the thickness of the plate boards according to the present invention are closely related to the size of the waste pulp and the waste fibers. For instance, the strength of the interior plate boards is weak when the waste fibers and pulp are too short, and on the contrary when the waste fibers and pulp are too long, more energy and heat is required for molding and compressing the fibers owing to the space produced among the fibers and pulp, and further the shape of the boards is not uniform.

According to the present invention, it is preferable that the length of the waste pulp and fibers is to be 2-5mm when the thickness of the board is about 2-4mm, and the length is preferably 3-8mm when the thickness is 4-8mm.

As for the filler used in the present invention, white clay, ocher, talc, asbestos, plaster, calcium carbonate and diatomite may be selected according to the final applications of the interior plate boards, for example, wall boards, ceiling boards and decoration boards.

The filler is added to distribute homogeneously the waste pulp and fibers which are different in their specific gravity, and not to be separated from one another. The ocher helps the homogenization since it is bound to comparatively heavy fibers or pulp of the material mixture. Further, the filler functions to closely pack the materials of the board and improve the heat-resistance of the board.

The size of the particles of the filler is preferably 20$\mu$ or less, even though it is slightly different depending on the kind of the filler.

In the present invention, 0.3-3.0% by weight of gasoline may be added to the homogeneous mixture to make the light impurities of the waste fibers and pulp mixed in the gasoline and make the gasoline layer float onto the material mixture. It is preferable for the gasoline layer to be discarded separately from the homogeneous mixture before the dehydration.

The moisture content of the plate board precursor after the dehydration is preferable to be 10-20%, since with that amount of moisture the precursor can absorb the sprayed thermosetting resinous solution as much as possible in the next step and the thermal moldability to form a final product can be improved.

The thermosetting resinous solution is to be an acidic

aqueous solution of pH 5-6 containing 3% by weight of cationic ureaformaldehyde or a solution obtained by dissolving 3-4% by weight of melamine resin in an aqueous HCl solution and maturating the solution for 3-5 hours. The resinous solution forms monohydrochlorides and can be diluted with water, wherein the resin particles have static electric charges and are easily adsorbed to the fibers. The thermosetting resinous solution is hardened by heat and accordingly improves the surface intensity and bearing power of the board, and makes the board water-resistant with the polypropylene.

After being sprayed with the thermosetting resinous solution, the plate board precursor is dried in the drier at temperatures of 60-90℃ until the moisture content becomes 5-20%. It is preferable to dry the plate board precursor under the melting point of the polypropylene, since a lot of thermosetting resinous solution can be absorbed in the precursor below the melting point and if the drying is carried out above the melting point, then the polypropylene becomes melted and bound by heat and prevents the penetration of the thermosetting resinous solution into the precursor.

Further, the present invention provides time-gaining manufacturing method and interior plate boards having smooth finishing, in that the paperboard is to be cut in specific shapes when containing some amount of moisture after being firstly dried, rather than to be cut immediately after being treated with the thermosetting resinous solution and secondly dried. Therefore, comparing the conventional method as described in the

patent application no. 95-20835 in which the paperboard precursor has to be cut immediately after thermosetting treatment with the thermosetting resinous solution and the secondary drying, the operating efficiency and the workability can be improved and the beautiful appearance and smooth finishing of the interior plate boards can be obtained.

After cutting, the plate board is sprayed with water on its upper and lower surfaces so as to receive heat and pressure imposed on its surfaces in next step, i.e., compression molding and to prevent the upper and lower surfaces from being scorched or twisted by the heat and the pressure and prevent the discoloration of the surfaces caused by bubbles from the inside of the plate board.

In the last step of compression molding, the conditions of temperature, pressure and humidity are important. It is most preferable to mold the plate board containing moisture therein and on both surfaces as well in temperatures of 180-200℃ and under the pressures of 120-150kg·f/cm$^2$ for about 20-25 seconds in order to produce the interior plate boards having desirable high strength.

In the range of 180-200℃ in temperature, the polypropylene is melted and binds the waste pulp and the waste polyester fibers, and the surface of the polyester fibers become adhesive in relation to other components and provides strong tensile strength in the plate board.

These conditions of temperature and pressure have been obtained by repeated experiments and researches by the inventor

of the present invention. Desired shape and strength of the interior plate boards can not be achieved out of the above conditions.

As for the amounts of the components of the material mixture, the use of excessive pulp may deteriorate the thermal moldability and the wet strength of the interior plate boards and weaken the surface strength of the boards produced, and the boards becomes easily contaminated. The use of excessive polypropylene may deteriorate the thermal resistance of the plate boards and cause the deformation of the boards. On the other hand, the use of smaller amount of polypropylene may cause the deterioration of the binding force among the components of the material mixture and make the surface of the board rough and bumpy. The polyester fibers contribute to the thermal moldability in the compression molding together with the polypropylene fibers and upon cooling, the physical properties of the polyester fibers such as tensile strength and the breaking strength increase greatly.

The present invention will become apparent upon reading the following detailed description of exemplary embodiments.

## Preferred Embodiments of the Invention

### Embodiment 1

35kg of various kinds of waste pulp, 30kg of waste polyester fibers and 30kg of waste polypropylene fibers discarded and collected from manufacturing factories were cut in a cutting

machine by the length of 3mm and removed to a mixer, where 1kg of gasoline, 5kg of ocher and 300kg of water were added to and mixed with the material mixture comprising the waste pulp and the waste fibers. The upper gasoline layer including various kinds of impurities from the waste pulp and fibers was discarded from the lower aqueous layer. Then, the homogeneous mixture was dehydrated while being distributed uniformly and removed along a network-structured belt, and further dehydrated through a pair of rollers to form a plate board precursor shaped like a board until the moisture content of the dehydrated plate board precursor became about 13%. After spraying the 3% melamine resinous solution onto the dehydrated plate board precursor, the plate board precursor was dried at 85℃ until the moisture content thereof becomes 10%. The dried plate board was cut in desired shapes and sizes and water was sprayed onto the both sides of the cut plate boards. The plate boards were layed on metal molds respectively to be oil-hydraulically molded at temperature of 180℃ and under the pressure of 125kg·f/cm$^2$ for 20 seconds, thus forming the interior plate boards for construction.

The thickness of the interior plate boards for construction according to this embodiment of the present invention was 3.5mm and the experimental results including their strength were as follows.

Table 1

| | embodiment 1 | embodiment 2 | method of experiment |
|---|---|---|---|
| Breaking Strength ($Kgf/cm^2$) | 37.5 | 37.5 | KS M 7082-92 |
| Piercing Strength (Kgf/cm) | | | KS M 7056-92 |
| - horizontally : average | 193 | 193 | |
| maximum | 185 | 185 | |
| minimum | 200 | 200 | |
| - vertically : average | 171 | 171 | |
| maximum | 181 | 181 | |
| minimum | 160 | 160 | |
| ∴ Total average | 182 | 182 | |
| Thickness (mm) | | | KS M 7054-92 |
| average | 3.5 | 4.5 | |
| maximum | 3.7 | 4.7 | |
| minimum | 3.3 | 4.3 | |
| Absorptivity ($g/m^2$) Cobb Method, surface, 30 minutes | 75 | 75 | KS M 7054-92 |
| Layer separation test | no separation | no separation | KS M 1225-94 |
| Weight per unit area ($g/m^2$) | 1157 | 1157 | KS A 7013-90 |
| Tensile strength (Kgf/15mm) | | | KS M 7014-90 |
| - horizontally : average | 62.1 | 62.1 | |
| maximum | 64.1 | 64.1 | |
| minimum | 60.1 | 60.1 | |
| - vertically : average | 73.2 | 73.2 | |
| maximum | 75.2 | 75.2 | |
| minimum | 71.2 | 71.2 | |

Embodiment 2

48kg of waste pulp, 25kg of waste polyester fibers and 25kg of waste polypropylene fibers discarded and collected from manufacturing factories were cut in a cutting machine by the length of 6mm and removed to a mixer, where 1kg of gasoline, 2kg of ocher and 300kg of water were added to and mixed with the material mixture comprising the waste pulp and the waste fibers. The upper gasoline layer including various kinds of impurities from the waste pulp and fibers was discarded from the lower aqueous layer. Then, the homogeneous mixture was dehydrated while being distributed uniformly and removed along a network-structured belt, and further dehydrated through a pair of rollers to form the plate board precursor shaped like a board until the moisture amount of the dehydrated precursor became about 15%. The plate board precursor was sprayed with 3.5% melamine resinous solution and dried at 90℃ until the moisture amount became about 15%. The dried plate board was cut into predetermined designs and sizes and sprayed with water onto the respective both sides of the boards. The amount of the sprayed water was less than that of the embodiment 1 since the thickness of the plate boards according to this embodiment was higher than that of the embodiment 1 and so the plate boards of this embodiment had more moisture content therein than that of the embodiment 1. The plate boards containing the moisture were put on metal molds respectively to be oil-hydraulically molded at the temperature of 200℃ and under the pressure of 140kg·f/cm$^2$ for 25 seconds, thus forming the interior plate boards.

The thickness of the interior plate boards according to this embodiment of the present invention was 4.5mm and the experimental results including their strength were shown in table 1.

The interior plate boards for construction manufactured by the method of the present invention have an excellent form-maintaining property and workability as well as superior tensile strength and breaking strength. Further, the interior plate boards are soundproofing due to the cotton pulp. Additionally, the manufacturing method of the interior plate boards for construction according to the present invention greatly contribute to the prevention of the environmental pollution in that the boards leave a little amount of ash after the incineration and are biodegradable even though they are not incinerated.

The present invention is very useful especially in those countries that have little natural resources like Korea and relates to a manufacturing method which is very effective in the aspects of the remarkable reduction of environmental pollution and the recycling of resources all over the world. Further, the present invention is very attractive to the manufacturers in the art in the aspects of light weight and economy.

Those skilled in the art will readily recognize that various other modifications and changes may be made to the present invention without strictly following the exemplary application illustrated and described herein and without departing from the true spirit and scope of the present invention, which is set forth

in the following claims.

**What is claimed is :**

1. A method for manufacturing interior plate boards for construction comprising the steps of:

cutting 30-55% by weight of waste pulp, 20-35% by weight of waste polyester fibers and 20-35% by weight of waste polypropylene fibers by predetermined length to make a material mixture;

homogeneously mixing the material mixture with 2-9% by weight of filler and water;

dehydrating the homogeneous mixture while uniformly distributing and removing the homogeneous mixture on a network-structured belt and passing through a pair of rollers to form a plate board precursor;

spraying a thermosetting resinous solution on the plate board precursor;

drying the plate board precursor at temperatures of 60-90℃ to form a plate board until the moisture content of the plate board becomes 5-20%;

cutting the plate board in specified shapes;

spraying water onto the surface of the plate board; and

compressively molding the plate board into interior plate boards having respective shapes at temperatures of 180-200℃ and under the pressures of 120~150kg·f/cm$^2$.

2. A method as claimed in claim 1, wherein the waste pulp

is the waste cotton pulp.

3. A method as claimed in claim 1, wherein the moisture content after the dehydration by means of the rollers is 10-20%.

4. A method as claimed in claim 1, wherein the thermosetting resinous solution is a solution obtained by dissolving 3-4% by weight of melamine resin in an aqueous HCl solution and maturating the solution for 3-5 hours.

5. A method as claimed in claim 1, wherein 0.3-3.0% by weight of gasoline is added to and mixed with the homogeneous mixture, and then gasoline layer is discarded separately from the homogeneous mixture before the dehydration.

6. A method as claimed in claim 1, wherein the waste fibers and waste pulp are cut by the length of 2-8mm.

7. A method for manufacturing interior plate boards for construction comprising:

homogeneously stirring a material mixture comprising 50% by weight of waste pulp, 20% by weight of polyester fibers and 30% by weight of polypropylene fibers in an aqueous solution containing 20-30g/ℓ of filler;

uniformly distributing the homogeneous mixture onto a network-structured belt and removing the mixture along the belt, to form a paperboard precursor;

primarily squeezing moisture from the paperboard precursor by passing the precursor through a pair of rollers to form a paperboard;

drying the squeezed paperboard at temperatures below the melting point of the polypropylene until the moisture content of the paperboard becomes 20% or less;

immersing the dried paperboard in a thermosetting resinous solution;

secondly squeezing the paperboard by passing it through a pair of rollers; and

drying the squeezed paperboard through a drying drum at temperatures of 180-200℃.