

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 August 2006 (03.08.2006)

PCT

(10) International Publication Number
WO 2006/080731 A1

- (51) International Patent Classification:
E04B 1/86 (2006.01)
- (21) International Application Number:
PCT/KR2005/003350
- (22) International Filing Date: 8 October 2005 (08.10.2005)
- (25) Filing Language: Korean
- (26) Publication Language: English
- (30) Priority Data:
10-2004-0083840 20 October 2004 (20.10.2004) KR
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Youido-dong, Youngdeungpo-ku, Seoul 150-727 (KR).
- (81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

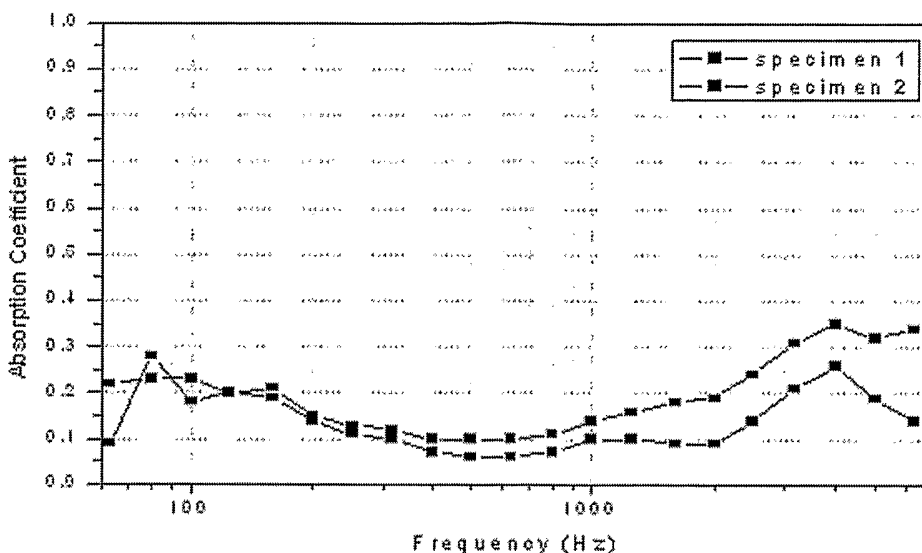
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SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC,
VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: A METHOD FOR IMPROVING WOOD SOUND-ABSORBANCE AND A SOUND-ABSORBING WOOD
THEREBY



(57) Abstract: Disclosed are a method of improving the sound-absorbing performance of wood and a sound-absorbing wood material prepared thereby. More specifically, disclosed are a method of improving the ability of wood to absorb sound waves incident in the fiber direction of the wood, the method comprising delignification of wood to remove substances present in intercellular and other regions of cell walls so as to increase the porosity of the wood, as well as a sound-absorbing wood material prepared by the method.

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【DESCRIPTION】**【Invention Title】**

A METHOD FOR IMPROVING WOOD SOUND-ABSORBANCE AND A SOUND-ABSORBING WOOD THEREBY

【Technical Field】

The present invention relates to a method of improving the sound-absorbing performance of wood as a sound-absorbing material, and more particularly to a method of improving the ability of wood to absorb sound waves incident in the fiber direction of the wood in a given frequency range by delignifying it. An object of the present invention is to provide a sound-absorbing board having sound-absorbing properties superior to that of unmodified wood by chemically treating wood.

【Background Art】

Currently, glass fiber, rock wool, gypsum board and the like, which are used as internal or external sound-absorbing materials, are frequently used as building materials, because they have excellent sound-absorbing capacity and insulation properties. However, when exposed in air during use, they will have a harmful effect on human health due to dust, etc., so that their use has gradually been restricted. Also, these materials have low intrinsic strength, and so require a supporting frame.

Wood, with the potential to replace non-eco-friendly materials, is a recyclable natural material and has a beautiful appearance and good processability, as well as excellent strength compared to other materials. However, wood resources in Korea mainly consist of small-diameter logs, curved logs and the like, and thus, there is a need to maximize the utility of the small-diameter logs or curved logs, having low added value.

The present inventor has delignified wood materials, using small-diameter logs or curved logs, by chemical treatment, and discovered that delignification resulted in substantial improvement in the sound-absorbing capacity of the wood materials thereby completing the present invention.

Wood is a sound reflective material having a sound absorption of about 5% in

a frequency range that human beings mainly use during their life. Thus, there have been many creative inventions to improve the sound-absorbing performance of wood. Korean Patent Application No. 99-38842 (entitled "a sound-absorbing wood material and a preparation method thereof") filed by the applicant discloses a wood board having improved sound-absorbing performance and low density and, at the same time, requisite strength, which is prepared by a method comprising the steps of: adding a synthetic resin adhesive to wood particles in an amount of about 5-30% by weight and stirring the mixture; forming the stirred mixture into a mat; placing the mat into a mold having a plurality of discharge holes form in the circumferential surface thereof; interposing the mold between upper and lower cowls each having a plurality of core pins, which have different diameters and are arranged on the same axis; and pressing the upper and lower cowls, in which the pressing step is performed at a temperature of about 140-240 °C and a pressure of about 20-40 kg/cm² for at least 5 minutes. Also, Korean Patent Laid-Open Publication No. 2003-30645 (entitled "a wood floor structure having a sound-absorbing elastic material") discloses a wood floor structure comprising: a sound-absorbing elastic material having perforated adhesive holes to be filled with an elasticity-reinforcing adhesive; and a wood floor panel placed on the sound-absorbing elastic material after being filled with the elasticity-reinforcing adhesive.

Because the above-published wood materials comprise, in addition to wood, a separate material for improving sound-absorbing performance, these materials are difficult to realize and do not meet the eco-friendly trend. For this reason, the present inventor developed a method capable of improving the sound-absorbing performance of wood using wood anatomical approach and based on his through study of wood structure, thereby completing the present invention. The sound-absorbing performance will now be described in order to fully understand the present invention.

The absorption of sound is a process for removing or reducing the energy of sound. Sound absorption is achieved by contact with a sound-absorbing

material having many pores, or by the vibration of a thin plate disposed on the wall surface with an air layer interposed therebetween, or by a sound-absorbing device including a single resonator. Although the absorbance of sound by the porous material varies depending on the thickness of the porous material, it shows an excellent effect in a wide frequency range, but the porous material needs structural support. Also, the plate vibration shows good sound absorbance only in low frequency range. In addition, the absorbance of sound by the single resonator shows high sound-absorbing effects only in a narrow frequency range.

Particularly, glass wool or rock wool is frequently used in buildings, owing to the advantages of good insulation properties in addition to sound-absorbing effects, but when exposed to air, during use, it can have a harmful effect on the human health due to dust. Also, this material has poor strength, and thus requires a supporting frame. Accordingly, the present inventor believes that there is a need to develop new materials, which have suitable levels of sound-absorbing and insulation properties and, at the same time, are not harmful to the humans, one of these materials being a wood material.

【Disclosure】

【Technical Problem】

The main objective of the present invention is to provide an eco-friendly, sound-absorbing material.

Another objective is to provide a method for improving the sound-absorbing properties of wood by removing substances from wood cell walls through a wood anatomical approach.

【Technical Solution】

To achieve the above objects, the present invention provides a method for improving the sound-absorbing performance of wood, comprising the steps of: processing normal wood into a wood disc; removing lignin from the wood disc; and drying the delignified wood disc under reduced pressure.

The kind of tree from which the wood used in the present invention is to be

obtained is not specifically limited. Wood mainly consists of cellulose, hemicellulose and lignin, in which the lignin to be removed according to the present invention is a polymer having a molecular weight of more than 50,000 and including a phenylpropane-type carbon framework deposited between the cellulose microfibrillar structures of wood. Lignin accounts for 20-30% of the dry weight of wood.

The delignification step can be performed using a known method, such as the chlorine-monoethanolamine method, comprising chlorinating the wood discs, which renders wood discs brighter, or the peracetic acid method. It is preferable in the present invention to use the sodium chlorite method for oxidizing, degrading and dissolving out the lignin.

In order to minimize cracking of wood, the delignified wood discs are dried under reduced pressure conditions (pressure: 70-90 cmHg; and temperature: 30-50 °C) to a water content of 10-15%, which results in fine cracks on the surface of the wood discs. Although the present invention is described with respect to the improvement of sound-absorbing performance only for the wood discs, the inventive idea of improving sound absorbance by increasing the wood pores can likewise be applied to plywood, particle board and fiber board. Hereinafter, the present invention will be described in detail with examples, but it is to be noted that these examples are for illustrative purpose only and are not construed to limit the scope of the present invention.

【Advantageous Effects】

According to the inventive method for improving the sound absorbance of wood, a sound reflective wood material having a sound absorbance of about 5% can be significantly improved with respect to sound-absorbing performance in a frequency of 2 KHz-4 KHz, in which the human hearing sense is generally most sensitive. Also, rock wool, glass fiber and the like, which have been used as sound-absorbing internal materials, can be substituted with inexpensive wood. Furthermore, the sound-absorbing wood material according to the present invention is eco-friendly, and so can be used without fear of health

hazard or damage to environment. In addition, the inventive material is recyclable so that it is superior to other materials in the efficiency of resource utilization, whereby it can contribute to the efficient utilization of resources and to an increase in the value of wood products.

【Description of Drawings】

FIG. 1 is a photograph showing the result of visual observation for a wood disc treated with the inventive method of improving sound-absorbing properties.

FIG. 2 is an electron micrograph showing a portion of the cross section of the wood disc shown in FIG. 1.

FIG. 3 shows the sound-absorbing properties of a wood disc treated with the inventive method and an untreated wood disc. In FIG. 3, specimen 1 is a result for the wood disc treated with the inventive method, and specimen 2 is a result for the untreated wood disc.

【Mode for Invention】

Example

Larch wood was processed in the transverse direction (to a 100-mm diameter for a middle and low frequency specimen and a 29.9-mm diameter for a high frequency range specimen, and a 30-mm thickness), to prepare wood discs. Each of the wood discs was degreased with a mixture of alcohol and benzene and kept in a water bath with 1.2l of water containing 8 g of sodium chlorite and 1.6 ml of glacial acetic acid at 80 °C for 120 hours. Each of the delignified wood discs was dried to a moisture content of 12% in a vacuum dryer at a pressure of 76 cmHg and a temperature of 40 °C. Then, the structural features of the cross-sectional surface of each of the wood discs was observed and at the same time, the sound absorbance thereof was measured in a frequency range of 50-6400 Hz. The sound absorbance was measured using a two-microphone tube and pulse analyzer.

FIG. 1 is a photograph showing the result of visual observation for a wood disc treated with the inventive method for improving sound-absorbing properties, and FIG. 2 is an electron micrograph showing a portion of the

cross section of the wood disc shown in FIG. 1.

As can be seen in FIG. 1, pluralities of fine cracks are distributed on the surface of the disc after treatment according to the present invention. This indicates that, on the surface having weak strength due to delignification, small splits were generated even under reduced-pressure drying conditions, which cause low drying stress. As can be seen from the electron micrograph of FIG. 1, intracellular substances between the wood cell walls were dissolved and removed. As a result of this microstructural change, the surface of the wood disc according to the present invention feels soft compared to untreated conventional wood discs. Also, because the portion between the wood cell walls, which has a high content of lignin, showing an elastic behavior in wood, was removed, the wood has an increased porosity leading to a reduced reflectivity to sound waves, thus showing improved sound-absorbing properties.

FIG. 3 shows the sound-absorbing properties of a wood disc treated with the inventive method and an untreated wood disc. As shown in FIG. 3, the wood disc according to the present invention showed improved sound-absorbing performance over the entire measured frequency range, compared to the untreated wood disc. In a high frequency range of more than 1 KHz, the difference in sound-absorbing performance between the two wood discs was increased more, and in a frequency range around 4 KHz, the inventive wood disc showed a 30% higher sound absorbance than that of the untreated wood disc. In addition, in frequency ranges around 2 KHz and 6 KHz, the inventive wood disc was almost twice as high in sound absorbance as the untreated disc.

【CLAIMS】**【Claim 1】**

A method for improving the sound-absorbing performance of wood, comprising the steps of:

processing normal wood into a wood disc;

removing lignin from the wood disc; and

drying the delignified wood disc under reduced pressure.

【Claim 2】

The method of Claim 1, wherein the step of removing lignin is performed using sodium chlorite.

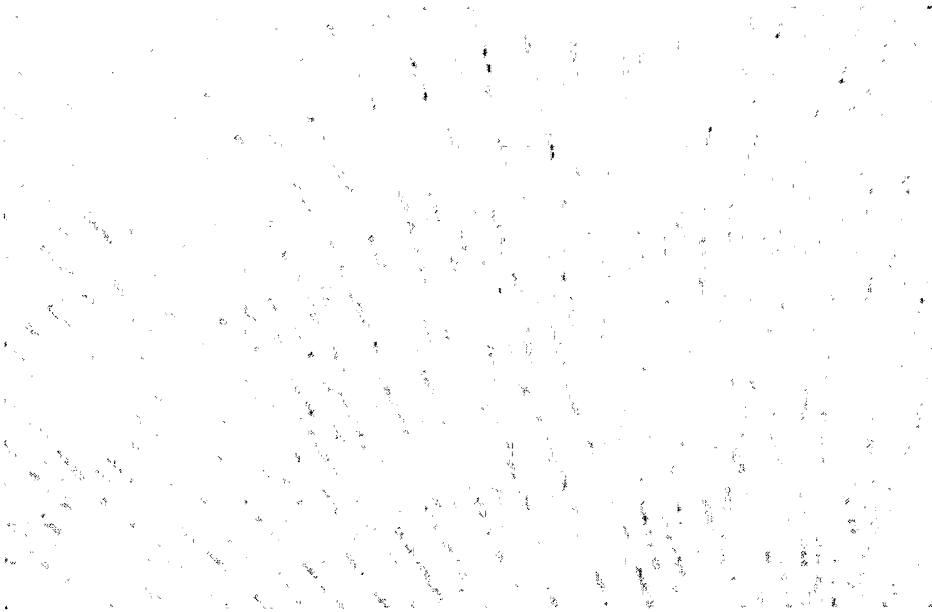
【Claim 3】

The method of Claim 1 or 2, which further comprises the step of degreasing the wood disc with a mixture of alcohol and benzene prior to delignification.

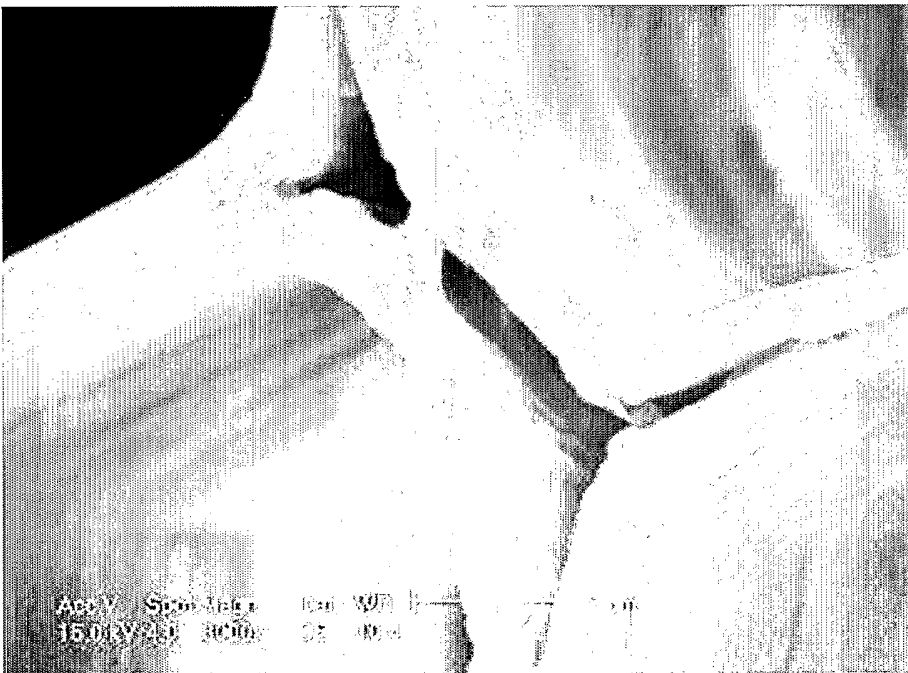
【Claim 4】

A sound-absorbing wood material prepared by the method of Claim 1.

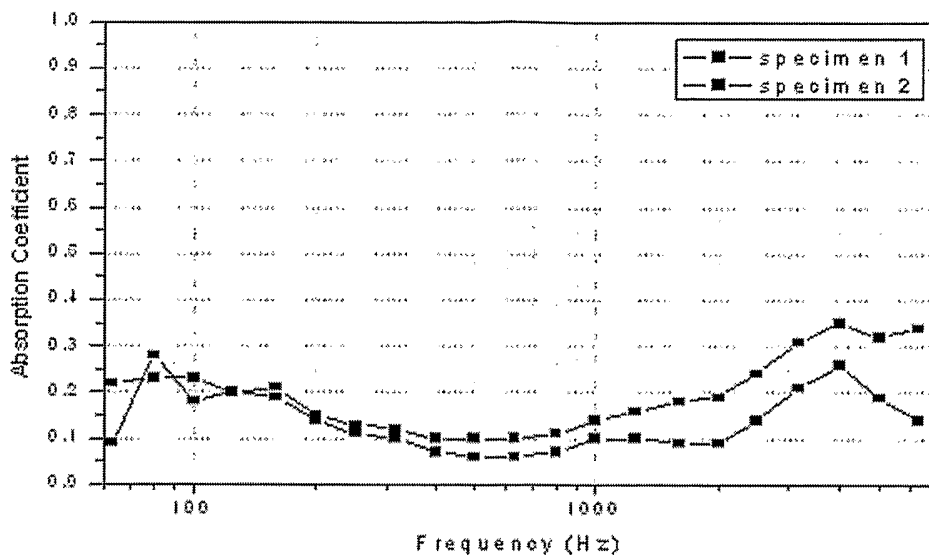
[Fig. 1]



[Fig. 2]



[Fig. 3]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003350**A. CLASSIFICATION OF SUBJECT MATTER*****E04B 1/86(2006.01)i***

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 E04B, E04F

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

KR, JP IPC as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6691358 B1 (ENGSTROM ET AL.) 17 February 2004 See the whole document	1-2
A	EP 0846812 A1 (LOCATELLI LAMINATI) 10 June 1998 See the whole document	4
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A	KR 10-2003-0060189 A (PARK CHUN-JONG) 16 July 2003 See the whole document	4

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

12 JANUARY 2006 (12.01.2006)

Date of mailing of the international search report

12 JANUARY 2006 (12.01.2006)

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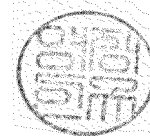
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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