Title: MANUFACTURING METHOD OF BAMBOO CHIP AND MANUFACTURING METHOD BAMBOO HBER USING THE BAMBOO CHIP

Abstract: There are provided a method for manufacturing a bamboo chip used to manufacture a natural fiber and a method for manufacturing a natural fiber using the bamboo chip. The method for manufacturing a bamboo chip includes steps of obtaining a soluble pulp from a bamboo chip; and manufacturing a rayon stable fiber from the soluble pulp using a viscose process as known in the prior art; and directly extracting only alpha-cellulose, in the form of fiber, from the bamboo chip by treating the bulky bamboo chip prepared in the present invention at a certain condition without undergoing a complicated process using raw materials for fiber articles as the rayon stable fiber. The alpha-cellulose in the form of fiber according to the present invention may be useful to apply to a variety of fields such as fibers, nonwoven fabrics and other sanitary articles, etc.
Description

MANUFACTURING METHOD OF BAMBOO CHIP AND MANUFACTURING METHOD BAMBOO FIBER USING THE BAMBOO CHIP

Technical Field

The present invention relates to a method for manufacturing a bamboo chip used to manufacture a natural fiber and a method for manufacturing a bamboo fiber using the bamboo chip, and more particularly to a method for manufacturing a bamboo chip including steps of obtaining a soluble pulp from a bamboo chip; and manufacturing a rayon stable fiber from the soluble pulp using a viscose process as known in the prior art; and directly extracting only alpha-cellulose, in the form of fiber, from the bamboo chip by treating the bulky bamboo chip prepared in the present invention at a certain condition without undergoing a complicated process using raw materials for fiber articles as the rayon stable fiber, wherein the alpha-cellulose in the form of fiber according to the present invention may be useful to apply to a variety of fields such as fibers, nonwoven fabrics and other sanitary articles, etc.

Background Art

Generally, a cotton fiber is mainly obtained as natural cellulose fiber from cotton plants, but the cultivation of the cotton plants has decreased due to a variety of reasons such as environmental changes. Therefore, there has been an urgent need for novel natural cellulose fibers.

Accordingly, there have been attempts to obtain natural fiber materials from bamboo, hemp, rice straw, corn stalk and the like in addition to the natural cellulose obtained from the cotton plant. Among them, there has been the most active attempt using a bamboo, but the studies using bamboo stems have been mainly attempted and a study as fiber materials is unsatisfactory until now.

Meanwhile, bamboo mainly grows and cultivates in Southeast Asian nations, and may be used as natural resources since the bamboo grows very rapidly for a short period.

A process of manufacturing fiber materials from a bamboo, as known in the art, will be described schematically.

First, a bamboo is harvested, bamboo leaves and stems are removed from the bamboo to obtain a cylindrical bamboo, and the cylindrical bamboo is then cut to obtain a flat fragmental chip.

The flat fragmental chip has an approximately size with a width of 20 to 30 mm, a
length of 30 to 40 mm and thickness of 2 to 4 mm, as shown in FIG. 4, and includes a hard bark region, an inner bark and a joint region. In this case, a soluble pulp may be prepared by treating the fragmental chip 1 with chemical agents under various conditions.

As a result, a large amount of the chemical agents are increasingly used to penetrate the chemical agents into the hard fragmental chip 1 in the above-mentioned chemical treatment process, and therefore the treatment process may be uneconomic due to the increase in the treatment temperature and time.

Also, even when the bamboo chip 1 is treated under the condition as described above, the content of alpha-cellulose, which is required for fibrosis, is low due to the insufficient delignification and the low efficiency to remove unnecessary components such as hemicellulose, and therefore it is difficult to manufacture a good soluble pulp.

Furthermore, when the above-mentioned technique is used herein, a yield of a soluble pulp is very low with a level of 30 to 37%, based on the total amount of the bamboo chip, and thus this process is not efficient.

In addition, a soluble pulp is gelated when the unnecessary components such as lignin and hemicellulose, which act as obstacles to fibrosis, is removed insufficiently, and then spun through a spinning process to obtain a filament yarn, or the soluble pulp is cut in a constant length to manufacture a stable fiber. However, the soluble pulp is increasingly cut finely since the components acting as obstacles to fibrosis are present in a large amount, and physical properties of fiber, such as strength, uniformity and productivity, may be deteriorated, which leads to the poor articles.

In particular, it is more difficult to manufacture a filament yarn as a long fiber using the poor soluble pulp as described above.

In addition to the above-mentioned problems, large base facilities such as chemical treatment facilities, spinning facilities, energy supply facilities and waste-water purifying facilities are required in a fibrosis process using the soluble pulp, but some of the nations in the world inhibit the operations of the base facilities since waste water and environmental pollutions are seriously caused in the operations of the base facilities.

Therefore, there is an urgent demand for a method capable of solving the obstacles to fibrosis industries of bamboo that may grow in a large scale and be used as natural resources due to the rapid growth rate, as well as having a more excellent antimicrobial activity than cotton fiber and excellent feeling sense, and therefore the above obstacles remains to be solved.

Disclosure of Invention
Technical Problem

Accordingly, the present invention is designed to solve the above problems, and therefore it is an object of the present invention to provide a method for manufacturing a bamboo chip, wherein bamboo fibers may be easily prepared through the simplified fibrosis process (a dissolution process is omitted) by extracting alpha-cellulose from a bamboo and manufacturing the alpha-cellulose into fibers, the method is environment-friendly, the facility investment and maintenance costs are high, and it is possible to mass-produce good bamboo fiber materials with the low cost.

Technical Solution

In order to accomplish the above object, one embodiment of the present invention provides a method for manufacturing a bamboo chip used to manufacture a natural fiber, the method including steps of obtaining a cylindrical bamboo 10 by removing leaves and twigs from harvested bamboo; obtaining a bamboo 12 having only bamboo stems by cutting and removing bamboo joints 11 from the cylindrical bamboo 10; and tearing the bamboo 12 into pieces in a longitudinal direction so as to give bulkiness by pressing the bamboo 12 with a pressure roller and a convex roller to crush the bamboo 12 in a longitudinal direction.

In order to accomplish the above object, another embodiment of the present invention provides a method for manufacturing a natural fiber using a bamboo chip, the method including steps of adding the bamboo chip 20 prepared in the method as defined in claim 1 and water in a solution ratio of 1:2.5 to 3.5 to a cooking container, heating the bamboo chip 20 at 160 to 180°C for 100 to 180 minutes, and discharging steam and prehydrolyzing the bamboo chip 20 under a reduced pressure; washing the prehydrolyzed bamboo chip 20; adding 16 to 26% by weight of caustic soda (NaOH) (in a solution ratio of 1:2.5 to 3.5) and 0.1 to 1.0% by weight of anthraquinone to a cooking container based on the total weight of the bamboo chip, and heating the mixture of the washed bamboo chip 20 at 130 to 150°C for 60 to 120 minutes, heating the mixture at 155 to 175°C for 60 to 120 minutes once more, and discharging steam at a reduced pressure; and washing the cooked bamboo chip.

Also, additional processes includes steps of arranging and cutting the obtained bamboo fiber (alpha-cellulose fiber) into pieces having a constant length, undergoing a reeling process and a concentration process, bleaching the fibers several times, acid-treating the bleached fibers, washing the fibers, and concentrating, pressing, drying and packaging the washed fibers.

Advantageous Effects

As described above, the method for manufacturing a bamboo fiber from a bamboo
according to the present invention may be useful to easily dissolve and remove impurities except for hemicellulose or alpha-cellulose such as lignin and pentoic acid that are unnecessary in the fibrosis process using a bamboo chip manufactured from a cylindrical bamboo in which bamboo joints are removed from a bamboo since chemical agents are easily penetrated into the bamboo chip in a prehydrolysis and cooking process by pressing the bamboo with a pressure roller or a convex roller to crush the bamboo and tearing the bamboo into pieces with scratches in a longitudinal direction so as to give rich bulkiness to the bamboo chip. Also, the manufacturing according to the present invention may be useful to mass-produce good and environment-friendly bamboo fibers without any investment of expensive facilities since a bamboo fiber may be directly extracted from the above-mentioned bamboo chip in the prehydrolysis and cooking process, and the bamboo fiber may be then spun to produce a yarn, or used for various fiber articles such as nonwoven fabrics, sanitary articles, etc.

Brief Description of the Drawings

These and other features, aspects, and advantages of preferred embodiments of the present invention will be more fully described in the following detailed description, taken accompanying drawings. In the drawings:

FIG. 1 is a configuration view showing a cylindrical bamboo used in the present invention,

FIG. 2 is a cross-sectional view showing a joint-free bamboo as shown in FIG. 1,

FIG. 3 is a cross-sectional view showing a bamboo chip having bulkiness through the pressing of the bamboo as shown in FIG. 2, and

FIG. 4 is a diagram showing a rectangular fragmental chip used in the convention method for manufacturing a bamboo fiber.

Best Mode for Carrying Out the Invention

Hereinafter, preferred embodiments of the present invention will be described in detail referring to the accompanying drawings. Prior to the description, it should be understood that the terms used in the specification and appended claims should not be construed as limited to general and dictionary meanings, but interpreted based on the meanings and concepts corresponding to technical aspects of the present invention on the basis of the principle that the inventor is allowed to define terms appropriately for the best explanation. Therefore, the description proposed herein is just a preferable example for the purpose of illustrations only, not intended to limit the scope of the invention, so it should be understood that other equivalents and modifications could be made thereto without departing from the spirit and scope of the invention.
[30] **Step 1: Preparation of materials**

Well-grown bamboo is harvested, and branches and leaves are removed from the harvested bamboo to obtain a cylindrical bamboo 10. Then, the cylindrical bamboo 10 is cut, and a region of bamboo joint 11 is removed from the cylindrical bamboo 10 to obtain a bamboo 12 that does not have a joint 11 (see FIG. 2).

[32] In this case, the length of the resulting bamboo 12 is varied according to the growth conditions and states of the harvested bamboo, but the bamboo 12 has a length of about 15 to 50 cm.

[33] However, there is no particular limitation on the length of the cut bamboo 12, but the bamboo 12 obtained by cutting off the joint 11 of the harvested cylindrical bamboo 10 is generally used as it is. Therefore, the length of the bamboo is preferably selected depending on the use and purpose of the resulting bamboo fiber.

[34] **Step 2: Manufacture of bamboo chip**

This process is important for the bamboo fiber provided in the present invention. In this process, a bamboo chip 20 having bulkiness is obtained by pressing the bamboo 12 prepared in the Step 1 with a pressure roller or a convex roller with protrusions to crush the bamboo 12 and tearing the bamboo 12 into pieces with scratches in a longitudinal direction (see FIG. 3).

[37] As shown in FIG. 3, the subsequent process is preferably effectively carried out by pressing the entire bamboo 12 to crush the entire part of the bamboo 12 while making scratches to the bamboo 12, and the bamboo 12 is simultaneously torn in a longitudinal direction to give bulkiness.

[38] Articles, which are manufactured under the conditions as described in the Korean Patent Application No. 2006-99406 filed by the present inventors, may be used herein without manufacturing a bamboo chip under the conditions as described above in the present invention.

[39] Referring to the context of the prior application filed by the present inventors, a bamboo from which leaves and twigs are removed is pressed with a plurality of convex rollers to tear the bamboo while crushing the bamboo in a longitudinal direction, thereby to give bulkiness to the bamboo, and the bamboo is cut into pieces having desired length using a cutting machine. In the crushing and cutting processes, joints, thin-walled tissues and silicated cuticles of the bamboo, which are obstacles to a pulping process, are crushed and removed partially.

[40] **Step 3: Washing process**

This process is to remove foreign substances attached to the bamboo chip and cleanly wash impurities such as small fragments and dusts generated in the process of
manufacturing a bamboo chip at the same time.

**Step 4: Prehydrolysis process**

This process is to maximize a yield of fibrous alpha-cellulose included in the bamboo chip by dissolving hemicellulose and lignin in the bamboo chip.

In order to treat the bamboo chip, the prepared bamboo chip and water are added to a cooking container and treated at a hot temperature for a suitable period.

In this case, a mixing ratio of the added bamboo chip and water ranges from 1:2.5 to 3.5 % by weight, and the bamboo chip is sufficiently immersed in water in the cooking container. The bamboo chip is treated at a temperature of 160 to 180°C for 100 to 180 minutes, a steam is discharged into a reduced pressure, and the bamboo chip treated in the cooking container is transferred into a washing process.

When the bamboo chip 20 is added to the cooking container together with the bamboo chip 20 and treated at high temperature and high pressure for an extended time as described above, hemicellulose and some of lignin in the bamboo chip are structurally changed, dissociated and dissolved by the heating.

At the same time, pentoic acid that is present at a large amount of about 20 % is also removed from the bamboo.

Particularly, the bulkiness is given to the bamboo chip used in the present invention since the bamboo chip is crushed in a longitudinal direction and simultaneously torn into pieces with scratches during the pressing process. Therefore, it is possible to easily dissolve hemicellulose or lignin and pentoic acid in the prehydrolysis.

**Step 5: Washing process**

This process is to wash dissolved hemicellulose or partially dissolved lignin and pentoic acid in the prehydrolysis process so as to facilitate a cooking process.

**Step 6: Cooking process**

This process is to remove lignin, which is not dissolved in the prehydrolysis process, in the most effective manner, but to extract only pure alpha-cellulose without any damage to the alpha-cellulose in the bamboo chip.

Therefore, a process using caustic soda (NaOH) and anthraquinone may apply to this process to improve the strength and yield of the alpha-cellulose.

That is to say, the bamboo chip undergoing the prehydrolysis and washing processes is added to a cooking container together with a suitable amount of caustic soda and a small amount of anthraquinone, and then treated at a high temperature to sufficiently dissolve lignin and pentoic acid that are not dissolved and removed in the prehydrolysis process. As a result, only the pure fibrous alpha-cellulose remains in the
cooking container.

In the above treatment conditions, the alkaline compound is added at a ratio of 16 to 26%, based on the compound (NaOH) used in the bamboo chip undergoing the prehydrolysis process. In this case, a solution ratio of the medicinal fluid (water, caustic soda and anthraquinone) ranges from about 1 : 2.5 to 3.5, based on the bamboo chip.

Also, the added anthraquinone is used to facilitate the removal of lignin but prevent the dissolution of alpha-cellulose, and the ratio of the added anthraquinone ranges from about 0.1 to 1.0% by weight, based on the total weight of the bamboo chip.

The caustic soda and the anthraquinone are added to a cooking container together with bamboo chip under the conditions as described above, and then primarily treated at 130 to 150°C for about 60 to 120 minutes and secondarily at 155 to 175°C for 60 to 120 minutes.

Only the fibrous alpha-cellulose remains in the cooking container since the lignin and pentoic acid that are not dissolved in the prehydrolysis process are sufficiently dissolved in the heat treatment process.

When the bamboo chip is completely cooked under the above-mentioned conditions, a steam is discharged into a reduced pressure, and the fibrous product including only alpha-cellulose is then harvested from the cooking container, followed by undergoing a washing process.

Step 7: Washing process

This process is to selectively extract the fibrous alpha-cellulose, for example a bamboo fiber, by washing the dissolved lignin and pentoic acid in the cooking process with water.

During the washing process (Step 7), a desired bamboo fiber according to the present invention is actually obtained.

That is to say, a fibrous alpha-cellulose, that is, a bamboo fiber is extracted from the bamboo chip. Then, the bamboo fiber may be spun to obtain a thread, or used to obtain various articles such as nonwoven fabrics and sanitary articles.

However, the subsequent process is required to obtain a good bamboo fiber.

Step 8: Alignment and Length adjustment

This process is to align the bamboo fiber extracted in the previous process and adjust any length of the bamboo fiber as the same time.

Step 9: Removal of Foreign substances

This process is to remove other foreign substances such as sands in the bamboo fiber by centrifuging the bamboo fiber aligned with any of lengths.
The centrifugation is carried out in a centrifuge under conditions including a concentration of 0.5 to 0.8% and a pressure of 2 kg/D, and therefore it is possible to effectively remove the foreign substances that have a higher specific gravity than the bamboo fiber.

**Step 10: Concentration process**

The foreign substance-free bamboo fiber prepared in the Step 9 is concentrated into a density of 2 to 3.5%.

**Step 11: Bleaching process**

This is a bleaching process to obtain a good bamboo fiber by removing pigments in the bamboo fiber to improve brightness.

The bamboo fiber is primarily bleached with chlorine. In this case, the bleaching condition is as follows: 3.0 to 3.5% by weight of the bamboo fiber is treated in 60% of the total amount of used chlorine for a chlorinating time of 40 to 60 minutes, and then washed several time until the remaining chlorine is 0.20g/l and pH of the bamboo fiber is pH<2.

The primarily chlorine-bleached chlorine bamboo fiber undergoes a secondary bleaching process.

In this case, the secondary bleaching condition is as follows: 5.0% by weight of the bamboo fiber is treated in 2.0 to 2.5% of an alkaline compound (based on a dry fiber) at a temperature of 50 to 90°C for 60 to 90 minutes, and then washed until the remaining alkaline compound is =50g/D.

The secondarily bleached bamboo fiber undergoes the third bleaching process.

The third bleaching condition is as follows: the secondarily bleached bamboo fiber is treated in 40% of the total amount of a used chlorine solution including =250g/D of an alkaline compound at a temperature of 38 to 45°C for a chlorinating time of 120 to 240 minutes, and then washed several time until a desired brightness is =75%, a content of alpha-cellulose fiber is =93% and the remaining alkaline compound is =50g/D.

The bleached bamboo fiber has an excellent brightness and a good quality.

**Step 12: Acid-treatment process**

This process is to stably maintain the brightness of the bamboo fiber bleached in the bleaching process. In this case, the bleached bamboo fiber is treated in 2.0 to 5.0% of used acid (HCl) (based on a dry fiber) at a room temperature for 40 to 60 minutes, and then washed until the remaining acid is =50g/D.
Step 13: Concentration process

The acid-treated bamboo fiber is concentrated to a density of 3.0 to 3.5% using a concentrator.

Step 14: Pressing and drying process

The concentrated bamboo fiber is pressed using a pressure roller to remove more than 80% of water from the bamboo fiber, and the water-remove bamboo fiber is dried into a dryness of about 8.5 to 10% using a hot-wind dryer.

Step 15: Packaging process

The suitably dried bamboo fiber is pressed into a reduced volume and packed with easy handling and transportation at the same time. Therefore, the manufacture of the bamboo chip according to the present invention and the bamboo fiber extracted from the bamboo chip are completed.

Mode for the Invention

As described above, as a substitute natural fiber from a cotton plant whose cultivation tends to decrease, a natural fiber having more excellent antimicrobial activity than the cotton fiber and a smooth feeling sense is extracted from a bamboo for use. In this case, articles having excellent physical properties such as tensile strength, feeling sense and antimicrobial activity may be mass-produced by manufacturing a bamboo chip so that the bamboo can be treated in the process of extracting a bamboo fiber without using the complicated process, investing the expensive facilities and causing the environment friend-associated problems, thereby to directly extract a bamboo fiber from a bamboo in a simple process, followed by directly extracting a bamboo fiber including only alpha-cellulose from the bamboo chip, which is used later in a spinning process or for nonwoven fabrics. That is to say, the use of the bamboo fiber in the spinning process or for the nonwoven fabrics means that a bamboo fiber is spun as it is, or manufactured into a nonwoven fabric without undergoing a conventional rayon viscose process (pulp dissolution-spinning-cutting processes).

For the present invention, the condition of the bamboo chip is very important to directly extract a bamboo fiber including only alpha-cellulose from the bamboo.

That is to say, the bamboo chip used in the present invention is not a conventional hard and fragment-type bamboo chip, but it is easily manufactured by crushing a joint-free cylindrical bamboo with a length of 15 to 40 cm while pressing the cylindrical bamboo in a pressing unit, and tearing the cylindrical bamboo into fine chips in a longitudinal direction, thereby to give bulkiness, which makes it easy to remove foreign
substances, which is unnecessary in the fibrosis, such as hemicellulose or lignin, and pentoic acid, which are included in the bamboo, during the prehydrolysis and cooking process.

In particular, the bamboo fiber according to the present invention may be useful to obtain a good bamboo fiber using a simple manufacturing process of directly extracting a bamboo fiber from a bamboo chip through the prehydrolysis and cooking process, the bamboo chip being prepared by pressing a long bamboo whose joints are removed from a cylindrical bamboo to crush the bamboo and tearing the bamboo in a longitudinal direction, unlike the conventional process of obtaining a soluble pulp from a fragment-type hard bamboo chip; gelating the soluble pulp; obtaining a stable fiber using a viscose process and using the stable fiber as a fiber article material.

Referring again to the conventional process of extracting a bamboo fiber, the conventional process includes a four-step process including a bamboo chip - a soluble pulp - a bamboo stable fiber in a viscose process - a fiber article, but the process according to the present invention includes a three-step process including a bamboo chip - a bamboo fiber - a fiber article (treads, nonwoven fabrics, sanitary articles). Therefore, the process according to the present invention is carried out in a simple manner since the articles are produced without manufacturing a stable fiber using the viscose process.

In addition, a process for manufacturing a stable fiber using a conventional viscose process may be omitted in the present invention since a bamboo fiber is directly extracted from the bamboo chip, and therefore it is possible to mass-produce a bamboo fiber with low expense without any of the environmental pollutions and the deterioration of productivity and quality that are caused by the huge investment and operation of the facilities.

The results obtained by comparing the conventional method for manufacturing a bamboo fiber with the manufacturing method according to the present invention are listed in the following Table 1.

Table 1
Comparison of the conventional method and the inventive method

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<tr>
<th></th>
<th>Conventional method</th>
<th>Inventive method</th>
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<tbody>
<tr>
<td>Bamboo chip shape</td>
<td>Hard and rectangular</td>
<td>Torn in a longitudinal direction with bulkiness</td>
</tr>
<tr>
<td>Hard bark, inner bark and joint</td>
<td>Very rich</td>
<td>Very low</td>
</tr>
<tr>
<td>Bulkiness</td>
<td>Very hard but not bulky</td>
<td>Bulkiness by scratches</td>
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The present invention has been described in detail. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

<table>
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<tr>
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<th>Long</th>
<th>Short</th>
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<tr>
<td>Cooking time</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Dose of agents</td>
<td>4 Processes</td>
<td>3 Processes (a stable fiber process omitted)</td>
</tr>
<tr>
<td>Alpha-cellulose</td>
<td>Highly damaged</td>
<td>Rarely damaged</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>Weak</td>
<td>Strong</td>
</tr>
<tr>
<td>No. of Processes</td>
<td>Expensive</td>
<td>Cheap (about 37%)</td>
</tr>
<tr>
<td>Manufacturing cost</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>and other expenses</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Antimicrobial activity</td>
<td>Under production</td>
<td>First development</td>
</tr>
<tr>
<td>Feeling</td>
<td>Mediocre</td>
<td>Very smooth</td>
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<td>Rarity</td>
<td>Restricted</td>
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[110]
Claims

[1] A method for manufacturing a bamboo chip used to manufacture a natural fiber, the method comprising:
obtaining a cylindrical bamboo 10 by removing leaves and twigs from harvested bamboo;
obtaining a bamboo 12 having only bamboo stems by cutting and removing bamboo joints 11 from the cylindrical bamboo 10; and
tearing the bamboo 12 into pieces in a longitudinal direction so as to give bulkiness by pressing the bamboo 12 with a pressure roller and a convex roller to crush the bamboo 12 in a longitudinal direction,
wherein the joint 11-free bamboo 12 has a length of 15 to 50 cm.

[2] A method for manufacturing a natural fiber using a bamboo chip, the method comprising:
adding the bamboo chip 20 prepared in the method as defined in claim 1 and water in a solution ratio of 1:2.5 to 3.5 to a cooking container, heating the bamboo chip 20 at 160 to 180°C for 100 to 180 minutes, and discharging steam and prehydrolyzing the bamboo chip 20 under a reduced pressure;
washing the prehydrolyzed bamboo chip 20;
adding 16 to 26% by weight of caustic soda (NaOH) (in a solution ratio of 1:2.5 to 3.5) and 0.1 to 1.0% by weight of anthraquinone to a cooking container based on the total weight of the bamboo chip, and heating the mixture of the washed bamboo chip 20 at 130 to 150°C for 60 to 120 minutes, heating the mixture at 155 to 175°C for 60 to 120 minutes once more, and discharging steam at a reduced pressure; and
washing the cooked bamboo chip.

[3] The method for manufacturing a natural fiber according to claim 2, further comprising a step of bleaching the washed bamboo chip so as to improve brightness of a fiber after the step of washing the cooked bamboo chip.
**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/KR2007/005891

**A. CLASSIFICATION OF SUBJECT MATTER**

*DOIB 1/10(2006.01)*

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)

IPC 8 D01B1/10

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

Korean utility models and applications for utility models since 1975

Japanese utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS (KIPO internal) "bamboo fiber"

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>JP 16-167730 A (YASUIMA KK) 17 June 2004 (17 06 2004) see abstract and figures</td>
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* Further documents are listed in the continuation of Box C

**Date of the actual completion of the international search**
12 MARCH 2008 (12 03 2008)

**Date of mailing of the international search report**
12 MARCH 2008 (12.03.2008)

**Name and mailing address of the ISA/KR**

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Form PCT/ISA/210 (second sheet) (April 2007)
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