

{DESCRIPTION}

{Title of Invention}

LABEL, TOP LAYER FORMATION MATERIAL FOR PRINTING MEDIUM,
5 INFORMATION-BEARING MEDIUM, WRISTBAND CLIP AND CARBON
DIOXIDE REDUCTION METHOD USING SAME

{Technical Field}

10 The present invention relates to a label, a top layer material formed on a printing
medium, an information-bearing medium, a solid fuel, a wristband clip, and carbon
dioxide reduction methods using them.

More specifically, the present invention relates to a label for use in various
applications in any fields, a top layer material formed on a printing medium for use in
various applications in any fields (for example, ink or ink ribbon, various coating
15 materials, and the like), an information-bearing medium for use in various applications in
any fields, a solid fuel manufactured using industry waste such as various used paper and
waste plastic materials as a raw material, a wristband clip for winding and clipping a
wristband to be used with being annularly wound around a wrist, an ankle or the like of a
patient and a visitor in the medical field and the playland field, and carbon dioxide
20 reduction methods using them.

{Background Art}

Various types of label materials and sticker materials have been conventionally
utilized in various applications in any fields, but these materials have no function of
25 suppressing the generation of carbon dioxide at the time of being incinerated.

However, the label materials and sticker materials are generally incinerated after
use as they are or together with objects of pasting depending on various forms of usage
including packaging boxes or packaging bags for commercial goods, and a problem is
that carbon dioxide is generated with burning of such materials.

30 Furthermore, a backing paper (release paper) temporarily attached to the rear
surfaces of labels is released upon the use of the labels and discarded, and there is

another problem that carbon dioxide is generated with an incineration disposal of such paper.

Various types of printing materials have been conventionally utilized in various applications in any fields.

Printing materials include top layer formation materials represented by inks and ink ribbons (thermal transfer ink ribbons and the like) to be printed on the printing medium, various coating materials and so forth, as well as printing mediums such as label materials or sticker materials and tag materials that are made of paper or synthetic resin

The top layer formation materials mean those that form a surface (top layer) with printing or coating on a printing medium, but the top layer formation materials have no function for suppressing the generation of carbon dioxide at the time of being incinerated.

However, the top layer formation materials are generally incinerated after use as they are or together with the printing medium. Furthermore, the top layer formation materials are generally incinerated together with packaging boxes and packaging bags for commercial goods to which the printing medium is pasted or attached and objects including various products to which the printing medium is pasted or attached depending on various forms of usage. Accordingly, a problem is that carbon dioxide is generated with burning of such materials.

Various types of information-bearing media have been conventionally utilized in various applications in any fields.

As information-bearing media, there are not only printing medium such as labels or stickers, tags, and tickets that are made of paper or synthetic resin, but there are also wristbands and various cards that are also made of paper or synthetic resin, and rewritable paper on which information can be rewritten a plurality of times are examples.

The information-bearing media mean those that indicate various information printed on a front surface or a rear surface or recorded on a magnetic layer or other functional layer, and that are attached to an object of pasting or object of attachment depending on the respective forms of usage, but the information-bearing media have no function of suppressing the generation of carbon dioxide at the time of being incinerated.

For example, while the labels, stickers and tags are used with price information and management information being indicated on objects of pasting or objects of attaching including food items, cloth items or the like, the labels, stickers and tags are incinerated and disposed of as domestic refuse after use. The tickets are also finally
 5 incinerated and disposed of after being used as admission tickets or the like.

While the wristbands are particularly used for identifying a patient or a visitor in a hospital, a playland or the like, the wristbands are also incinerated and disposed of as waste after use.

The cards mean those that indicate or bear necessary information by various
 10 systems such as a leuco system, a white opaque system, a thermal system or a magnetic system, or a system in which an IC chip is used, and the cards are also incinerated and disposed of as waste after use.

Similarly to the cards, the rewritable paper also means one that utilizes, for example, a method in which predetermined information can be rewritten by utilizing
 15 difference in heat-sensitive temperature, or other method, and the rewritable paper is finally incinerated and disposed of.

In short, the information-bearing media are generally incinerated after use as they are or together with the objects of pasting or the objects of attaching, and a problem is that carbon dioxide is generated with burning of such media.

Conventionally, used paper such as cardboard boxes and paper scraps, various
 20 waste plastic materials, and other flammables have been collected as industry waste by a recycle system and used as raw materials to manufacture solid fuels (R. P. F: Refuse Paper & Plastic Fuel), and the solid fuels have been utilized as a part of boiler fuels in paper-manufacturing companies, cement companies, chemical companies, and any other
 25 fields. Herein, as the industry waste, various labels and tags which are made of a paper material or a plastic material and used for printing variable information thereon, various stickers on which constant information is printed in advance, and other information-indicating media and information-bearing media are also collected from the viewpoint of holding confidential information.

30 However, the solid fuels naturally generate carbon dioxide when they are burned, and a problem is that the solid fuels have no function of suppressing the generation of carbon dioxide at the time of being burned.

Conventionally, the wristbands, on which identification data specific to an individual, such as department, name, age, and blood type of a patient, is printed and indicated, have been annularly and loosely wound to any extremity of a patient, such as a wrist, thereby ensuring the identification of a patient in a hospital or the like.

5 In general, the wristbands have a band shape and are used with being wound around a wrist or the like and being fastened by wristband clips on both ends thereof. The wristband clips are configured from a male clip portion and a female clip portion that are connected by a hinge, and a band hole insertion pin (boss) formed on the male clip portion is inserted into a band hole of the wristband and thereafter fitted into a pin
10 hole (boss hole) formed on the female clip portion to thereby allow the wristbands to be annularly wound and clipped. The wristbands fastened by the clips are not easily unfixed and can be worn for several weeks.

 However, the wristbands and the clips for fixing the wristbands are incinerated and disposed of as waste after the period of use. In other words, a problem is that
15 carbon dioxide is generated by burning with such incineration.

 Accordingly, for preventing global warming that is increasingly discussed worldwide, there is an urgent need for reduction in the generation of carbon dioxide, and a solution thereto is being sought.

20 {Citation List}
 {Patent Literature}
 {PTL 1}: None

 {Summary of Invention}

25 {Technical Problem}

 The present invention has been made in view of the above problems, and an object thereof is to provide a label having the function of absorbing carbon dioxide, and a carbon dioxide reduction method using the label.

 In addition, an object of the present invention is to provide a label that is capable
30 of absorbing carbon dioxide at the time of being incinerated, and a carbon dioxide reduction method using the label.

In addition, an object of the present invention is to provide a label that is capable of absorbing carbon dioxide by an incineration disposal together with an object of pasting, and a carbon dioxide reduction method using the label.

5 The present invention has been made in view of the above problems, and an object thereof is to provide a top layer material formed on a printing medium having the function of absorbing carbon dioxide, and a carbon dioxide reduction method using the top layer material formed on a printing medium.

10 In addition, an object of the present invention is to provide a top layer material formed on a printing medium that is capable of absorbing carbon dioxide at the time of being incinerated, and a carbon dioxide reduction method using the top layer material formed on a printing medium.

15 In addition, an object of the present invention is to provide a top layer material formed on a printing medium that is capable of absorbing carbon dioxide by incinerating the top layer material formed on a printing medium together with printing medium and an object of pasting or an object of attaching to the printing medium, and a carbon dioxide reduction method using the top layer material formed on a printing medium.

20 The present invention has been made in view of the above problems, and an object thereof is to provide an information-bearing medium having the function of absorbing carbon dioxide, and a carbon dioxide reduction method using the information-bearing medium.

In addition, an object of the present invention is to provide an information-bearing medium that is capable of absorbing carbon dioxide at the time of being incinerated, and a carbon dioxide reduction method using the information-bearing medium.

25 In addition, an object of the present invention is to provide an information-bearing medium that is capable of absorbing carbon dioxide by incinerating the information-bearing medium together with an object of pasting or an object of attaching thereto, and a carbon dioxide reduction method using the information-bearing medium.

30 The present invention has been made in view of the above problems, and an object thereof is to provide a solid fuel having the function of absorbing carbon dioxide, and a carbon dioxide reduction method using the solid fuel.

In addition, an object of the present invention is to provide a solid fuel that is capable of absorbing carbon dioxide at the time of being burned, and a carbon dioxide reduction method using the solid fuel.

5 In addition, an object of the present invention is to provide a solid fuel that is capable of absorbing carbon dioxide by being burned together with other fuel, and a carbon dioxide reduction method using the solid fuel.

The present invention has been made in view of the above problems, and an object thereof is to provide a wristband clip having the function of absorbing carbon dioxide, and a carbon dioxide reduction method using the wristband clip.

10 In addition, an object of the present invention is to provide a wristband clip that is capable of absorbing carbon dioxide at the time of being incinerated, and a carbon dioxide reduction method using the wristband clip.

In addition, an object of the present invention is to provide a wristband clip that is capable of absorbing carbon dioxide by incinerating the wristband clip together with
15 an object of attaching such as a wristband, and a carbon dioxide reduction method using the wristband clip.

{Solution to Problem}

That is, the present invention has been made focusing on, in a manufacturing
20 step of a label or a sticker, addition of a carbon dioxide absorbent to the material thereof or lamination of the carbon dioxide absorbent on the material.

According to a first aspect of the present invention, there is provided an information-bearing medium comprising a medium body and capable of bearing information on the medium body, wherein the medium body has a structure including at
25 least two layers, and a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the information-bearing medium, is added to any one of the layers.

According to a second aspect of the present invention, there is provided an information-bearing medium comprising a medium body and capable of bearing information on the medium body, wherein the medium body has a structure including at
30 least two layers, and a layer of a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the information-bearing medium, is laminated on any one of the layers.

According to a third aspect of the present invention, there is provided a carbon dioxide reduction method using an information-bearing medium, the method comprising: preparing an information-bearing medium having a medium body with a structure including at least two layers, wherein a carbon dioxide absorbent is added to any one of the layers of the medium body capable of bearing information; and incinerating the information-bearing medium to allow the carbon dioxide absorbent to absorb carbon dioxide.

According to a fourth aspect of the present invention, there is provided a carbon dioxide reduction method using an information-bearing medium, the method comprising: preparing an information-bearing medium having a medium body with a structure including at least two layers, wherein a layer of a carbon dioxide absorbent is laminated on any one of the layers of the medium body capable of bearing information; and incinerating the information-bearing medium to allow the carbon dioxide absorbent to absorb carbon dioxide.

According to a fifth aspect of the present invention, there is provided a label comprising: a label substrate; and an adhesive layer applied to a rear surface of the label substrate, wherein a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the label, is added to at least any one of the label substrate and the adhesive layer.

According to a sixth aspect of the present invention, there is provided a label comprising: a label substrate; and an adhesive layer applied to a rear surface of the label substrate, wherein a layer of a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the label, is laminated on at least any one of the label substrate and the adhesive layer.

According to a seventh aspect of the present invention, there is provided a label comprising: a label substrate formed of a paper material; and an adhesive layer applied to a rear surface of the label substrate, wherein a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the label, is added to the adhesive layer.

According to an eighth aspect of the present invention, there is provided a label comprising: a label substrate; an adhesive layer applied to a rear surface of the label substrate; and a backing paper temporarily attached to the adhesive layer, wherein a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the label, is added to any one of the label substrate, the adhesive layer and the backing paper.

According to a ninth aspect of the present invention, there is provided a carbon dioxide reduction method using a label, the method comprising: preparing a label comprising a label substrate and an adhesive layer applied to a rear surface of the label substrate, in which a carbon dioxide absorbent is added to any one of the label substrate and the adhesive layer; and incinerating the label to allow the carbon dioxide absorbent to absorb carbon dioxide.

According to a tenth aspect of the present invention, there is provided a carbon dioxide reduction method using a label, the method comprising: preparing a label having a label substrate and an adhesive layer applied to a rear surface of the label substrate, in which a carbon dioxide absorbent layer is laminated on any one of the label substrate and the adhesive layer; and incinerating the label to allow a carbon dioxide absorbent of the carbon dioxide absorbent layer to absorb carbon dioxide.

According to an eleventh aspect of the present invention, there is provided a thermal transfer ink ribbon used for printing on a printing sheet, wherein a carbon dioxide absorbent is added to any one of layers of the thermal transfer ink ribbon, wherein the thermal transfer ink ribbon does not include, in an ink receiving layer thereof, zeolite into whose structure an antibacterial ion is taken.

According to a twelfth aspect of the present invention, there is provided a thermal transfer ink ribbon used for printing on a printing sheet, wherein a layer of a carbon dioxide absorbent is laminated on any one of layers of the thermal transfer ink ribbon, wherein the thermal transfer ink ribbon does not include, in an ink receiving layer thereof, zeolite into whose structure an antibacterial ion is taken.

According to a thirteenth aspect of the present invention, there is provided a carbon dioxide reduction method using a thermal transfer ink ribbon, the method comprising: preparing a thermal transfer ink ribbon used for printing on a printing sheet, the thermal transfer ink ribbon including a carbon dioxide absorbent in any one of layers of the thermal transfer ink ribbon; and incinerating the thermal transfer ink ribbon to allow the carbon dioxide absorbent to absorb carbon dioxide.

According to a fourteenth aspect of the present invention, there is provided a carbon dioxide reduction method using a thermal transfer ink ribbon, the method comprising: preparing a thermal transfer ink ribbon used for printing on a printing sheet, wherein a layer of a carbon dioxide absorbent is laminated on any one of layers of the thermal transfer ink ribbon; and incinerating the thermal transfer ink ribbon to allow the carbon dioxide absorbent to absorb carbon dioxide.

In the present application, a first invention provides a label having a label substrate and an adhesive layer applied to the rear surface of the label substrate, wherein a carbon dioxide absorbent is added to at least any one of the label substrate and the adhesive layer.

A second invention provides a label having a label substrate and an adhesive layer applied to the rear surface of the label substrate, wherein a carbon dioxide absorbent layer is laminated on at least any one of the label substrate and the adhesive layer.

A third invention provides a label having a label substrate, an adhesive layer applied to the rear surface of the label substrate, and a backing paper temporarily attached to the adhesive layer, wherein a carbon dioxide absorbent is added to at least any one of the label substrate, the adhesive layer and the backing paper.

A fourth invention provides a carbon dioxide reduction method using a label, the method comprising: preparing a label having a label substrate and an adhesive layer applied to the rear surface of the label substrate, in which a carbon dioxide absorbent is added to at least any one of the label substrate and the adhesive layer; and incinerating
5 the label to allow the carbon dioxide absorbent to absorb carbon dioxide.

A fifth invention provides a carbon dioxide reduction method using a label, the method comprising: preparing a label having a label substrate and an adhesive layer applied to the rear surface of the label substrate, in which a carbon dioxide absorbent layer is laminated on at least any one of the label substrate and the adhesive layer; and
10 incinerating the label to allow a carbon dioxide absorbent of the carbon dioxide absorbent layer to absorb carbon dioxide.

A sixth invention provides a carbon dioxide reduction method using a label, the method comprising: preparing a label having a label substrate, an adhesive layer applied to the rear surface of the label substrate, and a backing paper temporarily attached to the
15 adhesive layer, in which a carbon dioxide absorbent is added to at least any one of the label substrate, the adhesive layer and the backing paper; and incinerating at least any one of the label substrate, the adhesive layer and the backing paper to allow the carbon dioxide absorbent to absorb carbon dioxide.

The carbon dioxide absorbent can be particulate.

20 The carbon dioxide absorbent can be particulate to nanometer in size.

The carbon dioxide absorbent can be uniformly dispersed.

The present invention has been made focusing on, in a manufacturing step of a top layer formation material, adding to or laminating on the top layer formation material a carbon dioxide absorbent, and a seventh invention provides a top layer material formed
25 on a printing medium which is represented by an ink or an ink ribbon, or various coating materials for performing printing on a printing medium, and to which a carbon dioxide absorbent is added.

An eighth invention provides a top layer material formed on a printing medium which is represented by an ink or an ink ribbon, or various coating materials for
30 performing printing on a printing medium, and on which a carbon dioxide absorbent layer is laminated.

A ninth invention provides a carbon dioxide reduction method using a top layer material formed on a printing medium, the method comprising: preparing a top layer material which is represented by an ink or an ink ribbon, or various coating materials for performing printing on a printing medium, and to which a carbon dioxide absorbent is added; and incinerating the top layer material to allow the carbon dioxide absorbent to absorb carbon dioxide.

A tenth invention provides a carbon dioxide reduction method using a top layer material formed on a printing medium, the method comprising: preparing a top layer material which is represented by an ink or an ink ribbon, or various coating materials for performing printing on a printing medium, and on which a carbon dioxide absorbent layer is laminated; and incinerating the top layer material to allow a carbon dioxide absorbent of the carbon dioxide absorbent layer to absorb carbon dioxide.

The carbon dioxide absorbent can be particulate.

The carbon dioxide absorbent can be particulate to nanometer in size.

The carbon dioxide absorbent can be uniformly dispersed.

The top layer material can be a thermal transfer ink ribbon, and the carbon dioxide absorbent can be added to any layer of the thermal transfer ink ribbon.

The top layer material can be a thermal transfer ink ribbon, and the carbon dioxide absorbent layer can be laminated on any layer of the thermal transfer ink ribbon.

The present invention has been made focusing on adding to or laminating on a medium body formed from each of various configurations a carbon dioxide absorbent, and an eleventh invention provides an information-bearing medium having a medium body and capable of bearing information on the medium body, wherein a carbon dioxide absorbent is added to the medium body.

A twelfth invention provides an information-bearing medium having a medium body and capable of bearing information on the medium body, wherein a carbon dioxide absorbent layer is laminated on the medium body.

A thirteenth invention provides a carbon dioxide reduction method using an information-bearing medium, the method comprising: preparing an information-bearing medium in which a carbon dioxide absorbent is added to a medium body capable of bearing information; and incinerating the information-bearing medium to allow the carbon dioxide absorbent to absorb carbon dioxide.

A fourteenth invention provides a carbon dioxide reduction method using an information-bearing medium, the method comprising: preparing an information-bearing medium in which a carbon dioxide absorbent layer is laminated on a medium body capable of bearing information; and incinerating the information-bearing medium to
5 allow a carbon dioxide absorbent of the carbon dioxide absorbent layer to absorb carbon dioxide.

The carbon dioxide absorbent can be particulate.

The carbon dioxide absorbent can be particulate to nanometer in size.

The carbon dioxide absorbent can be uniformly dispersed.

10 The medium body can have an at least two-layer structure, and the carbon dioxide absorbent can be added to at least any layer.

The medium body can have an at least two-layer structure, and the carbon dioxide absorbent layer can be laminated on at least any one of the layers.

The medium body can be a thermal paper.

15 The carbon dioxide absorbent can be added to a heat-sensitive color-forming layer of the thermal paper.

The carbon dioxide absorbent can be added to any of a dye, a developer or a stabilizer constituting the heat-sensitive color-forming layer.

The present invention has made focusing on adding a carbon dioxide absorbent
20 to used paper, various waste plastic materials, labels or stickers, cardboard boxes, or other industry waste to manufacture a solid fuel, and a fifteenth invention provides a solid fuel manufactured using industry waste as a raw material, wherein a carbon dioxide absorbent is added to the industry waste.

A sixteenth invention provides a carbon dioxide reduction method using a solid
25 fuel, the method comprising: preparing a solid fuel manufactured using industry waste as a raw material, to which a carbon dioxide absorbent is added; and burning the solid fuel to allow the carbon dioxide absorbent to absorb carbon dioxide.

The carbon dioxide absorbent can be added in a step of molding a chip obtained by sorting and grinding the industry waste.

30 The carbon dioxide absorbent can be particulate.

The carbon dioxide absorbent can be particulate to nanometer in size.

The carbon dioxide absorbent can be uniformly dispersed.

The industry waste can include a label having an adhesive layer.

The present invention has been made focusing on adding a carbon dioxide absorbent to a clip for fastening a wristband wound around a wrist, an ankle, or the like, and a seventeenth invention provides a wristband clip for fastening a wristband annularly wound, in which a plurality of band holes and setting holes are formed on both ends in the longitudinal direction at regular intervals, wherein a carbon dioxide absorbent is contained in the wristband clip.

An eighteenth invention provides a carbon dioxide reduction method using a wristband clip, the method comprising: preparing a wristband clip to which the carbon dioxide absorbent is added; and incinerating the wristband clip to allow the carbon dioxide absorbent to absorb carbon dioxide.

The wristband clip can include: a male clip on which a pair of bosses are formed corresponding to the intervals of the band holes of the wristband; and a female clip on which a pair of boss holes through which the pair of bosses are inserted are formed, wherein the bosses can be fitted into the boss holes via the band holes in the state where both ends of the wristband are overlaid each other, thereby fastening the wristband annularly wound, and the bosses and the boss holes can have a shape capable of joining the male clip and the female clip.

The boss can include: a shaft portion provided on the male clip in a protruding manner; a first radially-enlarged portion which is formed so as to radially protrude from the center shaft of the shaft portion; a second radially-enlarged portion which is formed on a tip of the boss and which has a smaller diameter than the first radially-enlarged portion; and a constricted portion which is formed between the first radially-enlarged portion and the second radially-enlarged portion, and has a smaller diameter than the first radially-enlarged portion and the second radially-enlarged portion.

The wristband clip can be formed from polyethylene.

The carbon dioxide absorbent can be particulate.

The carbon dioxide absorbent can be particulate to nanometer in size.

The carbon dioxide absorbent can be uniformly dispersed.

The carbon dioxide absorbent is preferably sodium aluminosilicate.

The sodium aluminosilicate is preferably encapsulated in a phospholipid.

The sodium aluminosilicate is preferably contained in a ribosome.

{Advantageous Effects of Invention}

In the label and the carbon dioxide reduction method using the label of the present invention, the carbon dioxide absorbent is added to or laminated on the material of the label or sticker, such as the label substrate, the adhesive layer or the backing paper, in the manufacturing step of the label or sticker. Therefore, the carbon dioxide absorbent can absorb carbon dioxide spreading and diffusing along with flowing of an air current not only at the time of incinerating the label alone but also at the time of incinerating the label together with various objects of pasting, thereby enabling to contribute to reduction in carbon dioxide.

In particular, according to the label of the first invention, since the carbon dioxide absorbent is added to at least any one of the label substrate and the adhesive layer, the carbon dioxide absorbent can absorb carbon dioxide at the time of the incineration disposal of the label.

In particular, according to the label of the second invention, since the carbon dioxide absorbent layer is laminated on at least any one of the label substrate and the adhesive layer, the carbon dioxide absorbent of the carbon dioxide absorbent layer can absorb carbon dioxide at the time of the incineration disposal of the label.

In particular, according to the label of the third invention, since the carbon dioxide absorbent is added to at least any one of the label substrate, the adhesive layer and the backing paper, the carbon dioxide absorbent can absorb carbon dioxide not only at the time of an incineration disposal together with to the label substrate and the object of pasting to the adhesive layer but also at the time of the incineration disposal of the backing paper alone.

In particular, according to the carbon dioxide reduction method using a label of the fourth invention, since the incineration disposal of the label of the first invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In particular, according to the carbon dioxide reduction method using a label of the fifth invention, since the incineration disposal of the label of the second invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In particular, according to the carbon dioxide reduction method using a label of the sixth invention, since the incineration disposal of the label of the third invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

5 In the top layer material formed on a printing medium and the carbon dioxide reduction method using this of the present invention, since the carbon dioxide absorbent is added to or laminated on in the manufacturing step of the top layer material, the carbon dioxide absorbent can absorb carbon dioxide spreading and diffusing along with flowing of an air current not only at the time of incinerating the top layer material alone
10 but also at the time of incinerating the top layer material together with the printing medium and the object of pasting or object of attaching used therewith, thereby enabling to contribute to reduction in carbon dioxide.

In particular, according to the top layer material formed on a printing medium of the seventh invention, since the carbon dioxide absorbent is added to the top layer
15 material itself, the carbon dioxide absorbent can absorb carbon dioxide at the time of the incineration disposal of the top layer material formed on a printing medium.

In particular, according to the top layer material formed on a printing medium of the eighth invention, since the carbon dioxide absorbent layer is laminated on the top layer material, the carbon dioxide absorbent of the carbon dioxide absorbent layer can
20 absorb carbon dioxide at the time of the incineration disposal of the top layer material formed on a printing medium.

In particular, according to the carbon dioxide reduction method using a top layer material formed on a printing medium of the ninth invention, since the incineration disposal of the top layer material formed on a printing medium of the first invention
25 allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In particular, according to the carbon dioxide reduction method using a top layer material formed on a printing medium of the tenth invention, since the incineration disposal of the top layer material formed on a printing medium of the second invention
30 allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In the information-bearing medium and the carbon dioxide reduction method using this of the present invention, since the carbon dioxide absorbent is added to or laminated on the medium body of the information-bearing medium, the carbon dioxide absorbent can absorb carbon dioxide spreading and diffusing along with flowing of an air current not only at the time of incinerating the information-bearing medium alone but also at the time of incinerating the information-bearing medium together with various objects of pasting or objects of attaching used therewith, thereby enabling to contribute to reduction in carbon dioxide.

In particular, according to the information-bearing medium of the eleventh invention, since the carbon dioxide absorbent is added to the medium body, the carbon dioxide absorbent can absorb carbon dioxide at the time of the incineration disposal of the information-bearing medium.

In particular, according to the information-bearing medium of the twelfth invention, since the carbon dioxide absorbent layer is laminated on the medium body, the carbon dioxide absorbent of the carbon dioxide absorbent layer can absorb carbon dioxide at the time of the incineration disposal of the information-bearing medium.

In particular, according to the carbon dioxide reduction method using an information-bearing medium of the thirteenth invention, since the incineration disposal of the information-bearing medium of the first invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In particular, according to the carbon dioxide reduction method using an information-bearing medium of the fourteenth invention, since the incineration disposal of the information-bearing medium of the second invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the label as usually performed.

In the solid fuel and the carbon dioxide reduction method using this of the present invention, the carbon dioxide absorbent is added to industry waste to manufacture the solid fuel, the carbon dioxide absorbent can absorb carbon dioxide spreading and diffusing along with flowing of an air current at the time of burning the solid fuel, thereby enabling to contribute to reduction in carbon dioxide.

In particular, according to the solid fuel of the fifteenth invention, since the carbon dioxide absorbent is added to the solid fuel itself, heat energy can be ensured and the carbon dioxide absorbent can absorb carbon dioxide at the time of burning the solid fuel.

5 In particular, according to the carbon dioxide reduction method using a solid fuel of the sixteenth invention, since the solid fuel of the first invention is burned to allow the carbon dioxide absorbent to absorb carbon dioxide, heat energy can be ensured using the solid fuel as usually performed and carbon dioxide can be reduced.

10 In the wristband clip and the carbon dioxide reduction method using this of the present invention, since the carbon dioxide absorbent is added to the wristband clip, the carbon dioxide absorbent can absorb carbon dioxide spreading and diffusing along with flowing of an air current not only at the time of incinerating the wristband clip alone but also at the time of incinerating the wristband clip together with the object of attaching used therewith such as the wristband, thereby enabling to contribute to reduction in
15 carbon dioxide.

In particular, according to the wristband clip of the seventeenth invention, since the carbon dioxide absorbent is contained in the wristband clip itself, the carbon dioxide absorbent can absorb carbon dioxide at the time of the incineration disposal of the wristband clip.

20 In particular, according to the carbon dioxide reduction method using a wristband clip of the eighteenth invention, since the incineration disposal of the wristband clip of the first invention allows the carbon dioxide absorbent to absorb carbon dioxide, carbon dioxide can be reduced at the time of incinerating and discarding of the clip as usually performed.

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{Brief Description of Drawings}

{Figure 1} Figure 1 is a plan view illustrating an example in which a label according to a first embodiment of the present invention is configured as a continuous label.

{Figure 2} Figure 2 is an enlarged cross-sectional view taken along line II-II of Figure 1.

30 {Figure 3} Figure 3 is an explanatory view illustrating a case in which a label strip is used as, for example, a refuse label, wherein Portion (1) in Figure 3 is an explanatory view illustrating a state where refuse is put in a refuse bag and a label strip is pasted to

the refuse bag, and Portion (2) in Figure 3 is an explanatory view illustrating a state where the refuse along with the refuse bag is incinerated in an incinerator.

{Figure 4} Figure 4 is an enlarged cross-sectional view of a main part of a label according to a second embodiment of the present invention.

5 {Figure 5} Figure 5 is an enlarged cross-sectional view of a main part of a label according to a third embodiment of the present invention.

{Figure 6} Figure 6 is an enlarged cross-sectional view of a main part of a label according to a fourth embodiment of the present invention.

10 {Figure 7} Figure 7 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by a carbon dioxide absorbent (Nano vesicle carbon dioxide reduction additive produced by Acteieve R&D).

{Figure 8} Figure 8 is a perspective view of an ink ribbon (thermal transfer ink ribbon) configured as a top layer material formed on a printing medium according to a fifth
15 embodiment of the present invention.

{Figure 9} Figure 9 is a schematic side view of a manufacturing apparatus of the thermal transfer ink ribbon.

{Figure 10} Figure 10 is a schematic side view of a thermal printer in which the thermal transfer ink ribbon is loaded for printing.

20 {Figure 11} Figure 11 is an explanatory view illustrating a state where the used thermal transfer ink ribbon is incinerated in an incinerator.

{Figure 12} Figure 12 is a plan view of an advertising label in which various printing inks are employed as a top layer formation material according to a sixth embodiment of the present invention.

25 {Figure 13} Figure 13 is a cross-sectional view taken along line XIII-XIII of Figure 12.

{Figure 14} Figure 14 is a schematic side view of a manufacturing apparatus of the advertising label.

{Figure 15} Figure 15 is a plan view of an identifying label in which a film for surface coating is employed as a top layer formation material according to a seventh embodiment
30 of the present invention.

{Figure 16} Figure 16 is a cross-sectional view taken along line XVI-XVI of Figure 15.

{Figure 17} Figure 17 is a plan view of a tag as an information-bearing medium according to an eighth embodiment of the present invention.

{Figure 18} Figure 18 is a schematic side view of a printer (thermal printer) in which a tag is loaded for printing.

5 {Figure 19} Figure 19 is an explanatory view illustrating a state where a used tag (tag strip) is incinerated in an incinerator.

{Figure 20} Figure 20 is a plan view of a wristband as an information-bearing medium according to a ninth embodiment of the present invention.

10 {Figure 21} Figure 21 is an enlarged cross-sectional view taken along line XXI-XXI of Figure 20.

{Figure 22} Figure 22 is a plan view of a wristband as an information-bearing medium according to a tenth embodiment of the present invention.

{Figure 23} Figure 23 is a cross-sectional side view of the wristband.

15 {Figure 24} Figure 24 is an explanatory view of a point card as an information-bearing medium according to an eleventh embodiment of the present invention, wherein Portion (1) in Figure 24 is a front surface view of the explanatory view and Portion (2) in Figure 24 is a rear surface view of the explanatory view.

{Figure 25} Figure 25 is an enlarged cross-sectional view taken along line XXV-XXV of Figure 24.

20 {Figure 26} Figure 26 is a perspective view of a solid fuel according to a twelfth embodiment of the present invention.

{Figure 27} Figure 27 is a schematic explanatory view of a manufacturing step of the solid fuel.

25 {Figure 28} Figure 28 is an explanatory view illustrating a state where the solid fuel is burned in a boiler of a plant.

{Figure 29} Figure 29 is a plan view illustrating a configuration of a wristband clip according to a thirteenth embodiment of the present invention.

{Figure 30} Figure 30 is a side view illustrating the configuration of the wristband clip according to the thirteenth embodiment of the present invention.

30 {Figure 31} Figure 31 is a perspective view illustrating a configuration of a wristband to which the wristband clip according to the thirteenth embodiment of the present invention is adapted.

{Figure 32} Figure 32 is a side view illustrating a state where a boss of a male clip portion of the wristband clip according to the thirteenth embodiment of the present invention is fitted into a boss hole of a female clip portion to fix a wristband.

{Figure 33} Figure 33 is an explanatory view illustrating a state where the wristband clip according to the thirteenth embodiment of the present invention after use is incinerated in an incinerator.

{Figure 34} Figure 34 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by a carbon dioxide absorbent (Nano vesicle carbon dioxide reduction additive produced by Acteiiive R&D).

{Figure 35} Figure 35 shows evaluation results in Production Examples of a carbon dioxide absorbent according to the present invention.

{Figure 36} Figure 36 shows evaluation results of conventional resin compositions.

{Figure 37} Figure 37 is a comparison chart of carbon dioxide emission amounts in Production Examples with those in Comparative Production Examples on types of carbon dioxide-absorbing substances.

{Figure 38} Figure 38 gives a comparison of carbon dioxide emission amounts in Production Examples with those in Comparative Production Examples on types of dispersion aids.

{Figure 39} Figure 39 gives a comparison of carbon dioxide emission amounts in Production Examples with those in Comparative Production Examples on types of resins.

{Figure 40} Figure 40 gives a comparison of carbon dioxide emission amounts on dispersion treatment methods.

{Figure 41} Figure 41 shows a transmission electron microscope photograph indicating dispersibility of a carbon dioxide-absorbing substance in a dispersion aid in the case where no dispersion treatment is performed.

{Figure 42} Figure 42 shows transmission electron microscope photographs indicating dispersibility of a carbon dioxide-absorbing substance in a dispersion aid in the case where a supercritical fluid treatment is performed.

{Figure 43} Figure 43 shows transmission electron microscope photographs indicating dispersibility of a carbon dioxide-absorbing substance in a dispersion aid in the case where an ultrasonic treatment is performed.

{Figure 44} Figure 44 shows transmission electron microscope photographs indicating dispersibility of a carbon dioxide-absorbing substance in a dispersion aid in the case where a stirring treatment is performed.

{Figure 45} Figure 45 shows a relationship between the exposure time and the average particle size of the carbon dioxide-absorbing substance in the supercritical fluid treatment.

{Figure 46} Figure 46 shows a relationship between the irradiation time and the average particle size of the carbon dioxide-absorbing substance in the ultrasonic irradiation treatment.

{Figure 47} Figure 47 shows a relationship between the stirring time and the average particle size of the carbon dioxide-absorbing substance in the stirring treatment.

{Figure 48} Figure 48 shows a relationship between the amount of the dispersion aid blended and the average particle size of the carbon dioxide-absorbing substance.

{Figure 49} Figure 49 shows a relationship between the amount of a carbon dioxide-absorbing substance dispersion liquid blended as well as the carbon dioxide emission amount and impact strength.

{Description of Embodiments}

(First Embodiment to Fourth Embodiment)

According to the present invention, since a carbon dioxide absorbent is added to or laminated on a material such as a label substrate, an adhesive layer or a backing paper, there have been realized a label in which the carbon dioxide absorbent can absorb carbon dioxide not only at the time of incinerating the label alone but also at the time of incinerating the label together with various objects of pasting used therewith to thereby contribute to reduction in carbon dioxide, and a carbon dioxide reduction method using this.

Then, a label 101 according to a first embodiment of the present invention and a carbon dioxide reduction method using this are described based on Figure 1 to Figure 3.

Figure 1 is a plan view of a label configured as a continuous label, and Figure 2 is an enlarged cross-sectional view taken along line II-II of Figure 1.

The label 101 has a band-shaped backing paper 102, and a plurality of label strips 103 temporarily attached to the backing paper 102.

The backing paper 102 can be, for example, glassine paper. The backing paper 120 has a release agent layer on its surface and can temporarily attach each of the label strips 103 on the surface.

5 The label strip 103 has a label substrate 104 and an adhesive layer 105 applied to a rear surface of the label substrate 104.

The adhesive layer 105 is any type of adhesive layer, such as emulsion-type, solvent-type, or hot melt-type, to which a carbon dioxide absorbent 106 is added in a manufacturing step of the label 101.

10 It is desirable that the carbon dioxide absorbent 106 be constituted from, for example, an inorganic carbon dioxide absorbent, be particulate to the nanometer (nm = 10^{-9} m) level, and be uniformly dispersed throughout the adhesive layer 105. For example, the particle size thereof can be, at least, less than 1 μm , more preferably about 10 to 100 nm.

15 As the carbon dioxide absorbent 106 particulate to nanometer in size, for example, a Nano vesicle carbon dioxide reduction additive produced by Acteive R&D can be used.

20 The label 101 of such a configuration exerts a predetermined representational function, a security function, or the like, by releasing the label strip 103 after printing, if needed, from the backing paper 102 and pasting the label trip 103 to any object of pasting.

25 Figure 3 is an explanatory view illustrating a case in which a label strip is used as, for example, a refuse label. Portion (1) in Figure 3 is an explanatory view illustrating a state where refuse is put in a refuse bag and a label strip is pasted to the refuse bag, and Portion (2) in Figure 3 is an explanatory view illustrating a state where the refuse along with the refuse bag is incinerated in an incinerator.

30 As illustrated in Portion (2) in Figure 3, while the label strip 103 is incinerated together with a refuse bag 107 and refuse 108 in an incineration disposal by an incinerating burner 110 in an incinerator 109, carbon dioxide (CO_2 gas) is generated due to burning by heating and is adsorbed to a carbon dioxide absorbent 106, and carbon dioxide generated from each of the refuse bag 107, the refuse 108 and the label strip 103 is absorbed by the portion of the carbon dioxide absorbent 106.

In particular, since the carbon dioxide absorbent 106 is particulate to nanometer in size (for example, about 10 to 100 nm) and also uniformly dispersed, it can effectively absorb carbon dioxide.

Also in the case where the label strip 103 is not used for the refuse bag 107, but
5 pasted to a packaging box, a packaging bag (both being not illustrated) or the like for commercial goods as a price tag or a indicate tag for generally commercial goods, and incinerated and disposed of, the function of effectively absorbing carbon dioxide by the carbon dioxide absorbent 106 can be expected as in the above case.

In the present invention, the carbon dioxide absorbent 106 can be added to or
10 laminated on any layer. That is, the carbon dioxide absorbent 106 may be added to at least any one of the label substrate 104, the adhesive layer 105 and the backing paper 102, or laminated on at least any one of these layers.

For example, Figure 4 is an enlarged cross-sectional view of a main part of a label according to a second embodiment of the present invention. A label strip 121 of a
15 label 120 has, in addition to the label substrate 104 and the adhesive layer 105, a carbon dioxide absorbent layer 122 laminated therebetween.

The carbon dioxide absorbent layer 122 is formed into a film in which the carbon dioxide absorbent 106 is uniformly dispersed, and a bonding adhesive layer 123 can also be provided between the layer 122 and the label substrate 104, if necessary.

20 The label 120 of such a configuration can also absorb carbon dioxide by incinerating it as in the case of the label 101 (Figure 1, Figure 2).

Figure 5 is an enlarged cross-sectional view of a main part of a label according to a third embodiment of the present invention, a label 130 has the backing paper 102 to which the carbon dioxide absorbent 106 is added, and a label strip 131 thereof also has
25 the label substrate 104 to which the carbon dioxide absorbent 106 is added.

The label 130 of such a configuration can also absorb carbon dioxide by incinerating it as in the cases of the label 101 (Figure 1, Figure 2) and the label 120 (Figure 4).

Figure 6 is an enlarged cross-sectional view of a main part of a label according to a fourth embodiment of the present invention, a label 140 has the backing paper 102 to
30 which the carbon dioxide absorbent 106 is added, and a label strip 141 of the label 140

also has the label substrate 104 and the adhesive layer 105 to which the carbon dioxide absorbent 106 is added.

Since the label 140 of such a configuration can also absorb carbon dioxide by incinerating it as in the cases of the label 101 (Figure 1, Figure 2), the label 120 (Figure 4) and the label 130 (Figure 5), and the carbon dioxide absorbent 106 is added to the entire laminate of the label 140, the label 140 can exert an effect of absorbing carbon dioxide at a maximum even if being used in any method.

It is to be noted that the present invention can be applied to a label or sticker having a composite multi-layered structure in which, in addition to the backing paper 102, the adhesive layer 103 and the label substrate 104, other intermediate layer or additional layer is incorporated as a substrate or an adhesive layer of a label.

Figure 7 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by a carbon dioxide absorbent (Nano vesicle carbon dioxide reduction additive produced by Acteive R&D).

Four samples each including the carbon dioxide absorbent 106 added to an emulsion-type adhesive in a concentration of 0.00%, 0.01%, 0.05%, or 0.10% were prepared as experimental samples, a thermogravimetric measurement method for plastics according to JIS K 7120 was employed as a test method, the mass of each sample was 10 mg, inflow gas was air, the flow rate of the inflow gas was 50 mL/min, the rate of temperature rise was 10°C/min, and the temperature was raised to 400°C to heat each sample for 100 minutes.

As shown in the table in Figure 7, the sample to which the carbon dioxide absorbent 106 was added in a concentration of 0.01% achieved a carbon dioxide reduction amount of 33.68%, the sample to which it was added in a concentration of 0.05% achieved a carbon dioxide reduction amount of 51.99%, and the sample to which it was added in a concentration of 0.10% achieved a carbon dioxide reduction amount of 56.20%, as determined from each difference in residue amount as compared with the sample to which the carbon dioxide absorbent 106 was not added.

The amount of the carbon dioxide absorbent 106 added is adjusted depending on the type and condition of the label 101 used and various conditions of the incineration disposal thereof, so that the effect of reducing carbon dioxide can be ensured at a predetermined level.

(Fifth Embodiment to Seventh Embodiment)

According to the present invention, since a carbon dioxide absorbent is added to or laminated on a top layer material formed on a printing medium, the carbon dioxide absorbent can absorb carbon dioxide not only at the time of incinerating the top layer formation material (top layer material) alone but also at the time of incinerating the top layer formation material together with various printing medium or objects of attaching (objects of pasting) used therewith. Thus, a top layer material formed on a printing medium which can contribute to reduction in carbon dioxide and a carbon dioxide reduction method using the top layer material formed on a printing medium are realized.

Then, a top layer material formed on a printing medium according to a fifth embodiment of the present invention and a carbon dioxide reduction method using this are described based on Figure 8 to Figure 11.

Figure 8 is a perspective view of an ink ribbon (thermal transfer ink ribbon 1) configured as a top layer material formed on a printing medium, and a thermal transfer ink ribbon 201 has a back coat layer 202, a PET (polyethylene terephthalate) film layer 203, an anchor coat layer 204 and a thermal transfer ink layer (carbon ink layer 205), and has a type of usage so that it is wound around a ribbon core tube 206 in a roll shape.

In the state where the thermal transfer ink ribbon 201 is loaded in a thermal printer 216 (Figure 10), the back coat layer 202 is positioned at the side in contact with a thermal head 226 (Figure 10) and has a sliding function relative to the thermal head 226, thereby facilitating movement of the thermal transfer ink ribbon 201.

The PET film layer 203 is a main substrate of the thermal transfer ink ribbon 201 and is a ribbon film having a thickness of, for example, about 4.5 to 6 μm , and the back coat layer 202, the anchor coat layer 204 and the carbon ink layer 205 are laminated on the PET film layer 203.

The anchor coat layer 204 is laminated between the PET film layer 203 and the carbon ink layer 205, and ensures the adhesiveness therebetween.

The carbon ink layer 205 serves to transfer a required section to printing medium (for example, a label strip 223 of a continuous label 221, in Figure 10) by heating from the thermal head, and a carbon dioxide absorbent 208 is added thereto together with a thermal transfer ink (carbon ink 207) and a required mixing agent (not illustrated).

The carbon dioxide absorbent 208 is added in a manufacturing step of the thermal transfer ink ribbon 201 (see Figure 9, described below).

It is desirable that the carbon dioxide absorbent 208 be made from, for example, an inorganic carbon dioxide absorbent, be particulate to nanometer in size ($\text{nm} = 10^{-9} \text{ m}$), and be uniformly dispersed throughout the carbon ink layer 205. For example, the particle size can be, at least, less than $1 \text{ }\mu\text{m}$, more preferably about 10 to 100 nm.

As the carbon dioxide absorbent 208 particulate to nanometer in size, for example, a Nano vesicle carbon dioxide reduction additive produced by Acteive R&D can be used.

Figure 9 is a schematic side view of a manufacturing apparatus 209 of the thermal transfer ink ribbon 201. A ribbon film substrate 210 having such a configuration that the back coat layer 202 and the anchor coat layer 204 are laminated on the PET film layer 203 in advance in a laminating step is prepared, and in the manufacturing apparatus 209, the carbon ink 207 is prepared in an ink vessel 211 and the carbon dioxide absorbent 208 particulate is added to the carbon ink 207 itself.

The carbon ink 207 including the carbon dioxide absorbent 208 is applied to the ribbon film substrate 210 in a determined thickness (for example, 1 to $1.5 \text{ }\mu\text{m}$) at the place between a gravure printing roll 212 and a backup roll 213, and then wound so as to form a large winding roll 214. The large winding roll 214 is allowed to pass through a small winding device 215 to obtain, as a final product, a roll-shaped thermal transfer ink ribbon 201 having a smaller diameter and being handleable.

Figure 10 is a schematic side view of a thermal printer 216 in which the thermal transfer ink ribbon 201 of such a configuration is loaded for printing, and the thermal printer 216 has a label-feeding portion 217, a label-printing portion 218, a backing paper-turning portion 219 and a backing paper-winding up portion 220.

The label-feeding portion 217 holds printing medium (for example, continuous label 221) in a roll shape, and allows the continuous label 221 to veer out in the direction of the label-printing portion 218 in a band shape.

The continuous label 221 has a band-shaped backing paper 222 and a plurality of label strips 223 temporarily attached to the band-shaped backing paper 222.

The label strip 223 has a label substrate 224 and an adhesive layer 225 on the rear surface of the label substrate 224, and the portion of the adhesive layer 225 is temporarily attached to the band-shaped backing paper 222.

5 The label-printing portion 218 has the thermal head 226, a platen roller 227, and a ribbon-feeding portion 228 and a ribbon-winding up portion 229 of the thermal transfer ink ribbon 201.

The thermal transfer ink ribbon 201 and the continuous label 221 are conveyed while being sandwiched between the thermal head 226 and the platen roller 227, and information having predetermined matter (variable information being matter if necessary printed by the thermal printer 216 in each case) is printed on the continuous label 221
10 (label strip 223) by thermal-transfer with heat from the thermal head 226.

As shown in Figure 10 illustrating a part of the released label strip 223 in an enlarged manner, the carbon ink 207 and the carbon dioxide absorbent 208 of the carbon ink layer 205 are transferred to an upper layer (top layer) of the label strip 223, and the
15 variable information is indicated by means of the carbon ink 207 and the carbon dioxide absorbent 208.

The thermal transfer ink ribbon 201 loaded in the thermal printer 216 and used as described above is wound up to the ribbon-winding up portion 229 while the printing matter on the label-printing portion 218 being kept on the carbon ink layer 205 in a
20 reverse state, and is generally collected, incinerated and disposed of for confidentiality reasons.

That is, Figure 11 is an explanatory view illustrating a state where the used thermal transfer ink ribbon 1 is incinerated in an incinerator 230.

As illustrated therein, the thermal transfer ink ribbon 201 is incinerated in an incineration disposal with an incinerating burner 231 in the incinerator 230.
25

Herein, the label strip 223 and any object of pasting or object of attachment 232 to the label strip 223 are also incinerated together with the thermal transfer ink ribbon 201 depending on a disposal system, in many cases.

Then, carbon dioxide (CO₂ gas) is generated due to burning by heating in the incinerator 230, carbon dioxide is absorbed to the carbon dioxide absorbent 208, and
30 carbon dioxide generated in each of the thermal transfer ink ribbon 201 and the label

strip 223 as well as the object of pasting or object of attachment 232 is absorbed in the portion of the carbon dioxide absorbent 208.

In particular, since the carbon dioxide absorbent 208 is particulate to nanometer in size (for example, about 10 to 100 nm) and uniformly dispersed, it can effectively
5 absorb carbon dioxide.

Also in the case where the label strip 223 is utilized as a price tag or a indicate tag for generally commercial goods, pasted to a packaging box or a packaging bag for commercial goods as the object of pasting or object of attachment 232, and incinerated and disposed of separately from the thermal transfer ink ribbon 201, the carbon ink layer
10 205 by printing forms the top layer of the label strip 223 itself, as described above, and therefore the function of effectively absorbing carbon dioxide by the carbon dioxide absorbent 208 added to the carbon ink layer 205 can be expected.

In the present invention, the carbon dioxide absorbent 208 can be added to or laminated on any layer. That is, the carbon dioxide absorbent 208 may be added to at
15 least any one of the back coat layer 202, the PET film layer 203 and the anchor coat layer 204.

For example, even if the carbon dioxide absorbent 208 is not added to the carbon ink layer 205, a function of absorbing carbon dioxide by the carbon dioxide absorbent 208 can be expected at the time of the incineration disposal of the thermal
20 transfer ink ribbon 201 as long as the carbon dioxide absorbent 208 is added to any of the above layers.

Furthermore, in the present invention, a carbon dioxide absorbent layer can be laminated on any layer of the thermal transfer ink ribbon 201.

For example, as illustrated in a dashed line in Figure 8, a carbon dioxide
25 absorbent layer 233 can be laminated between the PET film layer 203 and the anchor coat layer 204.

The carbon dioxide absorbent layer 233 is formed into a film in which the carbon dioxide absorbent 208 is uniformly dispersed, and a function of absorbing carbon dioxide by the carbon dioxide absorbent 208 of the carbon dioxide absorbent layer 233
30 can be expected at the time of the incineration disposal of the thermal transfer ink ribbon 201.

In the present invention, any top layer formation material can be employed as long as it can form a printing medium top layer.

For example, Figure 12 is a plan view of an advertising label in which various printing inks are employed as a top layer formation material according to a sixth

embodiment of the present invention, Figure 13 is a cross-sectional view taken along line XIII-XIII of Figure 12, and an advertising label 240 (printing medium) has a band-shaped backing paper 241 and a plurality of advertising label strips 242 temporarily attached to the surface of the backing paper 241.

The advertising label strips 242 each have an adhesive layer 244 on the rear surface of a label substrate 243 thereof, and have an advertising information 245 (for example, constant information such as "special sale") printed on the front surface thereof in advance.

The advertising information is printed by a predetermined printing ink 246 (top layer formation material) to which the carbon dioxide absorbent 208 is added.

Figure 14 is a schematic side view of a manufacturing apparatus of the advertising label. In a manufacturing apparatus 247, the backing paper 241 and a label substrate 248 of the advertising label strip 242 veer out in a band shape and the advertising information 245 is printed on a printing portion 249.

That is, the printing ink 246 and the carbon dioxide absorbent 208 added thereto are prepared in an ink vessel 250 of the printing portion 249, and the backing paper 241 and the label substrate 248 are allowed to pass between a printing cylinder 251 and an impression cylinder 252 to print the advertising information 245 on the label substrate 248. The advertising information 245 is preferably full-size printed or reverse printed.

It is to be noted that any method such as silk screen printing, relief printing, flexo printing, offset printing, gravure printing or pad printing method can be employed as a printing method.

Then, an unnecessary part of the label substrate 248 is removed by a debris removal unit 253 to form the label strip 242 and then, the label substrate 248 is formed into a large winding roll 254. Then, through a small winding device 255, a roll-shaped advertising label 240 having a smaller diameter and being easy to handle is obtained as a final product.

Also in the case of the advertising label 240 of such a configuration, when it is incinerated after use together with the object of pasting or object of attachment 232 such as, for example, commercial goods (Figure 11), the carbon dioxide absorbent 208 in the advertising information 245 can absorb carbon dioxide as in the case of the thermal transfer ink ribbon 201.

Also in the case of such an advertising label 240, the carbon dioxide absorbent 208 can be added to or laminated on any layer of the label as in the case of the thermal transfer ink ribbon 201 (Figure 8).

Figure 15 is a plan view of an identifying label in which a film for surface coating is employed as a top layer formation material according to a seventh embodiment of the present invention, Figure 16 is a cross-sectional view taken along line XVI-XVI of Figure 15, and an identifying label 260 (printing medium) has a band-shaped backing paper 261 and a plurality of identifying label strips 262 temporarily attached to the surface of the backing paper 261.

The identifying label strips 262 each have an adhesive layer 264 on the rear surface of the label substrate 263 thereof, and have an identifying printing layer 265 and a surface coating layer 266 on the front surface of the label substrate 263.

The identifying printing layer 265 is printed on the entire surface of the identifying label strips 262 so as to, for example, color-code with various colors, thereby enabling the respective identifying label strips 262 pasted to various articles to identify the respective articles.

The surface coating layer 266 is formed into a transparent film in which the carbon dioxide absorbent 208 is uniformly dispersed, and has the carbon dioxide absorbent 208 together with a coating agent 267 having a predetermined function such as weather resistance.

The identifying label 260 of such a configuration is also pasted to the required object of pasting or object of attachment 232 so that the identifying label 260 can achieve its representational function or an identifying function. When the identifying label 260 is incinerated together with the object of pasting or object of attachment 232 after use, the carbon dioxide absorbent 208 of the surface coating layer 266 can absorb carbon dioxide.

Also in the case of such an identifying label 260, the carbon dioxide absorbent 208 can be added to or laminated on any layer of the label as in the cases of the thermal transfer ink ribbon 201 (Figure 8) and the advertising label 240 (Figure 12).

Figure 7 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by a carbon dioxide absorbent (Nano vesicle carbon dioxide reduction additive produced by Acteieve R&D).

Four samples each including the carbon dioxide absorbent 8 added to an emulsion-type adhesive in a concentration of 0.00%, 0.01%, 0.05%, or 0.10% were prepared as experimental samples, a thermogravimetric measurement method for plastics according to JIS K 7120 was employed as a test method, the mass of each sample was 10 mg, inflow gas was air, the flow rate of the inflow gas was 50 mL/min, the rate of temperature rise was 10°C/min, and the temperature was raised to 400°C to heat each sample for 100 minutes.

As shown in the table in Figure 7, the sample to which the carbon dioxide absorbent 208 was added in a concentration of 0.01% achieved a carbon dioxide reduction amount of 33.68%, the sample to which it was added in a concentration of 0.05% achieved a carbon dioxide reduction amount of 51.99%, and the sample to which it was added in a concentration of 0.10% achieved a carbon dioxide reduction amount of 56.20%, as determined from each difference in residue amount as compared with the sample to which the carbon dioxide absorbent 208 was not added.

The amount of the carbon dioxide absorbent 208 added is adjusted depending on the types and conditions of usage of the thermal transfer ink ribbon 201, the advertising label 240 and the identifying label 260, and various conditions of the incineration disposal thereof so that the effect of reducing carbon dioxide can be ensured at a predetermined level.

That is, in the top layer material formed on a printing medium and the carbon dioxide reduction method using this according to the present invention, the carbon dioxide absorbent is added to or laminated on various top layer formation materials that are used for indicating information such as variable information and constant information by using various printing medium, and also used for a coating treatment for enhancing decorative properties, functionalities and performances of the printing medium, and it can absorb carbon dioxide at the time of incinerating the top layer formation materials

alone or the top layer formation materials together with the printing medium and various objects of pasting or objects of attaching.

(Eighth Embodiment to Eleventh Embodiment)

According to the present invention, since a carbon dioxide absorbent is added to
5 or laminated on an information-bearing medium, not only at the time of incinerating the information-bearing medium alone but also at the time of incinerating the information-bearing medium together with various objects of attaching (objects of pasting) used therewith, the carbon dioxide absorbent can absorb carbon dioxide. Thus, information-bearing medium which contribute to reduction in carbon dioxide, and a carbon dioxide
10 reduction method using this are realized.

Then, an information-bearing medium according to an eighth embodiment of the present invention and a carbon dioxide reduction method using this are described based on Figure 17 to Figure 19.

Figure 17 is a plan view of a tag as an information-bearing medium, and Figure
15 18 is a schematic side view of a printer (thermal printer) to which a tag is loaded for printing.

A tag 301 has a medium body 303 formed from a paper material or a plastic material in a band shape, and is cut along a cutting line 304 at a predetermined pitch to obtain one tag strip 305.

20 The tag 301 has a medium body 303 to which a carbon dioxide absorbent 306 is added, as shown particularly in Figure 18 illustrating a partial cross-sectional view thereof in an enlarged manner.

The carbon dioxide absorbent 306 is added by any way depending on a material of the tag 301 in a manufacturing step of the tag 301.

25 It is desirable that the carbon dioxide absorbent 306 be made from, for example, an inorganic carbon dioxide absorbent, be particulate to the nanometer ($\text{nm} = 10^{-9} \text{ m}$) level, and be uniformly dispersed throughout the medium body 303. For example, the particle size of the carbon dioxide absorbent 306 can be, at least, less than $1 \mu\text{m}$, more preferably about 10 to 100 nm.

30 As the carbon dioxide absorbent 306 particulate to nanometer in size, for example, a Nano vesicle carbon dioxide reduction additive produced by Acteieve R&D can be used.

As illustrated in Figure 18, a thermal printer 302 has a tag-feeding portion 307, a tag-printing portion 308 and a tag-cutting portion 309.

The tag-feeding portion 307 holds the tag 301 in a roll shape, and allows the tag 301 to veer out in the direction of the tag-printing portion 308 in a band shape.

5 The tag-printing portion 308 has a thermal head 310 and a platen roller 311, as well as a ribbon-feeding portion 313 and a ribbon-winding up portion 314 of a thermal transfer ink ribbon 312.

10 The tag 301 is conveyed while being sandwiched between the thermal head 310 and the platen roller 311, and information having predetermined matter (variable information being matter if necessary printed by the thermal printer 302 in each case) is thermal-transferred on the tag 301 (tag strip 305) by heat from the thermal head 310 and printed thereon.

15 Herein, it is also possible to print by heat from the thermal head 310 without using the thermal transfer ink ribbon 312 by laminating a heat-sensitive color-forming layer (not illustrated) on the surface of the tag body 303 to constitute a thermal paper. In this configuration, the carbon dioxide absorbent 306 can also be added to the heat-sensitive color-forming layer.

20 The carbon dioxide absorbent can be added to the heat-sensitive color-forming layer to thereby make a substrate with no starch.

 Specifically, the carbon dioxide absorbent can be added to a dye, a developer, a stabilizer or the like constituting the heat-sensitive color-forming layer.

 The tag-cutting portion 309 has a stationary knife 315 and a movable knife 316, and cuts the tag 301 at the portion of the cutting line 304 at a predetermined pitch to obtain one tag strip 305.

25 As shown in Figure 18 which illustrates a part of the cut tag strip 305 in an enlarged manner, the carbon ink of the thermal transfer ink ribbon 312 is transferred on the surface of the tag strip 305 so that the carbon ink of the thermal transfer ink ribbon 312 indicates the variable information 317.

30 In the case where the tag 301 (tag strip 305) loaded in the thermal printer 302, printed and cut as described above is utilized as a price tag, the tag 301 is attached to commercial goods (object of attachment, not illustrated) such as clothing items so as to indicate necessary information, and removed from commercial goods when purchase of

commercial goods so as to be used for managing the necessary information or to be broken off. In either case, the tag 301 is generally incinerated and disposed of.

Of course, in the case where the tag 301 is used as a ticket such as a general admission ticket, information necessary for such a ticket is printed on the tag 301.

5 That is, Figure 19 is an explanatory view illustrating a state where a used tag (tag strip) is incinerated in an incinerator.

As illustrated, the tag strip 305 is incinerated in an incineration disposal with an incinerating burner 319 in an incinerator 318.

10 Herein, the tag strip 305 and any object of pasting or object of attachment 320 pasted to the tag strip 305 are also incinerated together with the tag strip 305 depending on a disposal system, in some cases.

Then, carbon dioxide (CO₂ gas) is generated due to burning by heating in the incinerator 318, carbon dioxide is absorbed to the carbon dioxide absorbent 306, and carbon dioxide generated in each of the tag strip 305 and also the object of pasting or
15 object of attachment 320 is absorbed in the portion of the carbon dioxide absorbent 306.

In particular, since the carbon dioxide absorbent 306 is particulate to nanometer in size (for example, about 10 to 100 nm) and uniformly dispersed, it can effectively absorb carbon dioxide.

20 In the present invention, in the case where the tag 301 has an at least two or more-layer structure having a plurality of layers, the carbon dioxide absorbent 306 can be added to or laminated on any layer.

As illustrated in an enlarged part of Figure 18 by a dashed line, of course, a carbon dioxide absorbent layer 321 can be laminated on the rear surface of the medium body 303.

25 The carbon dioxide absorbent layer 321 is formed into a film in which the carbon dioxide absorbent 306 is uniformly dispersed. In this case, a function of absorbing carbon dioxide by the carbon dioxide absorbent 306 of the carbon dioxide absorbent layer 321 can also be expected at the time of the incineration disposal of the tag 301 (tag strip 305).

30 Figure 20 is a plan view of a wristband as an information-bearing medium according to a ninth embodiment of the present invention, Figure 21 is an enlarged cross-sectional view taken along line XXI-XXI of Figure 20. The wristband 330 is attached

to a wrist or an ankle of a patient in order to identify the patient in a hospital and the like, and has a center indicate region 331 and a left-and-right pair of a first attachment region 332 and a second attachment region 333.

The name and therapy department of a patient, and other necessary visible
5 information 334 and bar code information 335 are printed on the center indicate region 331.

The first attachment region 332 has a single attachment hole 336 formed thereon, the second attachment region 333 has a plurality of selection holes 337 formed thereon, and a attachment tool 338 is attached to the selected selection hole 337 and the
10 attachment hole 336, thereby enabling the wristband 330 to be attached to a patient in a ring shape having a predetermined diameter.

In particular, as illustrated in Figure 21, the wristband 330 has a base substrate 339, a coat layer 340 on the surface thereof, an embossed layer 341 on the rear surface in contact with the skin of a patient, and intermediate layers (first intermediate layer 342,
15 second intermediate layer 343 and third intermediate layer 344).

The carbon dioxide absorbent 306 is added to in particular in a manufacturing step of the base substrate 339.

Of course, the carbon dioxide absorbent 306 may be added to at least any one of the respective layers (base substrate 339, coat layer 340, embossed layer 341, first
20 intermediate layer 342, second intermediate layer 343 and third intermediate layer 344), and a carbon dioxide absorbent layer 345 that is the same as the carbon dioxide absorbent layer 321 (Figure 18) can also be laminated thereon, as illustrated in Figure 21 by a dashed line.

Also in the case of the wristband 330 of such a configuration, when it is
25 incinerated and disposed of after use, the carbon dioxide absorbent 306 can effectively absorb carbon dioxide to thereby contribute to reduction in carbon dioxide.

Figure 22 is a plan view of a wristband as an information-bearing medium according to a tenth embodiment of the present invention, and Figure 23 is a cross-sectional side view of the wristband.

A wristband 350 has a simpler configuration than the above-described wristband
30 330 (Figure 20), and has a name and therapy department of a patient, and other necessary

visible information 334 and bar code information 335 which are printed on its front surface as in the wristband 330.

As illustrated in particular in Figure 23, the wristband 350 has a base substrate 351, an adhesive layer 352 on the rear surface of the base substrate 351, and an embossed layer 353 on the rear surface of the adhesive layer 352.

The carbon dioxide absorbent 306 is added to the wristband 350 in particular in a manufacturing step of the base substrate 351.

Of course, the carbon dioxide absorbent 306 may be added to at least any one of the respective layers (base substrate 351, adhesive layer 352 and embossed layer 353), and a carbon dioxide absorbent layer 354 that is the same as the carbon dioxide absorbent layer 321 (Figure 18) can also be laminated thereon, as illustrated in Figure 21 by a dashed line.

A cut-off line (cut-here line) 355 is formed on the embossed layer 353, this cut-off line 355 is used to peel a release region 356 at the end side of the embossed layer 353 (left side in Figure 23) to thereby expose an internal adhesive layer 352, and this portion of the adhesive layer 352 is pasted to the opposite end of the wristband 350, thereby enabling the wristband 350 to be attached to a patient in a ring shape.

While the wristband 350 of such a configuration is of a simple type, not used for a long period of time but collected after being used for one day, and incinerated and disposed of as waste, the carbon dioxide absorbent 306 can effectively absorb carbon dioxide at the time of incinerating as in the cases of the tag 301 (Figure 17) and the wristband 330 (Figure 20).

Figure 24 is an explanatory view of a point card as an information-bearing medium according to an eleventh embodiment of the present invention. Portion (1) in Figure 24 is a front surface view of the explanatory view and Portion (2) in Figure 24 is a rear surface view of the explanatory view. Figure 25 is an enlarged cross-sectional view taken along line XXV-XXV of Figure 24.

A point card 360 is used in, for example, a retailing store, and can indicate on the front surface thereof, for example, constant information 361 such as "point card" and "XXX store", and variable information 362 such as a number of points and a user name, as illustrated in Portion (1) in Figure 24.

As illustrated in Portion (2) in Figure 24, the point card 360 can indicate on the rear surface thereof, for example, variable information 363 such as "purchase history".

As a method for printing or indicating the respective information (constant information 361, variable information 362 and variable information 363), any method
5 can be employed depending on the conditions and types of use thereof.

In the point card 360, the carbon dioxide absorbent 306 is added to a base substrate 364.

Of course, in the case where the point card 360 includes a plurality of layers, the carbon dioxide absorbent 306 may be added to at least any one of the respective layers,
10 and a carbon dioxide absorbent layer 365 that is the same as the carbon dioxide absorbent layer 321 (Figure 18) can also be laminated thereon, as illustrated in Figure 25 by a dashed line.

Information can be rewritten a plurality of times on the point card 360 of such a configuration. When the point card 360 is finally collected after use, incinerated and
15 disposed of as waste, the carbon dioxide absorbent 306 can effectively absorb carbon dioxide at the time of incinerating as in the cases of the tag 301 (Figure 17), the wristband 330 (Figure 20) and the wristband 350 (Figure 22).

Figure 7 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by a carbon dioxide absorbent
20 (Nano vesicle carbon dioxide reduction additive produced by Acteieve R&D).

Four samples each including the carbon dioxide absorbent 6 added to an emulsion-type adhesive in a concentration of 0.00%, 0.01%, 0.05%, or 0.10% were prepared as experimental samples, a thermogravimetric measurement method for plastics according to JIS K 7120 was employed as a test method, the mass of each sample was 10
25 mg, inflow gas was air, the flow rate of the inflow gas was 50 mL/min, the rate of temperature rise was 10°C/min, and the temperature was raised to 400°C to heat each sample for 100 minutes.

As shown in the table in Figure 7, the sample to which the carbon dioxide absorbent 306 was added in a concentration of 0.01% achieved a carbon dioxide
30 reduction amount of 33.68%, the sample to which it was added in a concentration of 0.05% achieved a carbon dioxide reduction amount of 51.99%, and the sample to which it was added in a concentration of 0.10% achieved a carbon dioxide reduction amount of

56.20%, as determined from each difference in residue amount as compared with the sample to which the carbon dioxide absorbent 306 was not added.

The amount of the carbon dioxide absorbent 306 added is adjusted depending on the type and condition of the label 301 used and various conditions of the incineration disposal thereof so that the effect of reducing carbon dioxide can be ensured at a predetermined level.

That is, in the information-bearing medium and the carbon dioxide reduction method using this according to the present invention, the carbon dioxide absorbent is added to or laminated on various information-bearing media in which information such as variable information and constant information is indicated on the surface thereof by using various information-bearing media, and to which a coating treatment for enhancing decorative properties, functionalities and performances of the printing medium is applied. When such information-bearing medium is incinerated alone or together with various objects of pasting or objects of attaching, carbon dioxide can be absorbed.

(Twelfth Embodiment)

According to the present invention, since a carbon dioxide absorbent is added to a solid fuel itself, there have been realized a solid fuel in which the carbon dioxide absorbent can absorb carbon dioxide at the time of burning the solid fuel to thereby contribute to reduction in carbon dioxide, and a carbon dioxide reduction method using this.

Then, a solid fuel 401 according to a twelfth embodiment of the present invention and a carbon dioxide reduction method using this are described based on Figure 26 to Figure 28.

Figure 26 is a perspective view of the solid fuel, Figure 27 is a schematic explanatory view of a manufacturing step of the solid fuel, and the solid fuel 401 is manufactured using flammable industry waste as a raw material via each step of sorting, grinding and molding.

That is, the solid fuel 401 is molded in, for example, a column shape as illustrated, and has a flammable body 402 and a carbon dioxide absorbent 403 added to the flammable body 402.

The solid fuel 401 has a diameter of 6 to 60 mm and a length of about 10 to 100 mm, for example, but can be molded in any shape and size.

As illustrated in Figure 27, examples of industry waste include used paper, a waste plastic material and other flammable waste. In addition to them, a cardboard box 404, a label 405, a sticker 406, a printing ink ribbon (thermal transfer ink ribbon 407) or the like is utilized. It is to be noted that the industry waste may be used as it is or may
 5 be used with if necessary being mixed with general waste such as domestic refuse.

In the sorting step, metals that serve as the flammable body 402 with difficulty and other articles that are unsuitable for being converted into a fuel, and also products that can be burned to cause toxicity, including vinyl chloride and other chlorine compounds, are removed from the collected industry waste.

10 In the grinding step, the sorted raw material is ground to a chip 408 having a required size, for example, about 5 to 15 cm in each of length, width and height.

In the molding step, the chip 408 is molded and compressed into a column, and the column is designated as the solid fuel 401.

In addition, if being necessary for the molding, a binder is desirably added in a
 15 predetermined amount. Herein, if the label 405, the sticker 406 or the like having an adhesive layer is contained in industry waste, a binder needs not to be added or the amount thereof can be reduced.

Furthermore, in the present invention, a carbon dioxide absorbent 403 is added to the chip 408 in the molding step.

20 It is desirable that the carbon dioxide absorbent 403 be made from, for example, an inorganic carbon dioxide absorbent, be particulate to the nanometer ($\text{nm} = 10^{-9} \text{ m}$) level, and be uniformly dispersed throughout the solid fuel 401 (flammable body 402). For example, the particle size thereof can be, at least, less than $1 \mu\text{m}$, more preferably about 10 to 100 nm.

25 As the carbon dioxide absorbent 403 particulate to nanometer in size, for example, a Nano vesicle carbon dioxide reduction additive produced by Acteive R&D can be used.

The solid fuel 401 of such a configuration can be applied as a part of a boiler fuel in paper-manufacturing companies, cement companies, chemical companies, and
 30 any other fields.

Figure 28 is an explanatory view illustrating a state where a solid fuel is burned in a boiler of a plant. While the solid fuel 401 is burned in a boiler 410 to obtain heat

energy for a plant 409, carbon dioxide (CO₂ gas) is generated due to the burning by heating and the carbon dioxide is adsorbed to the carbon dioxide absorbent 403. Carbon dioxide generated from other fuel used as needed basis is also absorbed to the portion of the carbon dioxide absorbent 403.

5 In particular, since the carbon dioxide absorbent 403 is particulate to nanometer in size (for example, about 10 to 100 nm) and uniformly dispersed, it can effectively absorb carbon dioxide.

 Also in the case where the solid fuel 401 is not used for companies or the plant 409, but used as a common fuel, the function of effectively absorbing carbon dioxide by the carbon dioxide absorbent 403 can be expected as in the above case.

 Figure 7 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by the carbon dioxide absorbent 403 (Nano vesicle carbon dioxide reduction additive produced by Acteive R&D).

15 Four samples each including the carbon dioxide absorbent 3 added to an emulsion-type adhesive in a concentration of 0.00%, 0.01%, 0.05%, or 0.10% were prepared as experimental samples, a thermogravimetric measurement method for plastics according to JIS K 7120 was employed as a test method, the mass of each sample was 10 mg, inflow gas was air, the flow rate of the inflow gas was 50 mL/min, the rate of temperature rise was 10°C/min, and the temperature was raised to 400°C to heat each sample for 100 minutes.

 As shown in the table in Figure 7, the sample to which the carbon dioxide absorbent 403 was added in a concentration of 0.01% achieved a carbon dioxide reduction amount of 33.68%, the sample to which it was added in a concentration of 0.05% achieved a carbon dioxide reduction amount of 51.99%, and the sample to which it was added in a concentration of 0.10% achieved a carbon dioxide reduction amount of 56.20%, as determined from each difference in residue amount as compared with the sample to which the carbon dioxide absorbent 403 was not added.

30 The amount of the carbon dioxide absorbent 403 added is adjusted depending on the type and condition of the solid fuel 401 used and various conditions of burning thereof so that the effect of reducing carbon dioxide can be ensured at a predetermined level.

(Thirteenth Embodiment)

According to the present invention, since a carbon dioxide absorbent is added to a wristband clip, there have been realized a wristband clip in which the carbon dioxide absorbent can absorb carbon dioxide at the time of being incinerated to thereby
5 contribute to reduction in carbon dioxide, and a carbon dioxide reduction method using this.

Then, a wristband clip according to a thirteenth embodiment of the present invention and a carbon dioxide reduction method using this are described based on Figure 29 and Figure 30.

10 Figure 29 is a plan view illustrating the configuration of the wristband clip, and Figure 30 is a side view illustrating the configuration of the wristband clip.

A wristband clip 510 of the present invention is mainly formed from a synthetic resin material as illustrated in Figure 29. This wristband clip 510 includes a male clip portion 512 and a female clip portion 514 that have a substantial eight figure and that are
15 connected via a hinge 516 in a bilateral symmetrical manner to be integrally formed.

Each of bosses 520 is formed on the center of each of circular portions 512a and 512b of the male clip portion 512 of the wristband clip 510, and such bosses 520 are formed at the same interval as the interval of band holes 536 and setting holes 538 formed on a wristband 530 described later. In addition, each of boss holes 522 is
20 formed on the center of each of circular portions 514a and 514b of the female clip portion 514 of the wristband clip 510, and such boss holes 522 are also formed at the same interval as the interval of the band holes 536.

The hinge 516 of the wristband clip 510 is formed into a thin sheet, and is provided with flexion portions 516a on both edges thereof, each having a substantial U-
25 shape for making flexion easy, as illustrated in Figure 30.

The bosses 520 formed so as to be protruded to the male clip portion 512 are each provided with a columnar shaft portion 523 disposed on the center thereof in a protruding manner and a first radially-enlarged portion constituting four sheet-shaped engagement portions 524 radially protruded at equal angles in the circumferential
30 direction of the shaft portion 523. The bosses 520 are each further provided with, on the tip thereof, a non-return portion 526 constituting a second radially-enlarged portion having a smaller diameter than the first radially-enlarged portion. A constricted portion

525 having a smaller diameter than the first radially-enlarged portion and the second radially-enlarged portion is provided between the first radially-enlarged portion and the second radially-enlarged portion. A portion protruded from the outer circumference of the shaft portion 523 on the non-return portion 526 is configured to have a scalable
 5 diameter by elastic deformation.

On the other hand, the boss holes 522 of the female clip portion 514 each have a holding portion 527 formed in an inverted cone shape (mortar shape), corresponding to the shape of the engagement portion 524 for the bosses 520 of the male clip portion 512.

In addition, a retaining portion 528 is formed on the lower surface of the female
 10 clip portion 514 provided with the boss hole 522, the retaining portion 528 being built up along the inner circumference of the boss hole 522. This retaining portion 528 has two notches 529 formed so that the inner diameter of the retaining portion 528 is made scalable.

When this wristband clip 510 is folded by the hinge 516, the boss 520 of the
 15 male clip portion 512 is fitted into the boss hole 522 of the female clip portion 514 to thereby join the male clip portion 512 and the female clip portion 514. That is, the boss 520 is inserted into the boss hole 522 while the retaining portion 528 of the boss hole 522 being pushed and extended by the non-return portion 526 of the boss 520. After the non-return portion 526 passing through the retaining portion 528, the diameter of the
 20 retaining portion 528 contracts by an elastic restoring force is fitted between the non-return portion 526 and the engagement portion 524. The holding portion 527 of the boss hole 522 corresponds to the engagement portion 524 of the boss 520 in terms of shape, and thus the engagement portion 524 is held to the holding portion 527 in close contact with each other to prevent backlash of the boss 520 on the boss hole 522. Even
 25 if the boss 520 is tried to be pulled out of the boss hole 522 in this state, the retaining portion 528 gets hung up the non-return portion 526 to prevent the boss 520 from being pulled out.

Then, a use method in which the wristband clip of the present invention is applied to a wristband is described based on Figure 31 and Figure 32.

30 Figure 31 is a perspective view illustrating a configuration of a wristband to which the wristband clip according to the thirteenth embodiment of the present invention is adapted, and Figure 32 is a side view illustrating a state where the boss of the male clip

portion of the wristband clip according to the thirteenth embodiment of the present invention is fitted into the boss hole of the female clip portion to fix the wristband. A wristband 530 includes a display portion 532 whose center region can be printed by an electronic printer (not illustrated) or the like, and band portions 531a and 531b extending
 5 to both sides of the display portion 532. Herein, the band portions 531a and 531b constitute a band main body 531.

Identification data 534 specific to an individual, such as the department, name, age and blood type of a patient, is printed on the display portion 532.

A pair of setting holes 538 for setting the wristband clip 510 is formed on a
 10 shorter band portion 531a. The setting holes 538 are formed at regular intervals. On the other hand, a plurality of band holes 536 is formed on a longer band portion 531b at regular intervals.

The function of the wristband clip 510 thus configured is described by the procedure of winding the wristband 530 around a wrist, an ankle or the like.

15 First, the bosses 520 of the male clip portion 512 are allowed to pass through the setting holes 538 formed on the shorter band portion 531a of the wristband 530 to attach the wristband 530 to the clip 510.

Then, after the wristband 530 is wound around a wrist, any of the band holes 536 formed on the longer band portion 531b is selected depending on the size of a wrist,
 20 and the boss 520 is allowed to pass through the selected band hole 536. Thus, the wristband 530 is wound around a wrist at a temporary position.

Then, the female clip portion 514 is bent to the side of the male clip portion 512 by means of the hinge 516 to close the upper surface of the male clip portion 512 by the female clip portion 514, thereby folding the clip 510.

25 After the non-return portion 526 formed on the tip of the boss 520 pushes and extends the retaining portion 528 of the female clip portion 514, the non-return portion 526 engages with the retaining portion 528 to lock the female clip portion 514. At this time, if the space between the male clip portion 512 and the female clip portion 514 is set to have a thickness equal to or less than the thickness when the band portions 531a and
 30 531b are overlaid each other, the wristband 530 can be strongly sandwiched by the clip 510 and the backlash thereof can be further prevented. In addition, the constricted portion 525 is formed to have a smaller diameter than the first radially-enlarged portion

and the second radially-enlarged portion of the boss 520, and therefore the male clip portion 512 and the female clip portion 514 of the wristband 530 are securely fitted to each other.

In this way, the wristband 530 is annularly wound around a wrist or the like.

5 Since the boss 520 and the boss hole 522 can be fitted to each other only by bending the hinge 516, the wristband 530 can be attached even by one hand. Since the non-return portion 526 once engaged with the retaining portion 528 locks the boss 520 so that the boss 520 is never pulled out again, the wristband 530 can be safely used even in, for example, hospital or the like. When the wristband 530 is detached, the wristband 530 is
10 cut by scissors or the like.

This wristband clip 510 is configured from, for example, a synthetic resin material composed of polyethylene excellent in chemical resistance. In a manufacturing step of the wristband clip 510, a carbon dioxide absorbent 540 is added thereto by any way depending on a material of the clip 510 (see Figure 32).

15 The carbon dioxide absorbent 540 is a material that is reacted with carbon dioxide generated at the time of burning to allow the carbon dioxide not to be released in air but to remain as ash (carbonate).

It is desirable that this carbon dioxide absorbent 540 be made from, for example, an inorganic carbon dioxide absorbent 540, be particulate to the nanometer ($\text{nm} = 10^{-9}$
20 m) level, and be uniformly dispersed throughout the clip 510. For example, the particle size thereof can be, at least, less than $1\ \mu\text{m}$, more preferably about 10 to 100 nm.

As the carbon dioxide absorbent 540 particulate to nanometer in size, for example, a Nano vesicle carbon dioxide reduction additive produced by Acteive R&D can be used.

25 The wristband clip 510 of such a configuration is used for winding the wristband 530, on which identification information specific to a patient is printed for identifying the patient, around a wrist of the patient to clip it, and after use, detached from the wrist, and incinerated and disposed of.

Figure 33 is an explanatory view illustrating a state where the used wristband
30 clip is incinerated in an incinerator.

While the wristband clip 510 is incinerated in an incineration disposal by an incinerating burner 552 in an incinerator 550, carbon dioxide (CO_2 gas) is generated due

to burning by heating, and the carbon dioxide is adsorbed by the carbon dioxide absorbent 540.

Carbon dioxide generated by burning the wristband clip 510 is absorbed by the portion of the carbon dioxide absorbent 540.

5 In particular, if the carbon dioxide absorbent 540 is particulate to nanometer in size (for example, about 10 to 100 nm) and also uniformly dispersed, the carbon dioxide absorbent 540 can have an increased surface area so as to effectively absorb carbon dioxide.

10 Figure 34 is a table of a carbon dioxide reduction amount, showing experimental results for confirming an effect of reducing carbon dioxide by the carbon dioxide absorbent 540 (Nano vesicle carbon dioxide reduction additive produced by Acteive R&D).

Two kinds of clips were prepared as experimental samples: one of which was a commercially available and to which the carbon dioxide absorbent 540 was not added (manufactured by Sato Corporation, product name: Soft clip); and the other was the 15 wristband clip 510 of the present invention obtained by adding 3.00% of the carbon dioxide absorbent 540 to the commercially available wristband clip. A thermogravimetric measurement method for plastics according to JIS K 7120 was employed as a test method, the mass of each sample was 10 mg, inflow gas was air, the 20 flow rate of the inflow gas was 50 mL/min, the rate of temperature rise was 10°C/min, and the temperature was raised to 400°C to heat each sample for 100 minutes.

As shown in the table in Figure 34, the wristband clip 510 of the present invention could achieve a carbon dioxide reduction amount of 64.89%, as determined from a difference in residue amount as compared with the commercially available 25 wristband clip.

In addition, the amount of the carbon dioxide absorbent 540 added is adjusted depending on the type and condition of the wristband clip 510 used and various conditions of the incineration disposal thereof so that the effect of reducing carbon dioxide can be ensured at a predetermined level.

30 Herein, a synthetic resin material such as polypropylene, rubber or urethane which has moldability comparable with polyethylene and is gentle to skin even if being

in contact with skin, can also be employed to the wristband clip 510 to which the carbon dioxide absorbent 540 is added.

Furthermore, if the carbon dioxide absorbent 540 is added at the time of manufacturing the wristband 530, the carbon dioxide absorbent 540 can effectively
 5 absorb carbon dioxide at the time of incinerating and disposing of the wristband 530, thereby contributing to reduction in carbon dioxide.

The carbon dioxide absorbent of the present invention is obtained by mixing a carbon dioxide-absorbing substance and a dispersion aid, subjecting them to a dispersion treatment (mixed dispersion), and then adding them to a resin.

10 The carbon dioxide-absorbing substance in the present invention may be any one to which carbon dioxide chemically or physically adsorbs. For example, metal hydroxide, metal oxide, aluminosilicate, a titanate acid compound, lithium silicate, silica gel, alumina, and activated carbon are preferable with respect to an inorganic compound, and a coconut mesocarp fiber is preferable with respect to an organic compound.

15 The metal hydroxide may include lithium hydroxide, sodium hydroxide, magnesium hydroxide, calcium hydroxide, and barium hydroxide.

The metal oxide may include magnesium oxide, calcium oxide, and zinc oxide.

The aluminosilicate may include amorphous aluminosilicate, natural zeolite, and synthetic zeolite.

20 The titanate acid compound may include barium titanate and barium orthotitanate.

The dispersion aid in the present invention may be any one that enables the carbon dioxide-absorbing substance being an inorganic compound or an organic compound to be effectively dispersed in a resin. For example, a metal salt of fatty acid, a polymeric surfactant, and an amphiphilic lipid are preferable.

25 The metal salt of fatty acid may include calcium stearate, zinc stearate, magnesium stearate, aluminum stearate, barium stearate, lithium stearate, sodium stearate, potassium stearate, calcium 12-hydroxystearate, zinc 12-hydroxystearate, magnesium 12-hydroxystearate, aluminum 12-hydroxystearate, barium 12-hydroxystearate, lithium 12-hydroxystearate, sodium 12-hydroxystearate, and potassium 12-hydroxystearate.

30 The polymeric surfactant may include sodium polyacrylate, sodium polycarboxylate, an olefin/maleic acid copolymer sodium salt, polyoxyethylene-type gemini surfactants (POE30-10-ODEs, POE20-10ODEs, POE10-10-ODEs), a phosphate

ester-type gemini surfactant (POH-10-ODEs), and a dicarboxylic acid-type gemini surfactant (DC-10-ODEs).

The amphiphilic lipid may include glycerophospholipids such as phosphatidylcholine, phosphatidylethanolamine, phosphatidylserine, phosphatidic acid, phosphatidylglycerol, phosphatidylinositol, cardiopine, egg yolk lecithin, hydrogenated egg yolk lecithin, soy lecithin and hydrogenated soy lecithin, and sphingophospholipids such as sphingomyelin, ceramide phosphorylethanolamine and ceramide phosphorylglycerol.

The dispersion treatment in the present invention may be any method that enables to effectively cover the surface of the carbon dioxide-absorbing substance with the dispersion aid to prepare a dispersion liquid in which the carbon dioxide-absorbing substance is uniformly dispersed.

For example, a supercritical fluid treatment, an ultrasonic irradiation treatment, and a stirring treatment are preferable.

As a solvent of the dispersion liquid, water or an organic solvent is preferable. The specific organic solvent may include ethanol, dichloromethane, and hexane.

In the supercritical fluid treatment, the mixture of the carbon dioxide-absorbing substance and the dispersion aid is exposed to a supercritical fluid, thereby enhancing dispersibility of the carbon dioxide-absorbing substance. As the supercritical fluid, carbon dioxide in a supercritical state is preferable.

The carbon dioxide in a supercritical state in the present invention means carbon dioxide that is in a supercritical state where the critical temperature is 30.98°C and the critical pressure is 7.3773 MPa or more. Carbon dioxide under a condition in which only the critical temperature or only the critical pressure is satisfied is not considered to be in the supercritical state.

Herein, Figure 42 shows transmission electron microscope photographs of a mixture of 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water as the dispersion solvent, which is subjected to a supercritical fluid treatment at a treatment pressure of 20 MPa and a treatment temperature of each of 25°C, 40°C, 60°C, 120°C and 130°C for 15 minutes.

The black areas in the photographs indicate the carbon dioxide-absorbing substance covered with the dispersion aid, and the white areas indicate an aqueous solution of the dispersion aid.

For comparison, Figure 41 shows a transmission electron microscope photograph indicating dispersibility of the carbon dioxide-absorbing substance in the dispersion aid in the case where no dispersion treatment is performed.

The respective mixtures after the supercritical fluid treatment at the respective treatment temperatures are compared. In the mixture after the dispersion treatment at a treatment temperature of 25°C that does not meet the supercritical fluid treatment condition, the particle size of the carbon dioxide-absorbing substance is 1 µm or more, and the carbon dioxide-absorbing substance is aggregated in the aqueous solution of the dispersion aid without being dispersed (see Figure 42(a)). On the contrary, in the mixture after the dispersion treatment at a treatment temperature of 40°C that satisfies the supercritical fluid treatment condition, the particle size of the carbon dioxide-absorbing substance is about 100 nm, and the carbon dioxide-absorbing substance in the mixture is uniformly dispersed (see Figure 42(b)). Therefore, it can be said that, in the supercritical fluid treatment, the treatment is required to be performed in a state where both pressure and temperature that make carbon dioxide be in a supercritical state are satisfied.

In addition, regarding the mixtures after the dispersion treatment at a treatment temperature of 60°C and a treatment temperature of 120°C, the particle size of the carbon dioxide-absorbing substance is about 10 nm in both cases, and high dispersibility is achieved (see Figures 8(c) and (d)). However, when the treatment temperature exceeds 130°C, the particle size of the carbon dioxide-absorbing substance becomes about 0.8 µm, and the carbon dioxide-absorbing substance is found to be aggregated (See Figure 42(e)). In other words, a treatment temperature that is too high is unfavorable, and a dispersion effect is adversely suppressed at a treatment temperature of an excessive condition.

In the ultrasonic irradiation treatment, the mixture of the carbon dioxide-absorbing substance and the dispersion aid is irradiated with an ultrasonic wave having a frequency of 15 KHz to 60 KHz and an intensity of about 75 W to about 600 W to thereby enhance dispersibility of the carbon dioxide-absorbing substance.

Herein, Figure 43 shows transmission electron microscope photographs of a mixture of 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water as the dispersion solvent, which is subjected to an ultrasonic irradiation treatment under a condition of 60°C with an ultrasonic wave having a frequency of 40 KHz and an intensity of each of 50 W, 75W, 300 W, 600 W and 700 W for 30 minutes.

The respective mixtures after the ultrasonic irradiation treatment at the respective intensities are compared. In the mixture after the dispersion treatment with the ultrasonic wave irradiation at an intensity of 50 W, the particle size of the carbon dioxide-absorbing substance is about 1 μm , and the carbon dioxide-absorbing substance in the mixture after the treatment is aggregated without being dispersed (see Figure 43(a)). On the contrary, in the mixture after the dispersion treatment at the ultrasonic wave irradiation at an intensity of 75 W, the particle size of the carbon dioxide-absorbing substance is about 150 nm, and the carbon dioxide-absorbing substance in the mixture is uniformly dispersed (see Figure 43(b)).

In addition, regarding the mixtures after the ultrasonic wave irradiation at an intensity of 300 W and an intensity of 600 W, the particle size of the carbon dioxide-absorbing substance is about 80 nm in both cases, and high dispersibility is achieved (see Figure 43(c) and (d)). However, in the ultrasonic wave irradiation at an intensity of 700 W, the particle size of the carbon dioxide-absorbing substance becomes about 1 μm , and the carbon dioxide-absorbing substance is found to be aggregated (see Figure 43(e)).

From this, an ultrasonic wave irradiation at an intensity of 75 W to 600 W is preferable in the ultrasonic irradiation treatment. An ultrasonic wave irradiation at an intensity below the range does not impart a sufficient dispersion effect, and on the contrary, an ultrasonic wave irradiation at an intensity above the range makes the function of the dispersion aid lost and thus is not preferable.

In addition, in the stirring treatment, the mixture of the carbon dioxide-absorbing substance and the dispersion aid is stirred at a rotation speed of 1,000 rpm to 20,000 rpm to thereby enhance dispersibility of the carbon dioxide-absorbing substance.

Herein, Figure 44 shows transmission electron microscope photographs of a mixture of 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing

substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water as the dispersion solvent, which is subjected to a stirring treatment under a condition of 60°C at a rotation speed of each of 500 rpm, 1,000 rpm, 15,000 rpm, 20,000 rpm and 25,000 rpm for 30 minutes.

5 The respective mixtures after the stirring treatment at the respective rotation speeds are compared. In the mixture after the stirring treatment at a rotation speed of 500 rpm, variation in the particle size of the carbon dioxide-absorbing substance is observed with the larger particle size being 3 μm or more, and the carbon dioxide-absorbing substance in the mixture is aggregated without being dispersed (see Figure 10 44(a)). On the contrary, in the mixture after the stirring treatment at a rotation speed of 1,000 rpm, the particle size of the carbon dioxide-absorbing substance is about 100 nm, and the carbon dioxide-absorbing substance in the mixture is uniformly dispersed (see Figure 44(b)).

 In addition, regarding the mixtures after the stirring treatment at rotation speeds 15 of 15,000 rpm and 20,000 rpm, the particle size of the carbon dioxide-absorbing substance is about 60 nm in both cases, and high dispersibility is achieved (see Figures 44(c) and (d)). However, in the mixture after the stirring treatment at a rotation speed of 25,000 rpm, the particle size of the carbon dioxide-absorbing substance becomes about 0.8 μm , and the carbon dioxide-absorbing substance is found to be aggregated (see 20 Figure 44(e)).

 From this, a stirring treatment at a rotation speed of 1,000 rpm to 20,000 rpm is preferable. A stirring treatment at a rotation speed below the range does not result in sufficient dispersion due to an unsatisfactory rotation speed, thereby aggregating the carbon dioxide-absorbing substance. On the contrary, a stirring treatment at a rotation 25 speed above the range prevents the surface of the carbon dioxide-absorbing substance from being covered with the dispersion aid, thereby aggregating the carbon dioxide-absorbing substance, and thus is not preferable.

 The resin in the present invention may be any one that is commonly used. For example, a polyolefin-based resin, a polyester-based resin, a polyamide-based resin, a 30 polyvinylchloride-based resin, and a polystyrene-based resin are preferable.

 In order to produce the carbon dioxide absorbent by the above component and dispersion treatment, the following procedure may be adopted.

First, the carbon dioxide-absorbing substance and the dispersion aid are mixed with water or an organic solvent, and the mixture is subjected to any of the supercritical fluid treatment, the ultrasonic irradiation treatment and the stirring treatment to produce a carbon dioxide-absorbing substance dispersion liquid. Herein, if the carbon dioxide-absorbing substance is uniformly dispersed, the mixture has transparency.

A mixing ratio of the dispersion aid to 100 parts by weight of the carbon dioxide-absorbing substance is preferably 0.1 to 10 parts by weight. The mixing ratio of the dispersion aid is most preferably 0.1 to 5 parts by weight.

The reason for the ranges is because if the amount of the dispersion aid added to the carbon dioxide-absorbing substance is smaller than the ranges, the carbon dioxide-absorbing substance is not sufficiently dispersed in the carbon dioxide-absorbing substance dispersion liquid which is a mixture to be produced. Eventually, the dispersibility of the carbon dioxide-absorbing substance in the resin to be mixed is deteriorated, and the amount of carbon dioxide absorbed is made smaller.

In addition, the reason for the ranges is because if the amount added is larger than the ranges, a carbon dioxide-absorbing substance dispersion liquid having the carbon dioxide-absorbing substance in a sufficient concentration is not obtained, and the amount added becomes larger in order to satisfy the required concentration of the carbon dioxide-absorbing substance dispersant added to the resin, thereby making kneading difficult.

In the case where the supercritical fluid treatment is performed, it is preferably performed at a pressure of 7.37 MPa or more for 1 minute to 12 hours while the mixture being warmed to a temperature of 30.98°C or higher under carbon dioxide, and most preferably at a temperature of 60°C to 120°C for 10 minutes to 1 hour.

Herein, a particle size distribution measurement is performed at the exposure times in the supercritical fluid treatment at a treatment temperature of 60°C and a treatment pressure of 20 MPa, and the results are used to calculate an average particle size at each exposure time. Figure 45 shows a relationship between the exposure time and the average particle size obtained from the results.

In the case where the exposure time is shorter than 10 minutes, that is, the cases where the exposure time of 0.1 minutes, 0.5 minutes and 1 minute, dispersibility of the carbon dioxide-absorbing substance to the dispersion aid is insufficient to cause

aggregation, and the average particle size of the carbon dioxide-absorbing substance is found to be as large as about 400 nm to about 700 nm. In the case where the exposure time is longer than 1 hour, that is, the cases where the exposure time of 2 hours to 24 hours, there is hardly observed a difference in average particle size from the case of the exposure time of 1 hour.

In the case where the ultrasonic irradiation treatment is performed, the mixture is preferably irradiated with an ultrasonic wave having a frequency of 15 KHz to 60 KHz and an intensity of about 75 W to 600 W under a condition of 40°C to 80°C for a period of 5 minutes to 60 minutes, most preferably an ultrasonic wave having a frequency of 40 KHz and an intensity of 300 W for 30 minutes.

Herein, a particle size distribution measurement is performed at the irradiation times in the ultrasonic irradiation treatment with an ultrasonic wave having a frequency of 40 KHz and an intensity of 300 W under a condition of 60°C, and the results are used to calculate an average particle size at each irradiation time. Figure 46 shows a relationship between the irradiation time and the average particle size obtained from the results.

In the case where the irradiation time is shorter than 5 minutes, that is, the cases where the irradiation time of 0.1 minutes, 0.5 minutes and 1 minute, dispersibility of the carbon dioxide-absorbing substance to the dispersant is insufficient to cause aggregation, and the average particle size of the carbon dioxide-absorbing substance is found to be as large as about 400 nm to about 800 nm. In the case where the irradiation time is longer than 60 minutes, that is, the cases where the irradiation time of 90 minutes, 120 minutes and 180 minutes, there is hardly observed a difference in average particle size from the case of the irradiation time of 60 minutes.

In the case where the stirring treatment is performed, the mixture is preferably stirred under a temperature condition of about 40°C to 80°C at a rotation speed of about 1,000 rpm to 20,000 rpm for a period of 5 minutes to 60 minutes, most preferably under a temperature of 60°C at a rotation speed of 15,000 rpm for 30 minutes.

Herein, a particle size distribution measurement is performed at the stirring times in the stirring treatment at 60°C and a rotation speed of 15000 rpm, and the results are used to calculate an average particle size at each stirring time. Figure 47 shows a

relationship between the stirring time and the average particle size obtained from the results.

In the case where the stirring time is shorter than 5 minutes, that is, the cases where the stirring time of 0.1 minutes, 0.5 minutes and 1 minute, dispersibility of the carbon dioxide-absorbing substance to the dispersant is insufficient to cause aggregation, and the average particle size of the carbon dioxide-absorbing substance is found to be as large as about 400 nm to about 900 nm. In the case where the stirring time is longer than 60 minutes, that is, the cases where the stirring time of 90 minutes, 120 minutes and 180 minutes, there is hardly observed a difference in average particle size from the case of the stirring time of 30 minutes.

In addition, calcium 12-hydroxystearate as the dispersion aid is blended with 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance and 20 parts by weight of ion exchange water while the amount thereof varying in amounts of 50, 20, 10, 5, 1, 0.5, 0.1, 0.05 and 0.01 parts by weight, and the resultant is subjected to the supercritical fluid treatment at a treatment temperature of 60°C and a treatment pressure of 20 MPa for 15 minutes. Figure 48 shows a relationship between the amount of the dispersion aid blended and the average particle size of the carbon dioxide-absorbing substance.

When the amount of the dispersion aid is 50 parts by weight, the average particle size is 1 μm or more, and the carbon dioxide-absorbing substance is aggregated. When the amount of the dispersion aid is 20 parts by weight or less, the average particle size of the carbon dioxide-absorbing substance is gradually reduced, and is the most smallest in an amount of 1 part by weight.

Thereafter, the average particle size becomes larger again and is about 500 nm in an amount of 0.01 parts by weight, and the carbon dioxide-absorbing substance aggregates.

From this, the dispersion aid is preferably added to 100 parts by weight of carbon dioxide-absorbing substance in an amount of 0.1 to 5 parts by weight.

In addition, 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid, and 20 parts by weight of ion exchange water as the dispersion medium are subjected to the supercritical fluid treatment at a treatment temperature of 60°C and a

treatment pressure of 20 MPa for 15 minutes to obtain a carbon dioxide-absorbing substance dispersion liquid, the carbon dioxide-absorbing substance dispersion liquid is mixed with 100 parts by weight of a low-density polyethylene as the resin in an amount of each of 0.001, 0.01, 0.1, 1, 10, 20, 30, 40, 50, 60 and 70 parts by weight to obtain a carbon dioxide-absorbing substance dispersion liquid of the carbon dioxide absorbent. Figure 49 shows a relationship between the amount of the carbon dioxide-absorbing substance dispersion liquid blended and the impact strength, and a relationship between the carbon dioxide-absorbing substance dispersion liquid blended and the carbon dioxide emission amount.

It is confirmed in Figure 49 that when the amounts of the carbon dioxide-absorbing substance dispersion liquid blended are 0.001, 0.01, 0.1, 1, 10, 20 and 30 parts by weight, the carbon dioxide absorbent has such strength as not to break in a tensile impact strength test.

The impact strength is reduced as the amount of the carbon dioxide-absorbing substance dispersion liquid blended is increased, resulting in breaking at 20 kJ/m² in an amount of 40 parts by weight, at 12 kJ/m² in an amount of 50 parts by weight, at 6 kJ/m² in an amount of 60 parts by weight, and at 2 kJ/m² in an amount of 70 parts by weight.

On the contrary, the carbon dioxide emission amount is reduced and exhibits a good value, as the amount of the carbon dioxide-absorbing substance dispersion liquid blended is increased.

From this, in order to obtain a carbon dioxide absorbent good in impact strength and excellent in carbon dioxide emission reduction amount, the carbon dioxide-absorbing substance dispersion liquid is preferably added in an amount of 0.1 to 40 parts by weight to 100 parts by weight of the resin.

Each of various carbon dioxide-absorbing substance dispersion liquids obtained by the above operation is added to the resin while being spayed at a rate of about 100 ml/min, and stirred by a mixer for about 15 minutes to obtain a mixture. Thereafter, the mixture can be kneaded by a twin-screw extruder, a single-screw extruder, a heating-type triple roll, a heating pressure kneader, a Banbury mixer, or the like with a usual method, thereby obtaining a pellet of the carbon dioxide absorbent of the present invention.

Hereinafter, the present invention is described with reference to Production Examples in more detail. It is to be noted that the present invention is not limited to these Production Examples at all.

(Production Example 1)

5 A high-pressure stainless vessel kept at 60°C was charged with 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water and sealed, and a supercritical treatment, in which carbon dioxide was injected so that the pressure was 20 MPa to be made in a supercritical state, the content
10 of the vessel was stirred and mixed for 15 minutes while the temperature and pressure being kept, and carbon dioxide was discharged to return to atmospheric pressure, was performed, thereby obtaining a carbon dioxide-absorbing substance dispersion liquid. Then, a stirring treatment was performed by a mixer for 15 minutes while 30 parts by weight of the carbon dioxide-absorbing substance dispersion liquid were being sprayed
15 to 100 parts by weight of a low density polyethylene resin (Moretec 0168N produced by Prime Polymer Co., Ltd.,) at a rate of 100 ml/min. The resultant was dried in vacuum to remove a water content, and kneaded by a twin-screw extruder having a screw inner diameter of 30 mm, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in
20 Production Example 1 except for the supercritical treatment process was referred to as Comparative Production Example 1.

(Production Example 2)

The supercritical treatment in Production Example 1 was performed with calcium hydroxide as the carbon dioxide-absorbing substance being changed to calcium
25 oxide, and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 2 except for the supercritical treatment process was referred to as
30 Comparative Production Example 2.

(Production Example 3)

The supercritical treatment in Production Example 1 was performed with calcium hydroxide as the carbon dioxide-absorbing substance being changed to amorphous aluminosilicate, and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 3 except for the supercritical treatment process was referred to as Comparative Production Example 3.

(Production Example 4)

The supercritical treatment in Production Example 1 was performed with calcium hydroxide as the carbon dioxide-absorbing substance being changed to barium titanate, and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 4 except for the supercritical treatment process was referred to as Comparative Production Example 4.

(Production Example 5)

The supercritical treatment in Production Example 1 was performed with calcium hydroxide as the carbon dioxide-absorbing substance being changed to lithium silicate, and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 5 except for the supercritical treatment process was referred to as Comparative Production Example 5.

(Production Example 6)

The supercritical treatment in Production Example 1 was performed with calcium 12-hydroxystearate (metal salt of fatty acid) as the dispersion aid being changed to phosphatidylcholine (amphiphilic lipid), and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 6 except for the supercritical treatment process was referred to as Comparative Production Example 6.

(Production Example 7)

5 The supercritical treatment in Production Example 1 was performed with calcium 12-hydroxystearate (metal salt of fatty acid) as the dispersion aid being changed to an olefin/maleic acid copolymer sodium salt (polymeric surfactant), and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

10 In addition, a resin composition obtained by performing the entire process in Production Example 7 except for the supercritical treatment process was referred to as Comparative Production Example 7.

(Production Example 8)

15 The supercritical treatment in Production Example 3 was performed with calcium 12-hydroxystearate (metal salt of fatty acid) as the dispersion aid being changed to phosphatidylcholine (amphiphilic lipid), and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

20 In addition, a resin composition obtained by performing the entire process in Production Example 8 except for the supercritical treatment process was referred to as Comparative Production Example 8.

(Production Example 9)

25 The supercritical treatment in Production Example 3 was performed with calcium 12-hydroxystearate (metal salt of fatty acid) as the dispersion aid being changed to sodium polyacrylate (polymeric surfactant), and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

30 In addition, a resin composition obtained by performing the entire process in Production Example 9 except for the supercritical treatment process was referred to as Comparative Production Example 9.

(Production Example 10)

The supercritical treatment in Production Example 1 was performed with calcium 12-hydroxystearate (metal salt of fatty acid) as the dispersion aid being changed to a polyoxyethylene-type gemini surfactant, POE30-10-ODEs (polymeric surfactant), and the obtained carbon dioxide-absorbing substance dispersion liquid was added to a low density polyethylene resin, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 10 except for the supercritical treatment process was referred to as Comparative Production Example 10.

(Production Example 11)

The carbon dioxide-absorbing substance dispersion liquid obtained after the supercritical treatment in Production Example 1 was added to a PET resin (A-PET FR produced by Teijin Chemicals Ltd.) to obtain a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 11 except for the supercritical treatment process was referred to as Comparative Production Example 11.

(Production Example 12)

The carbon dioxide-absorbing substance dispersion liquid obtained after the supercritical treatment in Production Example 1 was added to a nylon 6 resin (Amilan CM1017 produced by Toray Industries, Inc.) to obtain a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 12 except for the supercritical treatment process was referred to as Comparative Production Example 12.

(Production Example 13)

The carbon dioxide-absorbing substance dispersion liquid obtained after the supercritical treatment in Production Example 1 was added to a PVC resin (SE-1100 produced by Sunarrow Kasei Co., Ltd.) to obtain a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 13 except for the supercritical treatment process was referred to as Comparative Production Example 13.

(Production Example 14)

The carbon dioxide-absorbing substance dispersion liquid obtained after the supercritical treatment in Production Example 1 was added to a PS resin (HIPS 475D produced by PS Japan Corporation) to obtain a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in
5 Production Example 14 except for the supercritical treatment process was referred to as Comparative Production Example 14.

(Production Example 15)

A glass vessel was charged with 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate
10 as the dispersion aid and 20 parts by weight of ion exchange water, and under a condition of 60°C, an ultrasonic irradiation treatment, in which an ultrasonic wave having a frequency of 40 KHz and an output of 300 W was radiated by an ultrasonic homogenizer for 15 minutes, was performed, thereby obtaining a carbon dioxide-absorbing substance dispersion liquid. Then, a stirring treatment was performed by a mixer for 15 minutes
15 while 30 parts by weight of the carbon dioxide-absorbing substance dispersion liquid were being sprayed to 100 parts by weight of a low density polyethylene resin at a rate of 100 ml/min. The resultant was dried in vacuum to remove a water content, and kneaded by a twin-screw extruder having a screw inner diameter of 30 mm, thereby obtaining a pellet-like carbon dioxide absorbent.

20 In addition, a resin composition obtained by performing the entire process in Production Example 15 except for the ultrasonic irradiation treatment process was referred to as Comparative Production Example 15. Herein, Comparative Production Example 15 is the same as Comparative Production Example 1.

(Production Example 16)

25 The ultrasonic irradiation treatment in Production Example 15 was performed on a mixture obtained by mixing amorphous aluminosilicate as the carbon dioxide-absorbing substance and phosphatidylcholine (amphiphilic lipid) as the dispersion aid, and the obtained carbon dioxide-absorbing substance dispersion liquid was subjected to the same method as in Production Example 15 to obtain a pellet-like resin for achieving
30 reduction in carbon dioxide emission amount.

In addition, a resin composition obtained by performing the entire process in Production Example 16 except for the ultrasonic irradiation treatment process was

referred to as Comparative Production Example 16. Herein, Comparative Production Example 16 is the same as Comparative Production Example 8.

(Production Example 17)

5 A stainless vessel was charged with 100 parts by weight of calcium hydroxide as the carbon dioxide-absorbing substance, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water, and under a condition of 60°C, the stainless vessel was set to a stirring machine (CLEARMIX CLM-0.8S manufactured by M Technique Co., Ltd.) to perform a stirring treatment at a rotation number of 10,000 rpm for 30 minutes, thereby obtaining a carbon dioxide-absorbing
10 substance dispersion liquid. Then, a stirring treatment was performed by a mixer for 15 minutes while 30 parts by weight of the carbon dioxide-absorbing substance dispersion liquid being sprayed to 100 parts by weight of a low density polyethylene resin at a rate of 100 ml/min. The resultant was dried in vacuum to remove a water content, and kneaded by a twin-screw extruder having a screw inner diameter of 30 mm, thereby
15 obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 17 except for the stirring treatment process was referred to as Comparative Production Example 17. Herein, Comparative Production Example 17 is the same Comparative Production Example 1.

20 (Production Example 18)

The stirring treatment in Production Example 17 was performed on a mixture obtained by mixing amorphous aluminosilicate as the carbon dioxide-absorbing substance and phosphatidylcholine (amphiphilic lipid) as the dispersion aid, and the obtained carbon dioxide-absorbing substance dispersion liquid was subjected to the same
25 method as in Production Example 17 to obtain a pellet-like resin for achieving reduction in carbon dioxide emission amount.

In addition, a resin composition obtained by performing the entire process in Production Example 18 except for the stirring treatment process was referred to as Comparative Production Example 18. Herein, Comparative Production Example 18 is
30 the same as Comparative Production Example 8.

(Production Example 19)

A stainless vessel was charged with 100 parts by weight of a coconut mesocarp fiber as the carbon dioxide-absorbing substance of the organic compound, 1 part by weight of calcium 12-hydroxystearate as the dispersion aid and 20 parts by weight of ion exchange water, and under a condition of 60°C, the stainless vessel was set to a stirring machine (CLEARMIX CLM-0.8S manufactured by M Technique Co., Ltd.) to perform a stirring treatment at a rotation number of 10,000 rpm for 30 minutes, thereby obtaining a carbon dioxide-absorbing substance dispersion liquid. Then, a stirring treatment was performed by a mixer for 15 minutes while 30 parts by weight of the carbon dioxide-absorbing substance dispersion liquid being sprayed to 100 parts by weight of a low density polyethylene resin (Moretec 0168N produced by Prime Polymer Co., Ltd.) at a rate of 100 ml/min. The resultant was dried in vacuum to remove a water content, and kneaded by a twin-screw extruder having a screw inner diameter of 30 mm, thereby obtaining a pellet-like carbon dioxide absorbent.

In addition, a resin composition obtained by performing the entire process in Production Example 19 except for the stirring treatment process was referred to as Comparative Production Example 19.

Evaluations for the carbon dioxide absorbents in Production Example 1 to Production Example 19 and resin compositions in Comparative Production Example 1 to Comparative Production Example 19 were performed by tensile impact strength measurement (method described in JISK7160), Tensile Yield Stress Measurement (method described in JISK7161), bending elastic modulus measurement (method described in JISK7171), and carbon dioxide emission amount measurement (method described in JISK7217). Specific evaluation methods are described hereafter.

Evaluation methods

(Impact Strength Measurement)

A digital impact tester, DR-IB tester (manufactured by Toyo Seiki Seisaku-sho, Ltd.) was used for measurement.

In accordance with the material standards regulated by JIS standards, each of the pellet-like carbon dioxide absorbents of Production Example 1 to Production Example 19 and the resin compositions of Comparative Production Example 1 to Comparative Production Example 19 was directly molded by injection molding to prepare a notched sheet-shaped test piece having a length of 80 mm, a width of 10 mm and a thickness of 4

mm, or once molded by compression molding or injection molding into a sheet material and then the sheet material was processed by cutting to prepare a test piece having the dimension. Measurement was performed by fixing one end of the test piece to a gripping tool fixed to a base, and the other end thereof to a movable cross-head support base, respectively, and striking the cross-head support base with a striker having any weight at an impact speed of 3.46 m/s. The measurement was performed 10 times for each case.

(Tensile Yield Stress Measurement)

A strograph HT tester (manufactured by Toyo Seiki Seisaku-sho, Ltd.) was used for measurement.

In accordance with the material standards regulated by JIS standards, each of the pellet-like carbon dioxide absorbents of Production Example 1 to Production Example 19 and the resin compositions of Comparative Production Example 1 to Comparative Production Example 19 was directly molded by injection molding to prepare a dumbbell-shaped sheet-shaped test piece having a parallel section measuring 20 mm × 5 mm and having a length of 100 mm, a width of 25 mm and a thickness of 4 mm, or once molded by compression molding or injection molding into a sheet material and then the sheet material was processed by cutting to prepare a test piece having the dimension. Measurement was performed by fixing both ends of the test piece and applying constant tensile weight in the length direction of the test piece to measure stress at each point and strain corresponding to the stress, thereby determining yield stress at a yield point from a stress-strain curve. The measurement was performed 5 times for each case.

(Bending Elastic Modulus Measurement)

A bend graph-2 tester (manufactured by Toyo Seiki Seisaku-sho, Ltd.) was used for measurement.

In accordance with the material standards regulated by JIS standards, each of the pellet-like carbon dioxide absorbents of Production Example 1 to Production Example 19 and the resin compositions of Comparative Production Example 1 to Comparative Production Example 19 was directly molded by injection molding to prepare a sheet-shaped test piece having a length of 80 mm, a width of 10 mm and a thickness of 4 mm, or once molded by compression molding or injection molding into a sheet material and then the sheet material was processed by cutting to prepare a test piece having the

dimension. Measurement was performed by free-supporting both ends of the test piece at a fulcrum interval of 64 mm, and applying bending weight (testing stress) to the center between the fulcrums by a pressurizing wedge to measure breaking stress and deflection. The measurement was performed 5 times for each case.

5 (Carbon Dioxide Emission Amount Measurement)

A plastic flammability tester (manufactured by Sugiyama-Gen Co., Ltd.) was used for measurement.

The test piece weighing 0.1 g resulted from each of the carbon dioxide absorbents of Production Example 1 to Production Example 19 and the resin compositions of Comparative Production Example 1 to Comparative Production Example 19 was used for a specimen. Measurement was performed by burning 0.1 g of the specimen under conditions of a gas feeding rate of 0.5 L/min and a setting temperature of 750°C for 10 minutes to measure the total emission amount of carbon dioxide generated in this time. The measurement was performed 3 times for each case.

15 Figure 35 shows the evaluation results for the carbon dioxide emission amount, the tensile yield stress, the bending elastic modulus and the tensile impact strength of each Production Example, and Figure 36 shows the evaluation results for the carbon dioxide emission amount, the tensile yield stress, the bending elastic modulus and the tensile impact strength of each Comparative Production Example, respectively. Each of the evaluation results was indicated as an average value in relation to the number of the measurement times.

Regarding to all combinations of the carbon dioxide-absorbing substance, the dispersion aid and the resin, the carbon dioxide emission amount is found to be significantly reduced in each Production Example where the mixture of the carbon dioxide-absorbing substance and the dispersion aid was subjected to the dispersion treatment, as compared with that in each Comparative Production Example where no dispersion treatment was performed.

In addition, favorable values are indicated in each Production Example for mechanical properties such as tensile yield stress, bending elastic modulus and tensile impact strength, as compared with values in each Comparative Production Example.

Furthermore, it has been confirmed that when the mechanical strength in each Production Example is compared with the mechanical strength of the simple resin used in

each Production Example as 100%, it is as sufficient as 90 to 70% in most of Production Examples. Although the mechanical strength is inferior in some Production Examples, the carbon dioxide absorbents of such Production Examples may be used for applications in which such a load is not applied.

5 In order to describe the carbon dioxide emission amount reduction performance of the present invention in more detail, comparisons of the carbon dioxide emission amount on the type of the carbon dioxide-absorbing substance, the type of the dispersion aid, the type of the resin and the type of the dispersion treatment method are discussed below.

10 (Comparison of Carbon Dioxide Emission Amounts on Types of Carbon Dioxide-Absorbing Substances)

The reduction amounts of carbon dioxide emission were compared with respect to calcium hydroxide (Production Example 1 and Comparative Production Example 1), calcium oxide (Production Example 2 and Comparative Production Example 2),
15 amorphous aluminosilicate (Production Example 3 and Comparative Production Example 3), barium titanate (Production Example 4 and Comparative Production Example 4), and lithium silicate (Production Example 5 and Comparative Production Example 5), as the carbon dioxide-absorbing substances.

Herein, calcium 12-hydroxystearate was used for the dispersion aid, and a low
20 density polyethylene resin (LLDPE) was used for the resin.

As shown in Figure 37, regarding to all of the carbon dioxide-absorbing substances, significant reduction in carbon dioxide emission amount was observed. The reductions in emission amount realized were 51.6% in the case of calcium hydroxide, 52.5% in the case of calcium oxide, 56.4% in the case of amorphous aluminosilicate,
25 55.0% in the case of barium titanate, and 53.4% in the case of lithium silicate.

In particular, amorphous aluminosilicate being one aluminosilicate exhibited the most favorable result of 56.4%.

(Comparison of Carbon Dioxide Emission Amounts on Types of Dispersion Aids)

30 The reduction amounts of carbon dioxide emission were compared in the case where calcium hydroxide was used as the carbon dioxide-absorbing substance, with respect to calcium 12-hydroxystearate (Production Example 1 and Comparative

Production Example 1), phosphatidylcholine (Production Example 6 and Comparative Production Example 6), an olefin/maleic acid copolymer sodium salt (Production Example 7 and Comparative Production Example 7), and POE30-10-ODEs (Production Example 10 and Comparative Production Example 10), as the dispersion aids.

As shown in Figure 38(a), regarding to all of the dispersion aids, significant reduction in carbon dioxide emission amount was observed. The reductions in carbon dioxide emission amount realized were 51.6% in the case of calcium 12-hydroxystearate, 52.5% in the case of phosphatidylcholine, 51.8% in the case of olefin/maleic acid copolymer sodium salt, and 53.8% in the case of POE30-10-ODEs.

In particular, POE30-10-ODEs being one polymeric surfactant exhibited the most favorable result of 53.8%.

Furthermore, the reduction amounts of carbon dioxide emission were compared in the case where amorphous aluminosilicate that exhibited the most favorable reduction amount in the comparison on the carbon dioxide-absorbing substances was used as the carbon dioxide-absorbing substance, with respect to calcium 12-hydroxystearate (Production Example 3 and Comparative Production Example 3), phosphatidylcholine (Production Example 8 and Comparative Production Example 8), and sodium polyacrylate (Production Example 9 and Comparative Production Example 9), as the dispersion aids.

As illustrated in Figure 38(b), more favorable values were exhibited as a whole than the case of calcium hydroxide as the carbon dioxide-absorbing substance, and the reductions in emission amount realized were 56.4% in the case of calcium 12-hydroxystearate, 51.5% in the case of phosphatidylcholine, and 55.0% in the case of sodium polyacrylate.

In particular, calcium 12-hydroxystearate being metal salt of fatty acid exhibited the most favorable result of 56.4%.

The evaluation results indicate that while a few combinations of the carbon dioxide-absorbing substance and the dispersion aid are observed to be effective, in all of such combinations, there is seen no significant difference in the carbon dioxide emission amount based on combinations.

(Comparison of Carbon Dioxide Emission Amounts on Types of Resins)

The reduction amounts of carbon dioxide emission were compared in the case where, as a mixture of calcium hydroxide as the carbon dioxide-absorbing substance and calcium 12-hydroxystearate as the dispersion aid, a low density polyethylene resin (LLDPE) (Production Example 1 and Comparative Production Example 1), a PET resin (Production Example 11 and Comparative Production Example 11), a nylon 6 resin (Production Example 12 and Comparative Production Example 12), a polyvinylidene chloride resin (PVC) (Production Example 13 and Comparative Production Example 13), and a polystyrene resin (PS) (Production Example 14 and Comparative Production Example 14) were used.

As shown in Figure 39, very little difference in effect based on the resins was observed. Regarding all the resins, significant reduction in carbon dioxide emission amount was observed. The reductions in emission amount realized were 51.6% in the case of LLDPE, 42.0% in the case of PET, 52.0% in the case of nylon 6, 51.3% in the case of PVC, and 52.5% in the case of PS.

(Comparison of Carbon Dioxide Emission Amounts on Types of Dispersion Treatment Methods)

The reduction amounts of carbon dioxide emission were compared in the case where to a mixture of calcium hydroxide as the carbon dioxide-absorbing substance and calcium 12-hydroxystearate as the dispersant was used, no dispersion treatment was performed (Comparative Production Example 1), the supercritical fluid treatment was performed (Production Example 1), the ultrasonic irradiation treatment was performed (Production Example 15), and the stirring treatment was performed (Production Example 17), as the dispersion treatment methods.

As shown in Figure 40(a), regarding all the dispersion treatment methods, the carbon dioxide emission amount was reduced by about half as compared with the case where no dispersion treatment was performed. The reductions in emission amount realized were 51.6% in the case of supercritical fluid treatment, 51.6% in the case of ultrasonic irradiation treatment, and 51.9% in the case of stirring treatment.

Furthermore, the reduction amounts of carbon dioxide emission were compared in the case where to a mixture of amorphous aluminosilicate as the carbon dioxide-absorbing substance and phosphatidylcholine as the dispersion aid, no dispersion treatment was performed (Comparative Production Example 8), the supercritical fluid

treatment was performed (Production Example 8), the ultrasonic irradiation treatment was performed (Production Example 16), and the stirring treatment was performed (Production Example 18), as the dispersion treatment methods.

As shown in Figure 40(b), regarding all the dispersion treatment methods, the carbon dioxide emission amount was reduced by about half as compared with the case where no dispersion treatment was performed, as in the case where calcium hydroxide was used as the carbon dioxide-absorbing substance and calcium 12-hydroxystearate was used as the dispersant. The reductions in emission amount realized were 51.5% in the case of supercritical fluid treatment, 53.5% in the case of ultrasonic irradiation treatment, and 51.5% in the case of stirring treatment.

From this, regardless of the types of the dispersion treatment methods, extremely useful evaluation results were obtained in that by subjecting the mixture of the carbon dioxide-absorbing substance and the dispersion aid to the dispersion treatment to enhance dispersibility of the carbon dioxide-absorbing substance in the resin, the carbon dioxide emission amount of the obtained carbon dioxide absorbent was reduced by about 50%.

Since such a carbon dioxide absorbent of the present invention also has the inherent characteristics of resin, existing resin products are easily converted to the carbon dioxide absorbent, and therefore early effects of suppressing global warming can be realized.

It is to be noted that the carbon dioxide absorbent of the present invention is not limited to the above type and can be variously modified if necessary.

According to the carbon dioxide absorbent of the present invention, by subjecting the mixture of the carbon dioxide-absorbing substance and the dispersion aid to the dispersion treatment and then adding the mixture to the resin, the carbon dioxide absorbent can be dispersed in the resin while preventing the carbon dioxide-absorbing substance which is incompatible with the resin from aggregating in the resin. Thus, a high effect of absorbing carbon dioxide can be achieved.

In addition, since dispersibility can be enhanced so as to increase the surface area of the carbon dioxide-absorbing substance in contact with the resin, thereby achieving a high effect of absorbing carbon dioxide with small amount of the carbon dioxide-absorbing substance. Thus, the amount of the carbon dioxide-absorbing

substance added to the resin can be reduced, thereby enabling to considerably extend applications without impairing the inherent characteristics of resin, such as lightness in weight and easiness in molding.

Furthermore, the carbon dioxide-absorbing substance added can be
5 appropriately selected depending on applications to thereby produce a carbon dioxide absorbent light in weight and high in impact resistance.

The carbon dioxide absorbent for use in the present invention is preferably sodium aluminosilicate.

The sodium aluminosilicate is preferably encapsulated in a phospholipid.

10 The sodium aluminosilicate is preferably contained in a ribosome.

Hereinafter, Production Examples of the carbon dioxide absorbent especially suitable for the present invention is described.

Adjustment of Carbon Dioxide Absorbent

In 130 g of water were dissolved 6 g of sodium aluminate (produced by Wako
15 Pure Chemical Industries Ltd., special grade) and 30 g of sodium silicate (produced by Wako Pure Chemical Industries Ltd., special grade), and stirred at 30°C for 60 minutes. After the stirring, amorphous sodium aluminosilicate was produced by centrifugal separation.

Adjustment of NVC (liposome)

20 A liposome containing the amorphous sodium aluminosilicate (carbon dioxide absorbent) was prepared by a supercritical reverse phase evaporation method and an apparatus disclosed in the following supercritical reverse phase evaporation method publications *.

(*Japanese National Republication of International Patent Application No.
25 02/032564, Japanese Patent Application Laid-Open No. 2003-119120, Japanese Patent Application Laid-Open No. 2005-298407 and Japanese Patent Application Laid-Open No. 2008-063284)

Specifically, a high-pressure stainless vessel kept at 60°C was charged with 0.15
30 to 0.35 parts by weight of sodium aluminosilicate having an average particle size of 10 to 500 nm, 5 parts by weight of phosphatidylcholine as a phospholipid and 100 parts by weight of ion exchange water and sealed, and a supercritical treatment, in which carbon dioxide was injected so that the pressure was 20 MPa to be made in a

supercritical state, the content of the vessel was stirred and mixed for 15 minutes while the temperature and pressure being kept, and carbon dioxide was discharged to return to atmospheric pressure, was performed, thereby obtaining a solution containing a liposome encapsulating sodium aluminosilicate in a phospholipid.

Herein, the phospholipid may include, in addition to the phosphatidylcholine, glycerophospholipids such as phosphatidylethanolamine, phosphatidylserine, phosphatidic acid, phosphatidylglycerol, phosphatidylinositol, cardiopine, egg yolk lecithin, hydrogenated egg yolk lecithin, soy lecithin and hydrogenated soy lecithin, and sphingophospholipids such as sphingomyelin, ceramide phosphorylethanolamine and ceramide phosphorylglycerol.

In addition, the carbon dioxide in a supercritical state means carbon dioxide that is in a supercritical state having a critical temperature (30.98°C) and a critical pressure (7.3773 ± 0.0030 MPa) or more, and the carbon dioxide having a temperature of the supercritical point or more or under the pressure condition means carbon dioxide under the condition above the critical condition about only one of the critical temperature or the critical pressure (provided that the other is not above the critical condition).

Such a carbon dioxide absorbent is excellent in dispersibility in an adhesive or resin, and is suitable for the present invention.

In the present application, the average particle size means a volume average particle size.

{Industrial Applicability}

The present invention provides a label, a top layer material formed on a printing medium, an information-bearing medium, a solid fuel and a wristband clip, with which existing products can be replaced, to thereby enable to realize a new carbon dioxide reduction method, and has industrial applicability.

{Reference Signs List}

- 101 label (first embodiment, Figure 1 to Figure 3)
- 102 band-shaped backing paper
- 103 label strip
- 104 label substrate

	105	adhesive layer
	106	carbon dioxide absorbent
	107	refuse bag (Portion (1) in Figure 3)
	108	refuse
5	109	incinerator (Portion (2) in Figure 3)
	110	incinerating burner
	120	label (second embodiment, Figure 4)
	121	label strip
	122	carbon dioxide absorbent layer
10	123	bonding adhesive layer
	130	label (third embodiment, Figure 5)
	131	label strip
	140	label (fourth embodiment, Figure 6)
	141	label strip
15	201	thermal transfer ink ribbon (top layer formation material, fifth embodiment, Figure 8)
	202	back coat layer
	203	PET film layer
	204	anchor coat layer
20	205	carbon ink layer
	206	ribbon core tube
	207	carbon ink
	208	carbon dioxide absorbent
	209	manufacturing apparatus of thermal transfer ink ribbon 201 (Figure 9)
25	210	ribbon film substrate
	211	ink vessel
	212	gravure printing roll
	213	backup roll
	214	large winding roll
30	215	small winding device
	216	thermal printer (Figure 10)
	217	label-feeding portion

	218	label-printing portion
	219	backing paper-turning portion
	220	backing paper-winding up portion
	221	continuous label (printing medium)
5	222	backing paper
	223	label strip
	224	label substrate
	225	adhesive layer
	226	thermal head
10	227	platen roller
	228	ribbon-feeding portion
	229	ribbon-winding up portion
	230	incinerator (Figure 11)
	231	incinerating burner
15	232	object of attachment or object of pasting
	233	carbon dioxide absorbent layer (Figure 8)
	240	advertising label (printing medium, Figure 12)
	241	backing paper
	242	advertising label strip
20	243	label substrate
	244	adhesive layer
	245	advertising information
	246	printing ink (top layer formation material)
	247	manufacturing apparatus of advertising label 240 (Figure 14)
25	248	label substrate
	249	printing portion
	250	ink vessel
	251	printing cylinder
	252	impression cylinder
30	253	debris removal unit
	254	large winding roll
	255	small winding device

	260	identifying label (printing medium, Figure 15)
	261	backing paper
	262	identifying label strip
	263	label substrate
5	264	adhesive layer
	265	identifying printing layer
	266	surface coating layer (top layer formation material)
	267	coating agent
	301	tag (information-bearing medium, eighth embodiment, Figure 17, Figure 18)
10	302	thermal printer (Figure 18)
	303	medium body
	304	cutting line
	305	one tag strip
	306	carbon dioxide absorbent
15	307	tag-feeding portion
	308	tag-printing portion
	309	tag-cutting portion
	310	thermal head
	311	platen roller
20	312	thermal transfer ink ribbon
	313	ribbon-feeding portion
	314	ribbon-winding up portion
	315	stationary knife
	316	movable knife
25	317	variable information
	318	incinerator (Figure 19)
	319	incinerating burner
	320	object of pasting or object of attachment
	321	carbon dioxide absorbent layer (Figure 18)
30	330	wristband (information-bearing medium, ninth embodiment, Figure 20)
	331	center indicate region
	332	first attachment region

	333	second attachment region
	334	visible information
	335	bar code information
	336	attachment hole
5	337	selection hole
	338	attachment tool
	339	base substrate
	340	coat layer
	341	embossed layer
10	342	first intermediate layer
	343	second intermediate layer
	344	third intermediate layer
	345	carbon dioxide absorbent layer (Figure 21)
	350	wristband (information-bearing medium, tenth embodiment, Figure 22)
15	351	base substrate
	352	adhesive layer
	353	embossed layer
	354	carbon dioxide absorbent layer (Figure 23)
	355	cut-off line
20	356	release region
	360	point card (information-bearing medium, eleventh embodiment, Figure 24)
	361	constant information
	362	variable information
	363	variable information
25	364	base substrate
	365	carbon dioxide absorbent layer (Figure 25)
	401	solid fuel (twelfth embodiment, Figure 26)
	402	flammable body
	403	carbon dioxide absorbent
30	404	cardboard box
	405	label
	406	sticker

	407	thermal transfer ink ribbon
	408	chip
	409	plant (Figure 28)
	410	boiler (Figure 28)
5	510	wristband clip (clip)
	512	male clip portion
	512a, 512b	circular portion
	514	female clip portion
	514a, 514b	circular portion
10	516	hinge
	516a	flexion portion
	520	boss
	522	boss hole
	523	shaft portion
15	524	engagement portion
	525	constricted portion
	526	non-return portion
	527	holding portion
	528	retaining portion
20	529	notch
	530	wristband
	531	band main body
	531a, 531b	band portion
	532	display portion
25	534	identification data
	536	band hole
	538	setting hole
	540	carbon dioxide absorbent
	550	incinerator
30	552	incinerating burner

{CLAIMS}

5 1. An information-bearing medium comprising a medium body and capable of
bearing information on the medium body, wherein
 the medium body has a structure including at least two layers, and
 a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of
the information-bearing medium, is added to any one of the layers.

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2. An information-bearing medium comprising a medium body and capable of bearing information on the medium body, wherein

5 the medium body has a structure including at least two layers, and
a layer of a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the information-bearing medium, is laminated on any one of the layers.

3. The information-bearing medium according to claim 1 or claim 2, wherein the
10 information-bearing medium is a thermal paper.

4. The information-bearing medium according to claim 3, wherein the carbon dioxide absorbent is added to a heat-sensitive color-forming layer of the thermal paper.

5 5. The information-bearing medium according to claim 1 or claim 2, wherein the information-bearing medium is a thermal paper,

wherein the thermal paper is formed by laminating a heat-sensitive color-forming layer on the medium body composed of a paper material, and

10 wherein the carbon dioxide absorbent is added to the heat-sensitive color-forming layer.

6. The information-bearing medium according to claim 1 or 2, wherein the information-bearing medium is a thermal paper,

15 wherein the thermal paper is formed by laminating a heat-sensitive color-forming layer on the medium body composed of a plastic material, and

wherein the carbon dioxide absorbent is added to the heat-sensitive color-forming layer.

7. The information-bearing medium according to claim 1 or 2, wherein the
20 information-bearing medium is used for a printer.

8. The information-bearing medium according to any one of claims 1 to 7, wherein the carbon dioxide absorbent is particulate.

9. The information-bearing medium according to claim 8, wherein the carbon
25 dioxide absorbent is particulate to nanometer in size.

10. The information-bearing medium according to any one of claims 1 to 9, wherein the carbon dioxide absorbent is uniformly dispersed.

30 11. The information-bearing medium according to any one of claims 1 to 10, wherein the carbon dioxide absorbent is added at a mixing ratio of 0.01 weight % or

more and 0.10 weight % or less to the one of the layers to which the carbon dioxide absorbent is added.

5 12. A carbon dioxide reduction method using an information-bearing medium, the method comprising:

preparing an information-bearing medium having a medium body with a structure including at least two layers, wherein a carbon dioxide absorbent is added to any one of the layers of the medium body capable of bearing information; and

10 incinerating the information-bearing medium to allow the carbon dioxide absorbent to absorb carbon dioxide.

13. A carbon dioxide reduction method using an information-bearing medium, the method comprising:

15 preparing an information-bearing medium having a medium body with a structure including at least two layers, wherein a layer of a carbon dioxide absorbent is laminated on any one of the layers of the medium body capable of bearing information; and

20 incinerating the information-bearing medium to allow the carbon dioxide absorbent to absorb carbon dioxide.

14. The carbon dioxide reduction method according to claim 12, wherein the carbon dioxide absorbent is added at a mixing ratio of 0.01 weight % or more and 0.10 weight % or less to the one of the layers to which the carbon dioxide absorbent is added.

25 15. A label comprising:
a label substrate; and
an adhesive layer applied to a rear surface of the label substrate, wherein

a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of the label, is added to at least any one of the label substrate and the adhesive layer.

- 5 16. A label comprising:
 a label substrate; and
 an adhesive layer applied to a rear surface of the label substrate, wherein
 a layer of a carbon dioxide absorbent, which absorbs carbon dioxide during
incineration of the label, is laminated on at least any one of the label substrate and the
10 adhesive layer.
17. A label comprising:
 a label substrate formed of a paper material; and
 an adhesive layer applied to a rear surface of the label substrate, wherein
15 a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of
the label, is added to the adhesive layer.
18. A label comprising:
 a label substrate;
20 an adhesive layer applied to a rear surface of the label substrate; and
 a backing paper temporarily attached to the adhesive layer, wherein
 a carbon dioxide absorbent, which absorbs carbon dioxide during incineration of
the label, is added to any one of the label substrate, the adhesive layer and the backing
25 paper.
19. The label according to any one of claims 15 to 18, wherein the label is used for a
printer.
20. The label according to any one of claims 15 to 19, wherein the carbon dioxide
30 absorbent is particulate.
21. The label according to claim 20, wherein the carbon dioxide absorbent is
particulate to nanometer in size.

22. The label according to any one of claims 15 to 21, wherein the carbon dioxide absorbent is uniformly dispersed.

5 23. The label according to any one of claims 15 to 22, wherein the carbon dioxide absorbent is added at a mixing ratio of 0.01 weight % or more and 0.10 weight % or less to the one of the label substrate and the adhesive layer to which the carbon dioxide absorbent is added.

10 24. A carbon dioxide reduction method using a label, the method comprising:
preparing a label comprising a label substrate and an adhesive layer applied to a rear surface of the label substrate, in which a carbon dioxide absorbent is added to any one of the label substrate and the adhesive layer; and
incinerating the label to allow the carbon dioxide absorbent to absorb carbon
15 dioxide.

25. A carbon dioxide reduction method using a label, the method comprising:
preparing a label having a label substrate and an adhesive layer applied to a rear surface of the label substrate, in which a carbon dioxide absorbent layer is laminated on
20 any one of the label substrate and the adhesive layer; and
incinerating the label to allow a carbon dioxide absorbent of the carbon dioxide absorbent layer to absorb carbon dioxide.

26. The carbon dioxide reduction method using the label according to claim 24,
25 wherein the carbon dioxide absorbent is added at a mixing ratio of 0.01 weight % or more and 0.10 weight % or less to the one of the label substrate and the adhesive layer to which the carbon dioxide absorbent is added.

27. A thermal transfer ink ribbon used for printing on a printing sheet, wherein a
30 carbon dioxide absorbent is added to any one of layers of the thermal transfer ink ribbon, wherein the thermal transfer ink ribbon does not include, in an ink receiving layer thereof, zeolite into whose structure an antibacterial ion is taken.

28. A thermal transfer ink ribbon used for printing on a printing sheet, wherein a layer of a carbon dioxide absorbent is laminated on any one of layers of the thermal transfer ink ribbon, wherein the thermal transfer ink ribbon does not include, in an ink receiving layer thereof, zeolite into whose structure an antibacterial ion is taken.

29. The thermal transfer ink ribbon according to claim 27 or 28, including a film layer and a thermal transfer ink layer.

30. The thermal transfer ink ribbon according to claim 27 or 28, including a back coat layer, a film layer, an anchor coat layer and a thermal transfer ink layer.

31. The thermal transfer ink ribbon according to claim 29 or 30, wherein the carbon dioxide absorbent is added to the thermal transfer ink layer.

32. The thermal transfer ink ribbon according to claim 29 or 30, wherein the carbon dioxide absorbent is added to the film layer.

33. The thermal transfer ink ribbon according to claim 30, wherein the carbon dioxide absorbent is added to the back coat layer.

34. The thermal transfer ink ribbon according to claim 30, wherein the carbon dioxide absorbent is added to the anchor coat layer.

35. The thermal transfer ink ribbon according to claim 29 or 30, wherein the film layer has a thickness of 4.5 to 6 μm .

36. The thermal transfer ink ribbon according to any one of claims 27 to 35, wherein the thermal transfer ink ribbon is used for a printer.

37. The thermal transfer ink ribbon according to any one of claims 27 to 36, wherein the carbon dioxide absorbent is particulate.

38. The thermal transfer ink ribbon according to claim 37, wherein the carbon dioxide absorbent is particulate to nanometer in size.

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39. The thermal transfer ink ribbon according to any one of claims 27 to 38, wherein the carbon dioxide absorbent is uniformly dispersed.

40. The thermal transfer ink ribbon according to any one of claims 27 to 39, wherein
10 the carbon dioxide absorbent is added at a mixing ratio of 0.01 weight % or more and 0.10 weight % or less to the one of the layers to which the carbon dioxide absorbent is added.

41. A carbon dioxide reduction method using a thermal transfer ink ribbon, the
15 method comprising:

preparing a thermal transfer ink ribbon used for printing on a printing sheet, the thermal transfer ink ribbon including a carbon dioxide absorbent in any one of layers of the thermal transfer ink ribbon; and

incinerating the thermal transfer ink ribbon to allow the carbon dioxide
20 absorbent to absorb carbon dioxide.

42. A carbon dioxide reduction method using a thermal transfer ink ribbon, the method comprising:

preparing a thermal transfer ink ribbon used for printing on a printing sheet,
25 wherein a layer of a carbon dioxide absorbent is laminated on any one of layers of the thermal transfer ink ribbon; and

incinerating the thermal transfer ink ribbon to allow the carbon dioxide absorbent to absorb carbon dioxide.

30 43. The carbon dioxide reduction method using a thermal transfer ink ribbon according to claim 41, wherein the carbon dioxide absorbent is added at a mixing ratio of

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0.01 weight % or more and 0.10 weight % or less to the one of layers to which the carbon dioxide absorbent is added.

{ABSTRACT}

Provided are a label, a top layer material formed on a printing medium, an information-bearing medium, a solid fuel and a wristband clip having the function of absorbing carbon dioxide, and carbon dioxide reduction methods using the same.

Provided are labels 101, 120, 130 and 140, top layer materials formed on a printing medium 201, 246 and 266, information-bearing media 301, 330, 350 and 360, a solid fuel 401, and a wristband clip 510, to which a new carbon dioxide absorbent is added.

Provided are also carbon dioxide reduction methods of absorbing carbon dioxide by

burning the same.