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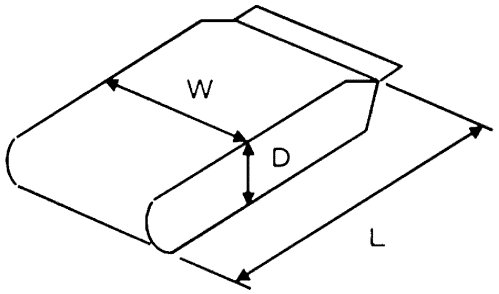
(54) PACKING METHOD AND TRANSPORTATION METHOD FOR CELLULOSE POLYMERS, AND PACKED CELLULOSE POLYMER

(57) A problem to be solved is to provide a packaging method suitable for transporting a cellulosic polymer, and another problem to be solved is to provide a packaging method suitable for transportation while suppressing the viscosity reduction of the cellulosic polymer.

The cellulosic polymer is packaged so as to meet the following conditions (1), (2), and (3):
(1) the packaging bag having a gas barrier property is filled with a cellulosic polymer;
(2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packaging bag was sealed; and
(3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy the relational expression of $6.1 \leq L/D \leq 10$.

[Fig. 1]



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Description

Technical Field

[0001] The present invention relates to a method for packaging a cellulosic polymer and applications of the same.

Background Art

[0002] Polymers derived from cellulose, such as hydroxyethyl cellulose, carboxymethyl cellulose, hydroxymethyl cellulose, and hydroxypropyl cellulose, are used in various fields, such as medicine and food, due to their high safety. For example, carboxymethyl cellulose is used in thickeners and emulsion stabilizers in foods, such as ice cream, as well as in non-food products, such as toothpastes, laxatives, diet tablets, aqueous inks, surfactants, and paper products.

[0003] Conventionally, cellulosic polymers are typically stored in powder form. However, the viscosity of the solution of the cellulosic polymer stored for a long period of time is greatly reduced as compared with the viscosity of the solution of the cellulosic polymer before storage, and thus there has been a problem that the cellulosic polymer cannot function as a viscosity regulator.

[0004] Therefore, Patent Document 1 proposes a storage method for suppressing viscosity reduction due to oxidation or others by keeping the oxygen concentration in the packaging bag at a constant level or less.

Citation List

Patent Literature

[0005] Patent Document 1: Japanese Unexamined Patent Application Publication No. 2012-121957

Summary of Invention

Technical Problem

[0006] Patent Document 1 proposes a method of reducing the residual oxygen concentration in the packaging bag as much as possible by nitrogen substitution to decrease the viscosity reduction to the maximum extent; however, the nitrogen substitution in the packaging bag to the maximum extent would inflate the packaging bag by internal pressure, thereby making it difficult to pack the packaging bag or to mutually stack the packaging bags for transportation.

[0007] In view of the above, one of the problems to be solved is to provide a packaging method suitable for transporting a cellulosic polymer.

[0008] In addition, one of the further problems to be solved is to provide a packaging method suitable for transportation or others while suppressing the viscosity reduction of the cellulosic polymer.

Solution to Problem

[0009] The invention presented in the present disclosure can be perceived in various aspects, and, for example, may include for solution(s) to the problem(s), as follows. That is, the present invention has the following aspects [1] to [20].

[1] A method for packaging a cellulosic polymer, comprising: filling a packaging bag having a gas barrier property with the cellulosic polymer; and sealing the packaging bag.

[2] The method for packaging a cellulosic polymer according to the above item [1], wherein the method satisfies the following conditions (1) to (3):

(1) the packaging bag having the gas barrier property is filled with the cellulosic polymer;
(2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packaging bag is sealed; and
(3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy a relational expression of $6.1 \leq L/D \leq 10$.

[3] The method for packaging a cellulosic polymer according to the above item 1 or 2, wherein the longest long side L of the packaging bag filled with the cellulosic polymer has a length of 700 mm or more and 1,100 mm or less.

[4] The method for packaging a cellulosic polymer according to any one of the above items [1] to [3], wherein a short side W of the packaging bag perpendicular to the long side L of the packaging bag filled with the cellulosic polymer

has a length of 400 mm or more and less than 700 mm.

[5] The method for packaging a cellulosic polymer according to any one of the above items [1] to [4], wherein the depth D of the packaging bag filled with the cellulosic polymer is less than 130 mm.

[6] The method for packaging a cellulosic polymer according to any one of the above items [1] to [5], comprising: filling the packaging bag having a gas barrier property with a cellulosic polymer, the packaging bag having an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

[7] The method for packaging a cellulosic polymer according to the above item [6], wherein the outermost layer of the packaging bag satisfies a range of a smoothness of 2 to 10 seconds.

[8] The method for packaging a cellulosic polymer according to the above item [6] or [7], wherein the outermost layer of the packaging bag is a paper base material.

[9] The method for packaging a cellulosic polymer according to any one of the above items [6] to [8], wherein the outermost layer of the packaging bag satisfies a range of a basis weight of 50 to 100 g/m^2.

[10] The method for packaging a cellulosic polymer according to any one of the above items [1] to [9], wherein the cellulosic polymer is carboxymethyl cellulose.

[11] The method for packaging a cellulosic polymer according to any one of the above items [1] to [10], wherein after the inside of the packaging bag is vacuum-treated, nitrogen substitution is conducted to adjust the oxygen concentration to 0.8% or less.

[12] The method for packaging a cellulosic polymer according to any one of the above items [1] to [11], wherein the packaging bag has an internal pressure of 85 kPa or less.

[13] A method for transporting a cellulosic polymer, comprising: stacking packaging bags obtained by the method for packaging a cellulosic polymer according to any one of the above items [1] to [12] and transporting the packaging bags to a destination.

[14] The method for transporting a cellulosic polymer according to the above item [13], wherein the packaging bags are stacked in two layers or more and ten layers or less.

[15] A cellulosic polymer package, comprising: a sealed packaging bag and a cellulosic polymer filled in the packaging bag under the following conditions (1) to (3):

(1) the packaging bag having a gas barrier property is filled with the cellulosic polymer;
(2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less before sealing; and
(3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy the relational expression of $6.1 \leq \mathrm{LID} \leq 10$.

[16] The cellulosic polymer package according to the above item [15], wherein the packaging bag has an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

[17] The cellulosic polymer package according to the above item [15] or [16], wherein the cellulosic polymer is carboxymethyl cellulose.

[18] The cellulosic polymer package according to any one of the above items [15] to [17], wherein the packaging bag has an oxygen concentration of more than 0.3% and 0.8% or less.

[19] The cellulosic polymer package according to any one of the above items [15] to [18], wherein the packaging bag has an internal pressure of 85 kPa or less.

[20] The cellulosic polymer package according to any one of the above items [15] to [19], wherein the packaging bag has a two-layer structure or a three or more-layer structure, the outermost layer of the packaging bag is a paper base material, and at least one of the inner bag layers inside the outermost layer is a gas barrier layer.

Advantageous Effects of Invention

[0010] One aspect of the present invention can provide a packaging method suitable for, e.g., transportation of a cellulosic polymer.

[0011] In addition, one aspect of the present invention can provide a packaging method suitable for, e.g., transportation of a cellulosic polymer while suppressing the viscosity reduction of the cellulosic polymer.

[0012] Further, one aspect of the present invention can provide a cellulosic polymer package suitable for, e.g., transportation.

[0013] Further, one aspect of the present invention can provide a package suitable for, e.g., transportation of a cellulosic polymer while suppressing viscosity reduction of the cellulosic polymer.

Brief Description of Drawings

[0014] FIG. 1 is a view illustrating a packaging bag filled with a cellulosic polymer, wherein the packaging bag is placed such that the longest long side L is horizontal to a horizontal placement plane (horizontal plane), in which D represents the depth from the horizontal plane and W represents the short side in the width direction perpendicular to L.

Description of Embodiments

[0015] Embodiments of the present invention will be described below. In this disclosure, unless otherwise stated, the expression "AA to BB" regarding numerical range refers to "AA or more and BB or less" (where "AA" and "BB" are arbitrary values). Unless otherwise stated, the units of the lower limit and upper limit are the same as the unit added immediately after the latter (i.e., "BB" here). In addition, in the present disclosure, the expression "X and/or Y" means both X and Y, or one of the two. In the present disclosure, unless otherwise stated, a gas concentration is expressed in terms of volume ratio. For example, the unit "%" or the oxygen concentration indicates the percentage of the volume ratio (Vol/Vol) of oxygen.

1. FIRST EMBODIMENT OF THE PRESENT INVENTION

[0016] As one embodiment of the present invention, there is provided a method for packaging a cellulosic polymer comprising: filling a packaging bag having a gas barrier property with a cellulosic polymer; and sealing the packaging bag, wherein the method satisfies the following conditions (1) to (3) (hereinafter also referred to as the first embodiment).

Condition (1): The packaging bag having gas barrier property is filled with a cellulosic polymer.
Condition (2): An oxygen concentration in the packaging bag is adjusted to 0.8% or less and the package bag is sealed.
Condition (3): When a packaging bag filled with a cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal placement plane (horizontal plane) and the long side L satisfy the relational expression of $6.1 \leq L/D \leq 10$.

CELLULOSIC POLYMER

[0017] In the first embodiment of the present invention, the cellulosic polymer is not particularly limited as long as it is a compound derived from cellulose, but is preferably chemically modified, such chemical modification is to introduce a functional group into pulp, and the chemical modification is preferably anionic modification, that is, the chemically modified cellulose preferably has an anionic group. Examples of the anionic group may include an acid group, such as a carboxyl group, a carboxyl group-containing group, a phosphate group, a phosphate group-containing group, and a sulfate ester group. Examples of the carboxyl group-containing group may include -COOH group, -R-COOH (R is an alkylene group having 1 to 3 carbon atoms), and -O-R-COOH (R is an alkylene group having 1 to 3 carbon atoms). Examples of the phosphate group-containing group may include a polyphosphate group, a phosphite group, a phosphonic acid group, a polyphosphonic acid group. Depending on reaction conditions, these acid groups may be introduced in the form of salts (for example, carboxylate groups (-COOM, M is a metal atom)). In the present invention, the chemical modification is preferably oxidation or etherification.

[0018] The oxidation can be carried out as is known. Examples may include oxidizing raw pulp in water using an oxidizing agent in the presence of an N-oxyl compound and a substance selected from the group consisting of bromide, iodide, and mixtures thereof. This method selectively oxidizes the primary hydroxyl group at the C6 position of the glucopyranose ring on the cellulose surface to produce a group selected from the group consisting of an aldehyde group, a carboxyl group, and a carboxylate group. Alternatively, an ozone oxidation method may be used. This oxidation reaction oxidizes hydroxyl groups, at least at the 2-positon and the 6-position of the glucopyranose ring constituting the cellulose, and decomposes the cellulose chain.

[0019] Examples of the etherification may include carboxymethylation (etherification), methylation (etherification), ethylation (etherification), cyanoethylation (etherification), hydroxyethylation (etherification), hydroxypropylation (etherification), ethylhydroxyethylation (etherification), and hydroxypropyl methylation (etherification). Among these, carboxymethylation is preferable. Carboxymethylation can be carried out, for example, by mercerizing raw pulp as a starting raw material and then etherifying the mercerized raw pulp. Among these, especially in the case of carboxymethylated cellulose, its viscosity reduction can be prevented when it is made into an aqueous solution, and the packaging bag can be made suitable for transportation or others.

[0020] Such carboxymethylated cellulose can generally be produced by treating (mercerizing) the cellulose with an alkali and then causing the resulting mercerized cellulose (also referred to as alkali cellulose) to react with a carboxymethylating agent (also referred to as an etherifying agent).

[0021] In the first embodiment of the present invention, cellulose means a polysaccharide having a structure in which D-glucopyranose (also referred to simply as "glucose residue" or "anhydrous glucose") is connected by β-1, 4 bonds. Cellulose is generally classified into natural cellulose, regenerated cellulose, fine cellulose, and microcrystalline cellulose excluding non-crystalline regions, among other celluloses based on its origin and manufacturing method, among other factors. In the present invention, any of these celluloses can be used as a raw material for mercerized cellulose.

[0022] Examples of natural celluloses may include: bleached or unbleached pulp (bleached or unbleached wood pulp); linter, purified linter; and cellulose produced by microorganisms such as acetic acid bacteria. Examples of raw materials of bleached pulp or unbleached pulp is not particularly limited and may include wood, cotton, straw, bamboo, hemp, jute, and kenaf. Examples of the method for producing the bleached pulp or the unbleached pulp is not particularly limited and may include a mechanical method, a chemical method, or an intermediate method combining the two methods. Examples of the bleached pulp or unbleached pulp classified by the production method may include: mechanical pulp (thermomechanical pulp (TMP) and crushed wood pulp); and chemical pulp (sulfite pulps such as unbleached softwood sulfite pulp [NUSP], bleached softwood sulfite pulp [NBSP], and kraft pulps such as unbleached softwood kraft pulp [NUKP], bleached softwood kraft pulp [NBKP], unbleached hardwood kraft pulp [LUKP], and bleached hardwood kraft pulp [LBKP]). Dissolved pulp may be used in addition to paper pulp. Dissolved pulp is chemically refined pulp that is mainly dissolved in chemicals and used as a main raw material for artificial fibers, cellophane, and others.

[0023] The degree of carboxymethyl substitution per anhydrous glucose unit of the carboxymethylated cellulose is preferably in the range of 0.2 to 1.5, more preferably in the range of 0.3 to 1.2, and still more preferably in the range of 0.5 to 1.0. When the degree of carboxymethyl substitution is less than 0.2, the expression of viscosity does not occur much when the carboxymethylated cellulose is made into an aqueous solution, which limits the effect of the present invention. When the degree of carboxymethyl substitution is more than 1.5, the viscosity reduction tends to occur, even using the packaging method of the present invention, thus being not suitable.

[0024] In the first embodiment of the present invention, the anhydrous glucose unit means each anhydrous glucose (glucose residue) constituting cellulose. The degree of carboxymethyl substitution (also referred to as the degree of etherification) indicates the proportion of the hydroxyl group that is substituted by the carboxymethyl ether group in the glucose residue constituting cellulose (number of carboxymethyl ether groups per one glucose residue). The degree of carboxymethyl substitution may be abbreviated as DS.

[0025] The degree of carboxymethyl substitution is measured by the following method.

[0026] First, precisely weighed about 2.0 g of a sample is put into a 300 mL stoppered Erlenmeyer flask. Next, 100 mL of a liquid, the liquid being obtained by adding 100 mL of special concentrated nitric acid to a solution of 1,000 mL of methanol, is added into the flask, and shaken for 3 hours, thus converting the salt of carboxymethylcellulose (CMC) into H-CMC (hydrogen-type carboxymethylcellulose). Precisely weighed 1.5 to 2.0 g of the absolutely dried H-CMC is put into a 300 mL stoppered Erlenmeyer flask. The H-CMC is moistened with 15 mL of 80% methanol and added with 100 mL of 0.1 N NaOH, and shaken at room temperature for 3 hours. Excess NaOH is back titrated with 0.1 N-H_2SO_4 by using phenolphthalein as an indicator, and the degree of carboxymethyl substitution (DS value) is calculated by the following equation.

$$A = [(100 \times F' - 0.1N\text{-}H_2SO_4\ (mL) \times F) \times 0.1] / (\text{absolute dry mass of H-CMC (g)})$$

$$\text{Degree of carboxymethyl substitution} = 0.162 \times A / (1 - 0.058 \times A)$$

F' : Factor of 0.1N-H_2SO_4
F: Factor of 0.1N-NaOH

[0027] As the cellulosic polymer usable in the first embodiment of the present invention, cellulose in a pulp-like material subjected to chemical modification may be used as it is, or the pulp-like material may be used as powder produced by pulverization or others. The pulp-like material may be defibrated to use as a dried material such as cellulose in the form of microfibrils or cellulose in the form of nanofibers.

[0028] Cellulose nanofibers can be produced by applying a strong shear force to unmodified cellulose raw material or chemically modified cellulose. In the first embodiment of the present invention, the cellulose raw material may be unmodified or chemically modified, but is more preferably chemically modified. As compared to cellulose nanofibers manufactured by using an unmodified cellulose raw material, cellulose nanofibers manufactured by using a chemically modified cellulose raw material have uniform fiber length and fiber diameter and thus have stable dispersibility in water and are presumed to exhibit superior effects. Examples of chemical modification are not particularly limited but may

include oxidation, etherification, phosphorylation, esterification, silane coupling, fluorination, and cationization. Among these, any one of oxidation, carboxymethylation, and cationization using an N-oxyl compound is preferable, and carboxymethylation or oxidation is particularly preferable.

[0029] The cellulosic polymer used in the first embodiment of the present invention has a dry solid content of preferably 60 % by weight or more, more preferably 70 % by weight or more, and still more preferably 80 % by weight or more when filled in a packaging bag. The dry solid content within this range can reduce the amount of divergence of the equilibrium moisture in the package, thereby suppressing the deterioration of the cellulosic polymer due to the moisture.

PACKAGING BAG

[0030] In the first embodiment of the present invention, any packaging bag can be used without any particular restriction as long as the packaging bag has a gas barrier property. In the present invention, "having a gas barrier property" means having a function of suppressing permeation of oxygen, moisture, and the like. Such a packaging bag is preferably formed by using: an aluminum having a high gas barrier property; a transparent barrier film comprising polyacrylonitrile, polyvinyl alcohol, a nylon film having a coating film of a polyvinylidene chloride resin, an ethylene-vinyl alcohol copolymer, an olefin-based polymer, an olefin-polycarboxylic acid copolymer, or a plastic base material on which a vapor deposition layer of an inorganic oxide such as silicon oxide or aluminum oxide is provided; and a barrier film provided with a vapor deposition layer of a metal such as aluminum.

[0031] Further, the outermost layer of the packaging bag is preferably made of a material that is strong and hard to tear, and a paper base material is suitable.

[0032] Examples of such paper base material may include kraft paper.

[0033] Therefore, it is preferable that the outermost layer of the packaging bag used in the first embodiment of the present invention is a paper base material and has a gas barrier layer in the inner layer. Such a gas barrier layer may be used as a separate bag as an inner bag, or may be attached by pasting processing (e.g., lamination processing) to the outermost paper base material. It is more preferable to use the gas barrier layer as the inner bag from the viewpoint of convenience of handling.

[0034] In addition, the packaging bag used in the first embodiment of the present invention preferably has ultraviolet impermeability or light shielding properties from the viewpoint of maintaining the quality of the cellulosic polymer to be filled.

FILLING OF CELLULOSIC POLYMER

[0035] The method for filling the packaging bag with the cellulosic polymer is not particularly limited, and the packaging bag may be filled in such a manner that the cellulosic polymer is appropriately filled. It should be noted that an excessive filling of the cellulosic polymer will make it difficult for adjustment of the condition (3) described later concerning the first embodiment or adjustment of the oxygen concentration; therefore, the filling amount of the cellulosic polymer is preferably 99% or less, more preferably 95% or less, and still more preferably 90% or less of the inner volume of the packaging bag.

[0036] In a case where the packaging bag is a packaging bag having an outer bag (or outer layer) of a paper base material in the outermost layer described above and an inner bag (or inner layer) of a gas barrier layer, the inner bag may be filled with a cellulosic polymer before being packed in the outer bag, or the inner bag may be packed in the outer bag before being filled with a cellulosic polymer.

ADJUSTMENT OF OXYGEN CONCENTRATION IN PACKAGING BAG

[0037] Although the adjustment of the oxygen concentration in the packaging bag is not particularly limited, the adjustment is preferably performed after filling the cellulosic polymer, and examples of the adjustment may include methods of, after filling the cellulosic polymer, 1) vacuuming the inside of the packaging bag, 2) conducting nitrogen substitution in the packaging bag, 3) conducting nitrogen substitution after vacuuming the inside of the packaging bag, and 4) enclosing an oxygen absorbent in the packaging bag. Among these methods, the method of conducting nitrogen substitution after vacuuming the inside of the packaging bag is more preferable in the first embodiment of the present invention because this method can suppress aggregation of the cellulosic polymer.

[0038] In the packaging method according to the first embodiment of the present invention, it is important that the packaging bag is sealed with the adjustment of the oxygen concentration to be more than 0.8%. If the oxygen concentration is more than 0.8%, the cellulosic polymer tends to deteriorate, and there is a concern that the viscosity reduction occurs when the cellulosic polymer is converted into an aqueous solution. The oxygen concentration is preferably 0.75% or less, more preferably 0.7% or less, and still more preferably 0.6% or less. Although the lower limit of the oxygen concentration is not limited, it is preferably 0.1% or more, more preferably 0.2% or more, and still more preferably 0.3% or more from the viewpoint of workability and internal pressure adjustment at the time of nitrogen substitution.

[0039] The internal pressure in the packaging bag is preferably 85 kPa or less, and in particular, the internal pressure

in the gas barrier layer is preferably 85 kPa or less. If the internal pressure is more than 85 kPa, the expansion of the packaging bag with respect to the filling material becomes large, and thus it becomes difficult to stack the packaging bags in a stacked state and there arises a problem in transportation and others. The internal pressure of such a packaging bag is more preferably 80 kPa or less.

[0040] Although the method of adjusting the internal pressure in the packaging bag is not particularly limited, in the case of, e.g., a method of conducting nitrogen substitution after vacuuming the inside of the packaging bag, the internal pressure in the packaging bag can be appropriately adjusted by appropriately adjusting the nitrogen injection amount and the internal pressure indication value from the original pressure when injecting nitrogen after the vacuum treatment.

SHAPE OF SEALED PACKAGING BAG

[0041] In the first embodiment of the present invention, when the packaging bag filled with the cellulosic polymer, adjusted in oxygen concentration and sealed is placed on a horizontal placement plane (also referred to as a horizontal plane) so that the longest long side L thereof is horizontal, it is important that the depth D of the packaging bag from the horizontal plane and the long side L satisfies the relational expression of $6.1 \leq L/D \leq 10$.

[0042] FIG. 1 shows a packaging bag filled with a cellulosic polymer, which is placed on a horizontal plane so that the long side L is horizontal. In the present invention, it is important that the packaging bag filled with the cellulosic polymer is placed horizontally, and then the filling region is uniformly filled along the horizontal plane before measuring the long side L and the depth D.

[0043] Such a long side L does not include the sealing opening of the packaging bag and represents the length of only the filling area of the packaging bag. The long side L is preferably 700 mm or more and 1,100 mm or less, more preferably 700 mm or more and 1,000 mm or less, and still more preferably 700 mm or more and 900 mm or less.

[0044] The short side W perpendicular to the long side L of the packaging bag filled with the cellulosic polymer is preferably 400 mm or more and less than 700 mm, more preferably 450 mm or more and 650 mm or less, still more preferably 450 mm or more and 600 mm or less.

[0045] The depth D of the packaging bag filled with the cellulosic polymer is preferably less than 130 mm, more preferably 125 mm or less, and still more preferably 120 mm or less.

[0046] In the packaging method of the cellulosic polymer according to the first embodiment of the present invention, satisfying the above relational expression will appropriately balance the packaging bags filled with the cellulosic polymer in stacking, thereby facilitating stacking. The long side L, the depth D, and the short side W of the packaging bag satisfying the above-mentioned ranges can facilitate filling of the cellulosic polymer and stacking of the packaging bags.

[0047] Further, it is important in the present invention in order to suppress the lack of balance in the stacked state due to vibration or others when the packaging bags are stacked and transported.

[0048] In the first embodiment of the present invention, when the packaging bags are stacked, it is preferable that the packaging bags are stacked in two layers or more and ten layers or less, and more preferably in two layers or more and eight layers or less. The stacked state within the above range will appropriately balance the stacked state of the packaging bags.

2. SECOND EMBODIMENT OF THE PRESENT INVENTION

[0049] As another embodiment of the present invention, there is provided a method for packaging a cellulosic polymer comprising filling a packaging bag having a gas barrier property with a cellulosic polymer, the packaging bag having an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35 (hereinafter also referred to as the second embodiment).

[0050] First, a packaging bag as one characteristic part in the second embodiment will be described.

PACKAGING BAG

[0051] In the second embodiment of the present invention, any packaging bag can be used without any particular restriction as long as the packaging bag has a gas barrier property. In the present invention, "having a gas barrier property" means having a function of suppressing permeation of oxygen, moisture, and the like. Such a packaging bag is preferably formed by using: an aluminum having a high gas barrier property; a transparent barrier film comprising polyacrylonitrile, polyvinyl alcohol, a nylon film having a coating film of a polyvinylidene chloride resin, an ethylene-vinyl alcohol copolymer, an olefin-based polymer, an olefin-polycarboxylic acid copolymer, or a plastic base material on which a vapor deposition layer of an inorganic oxide such as silicon oxide or aluminum oxide is provided; and a barrier film provided with a vapor deposition layer of a metal such as aluminum.

[0052] Further, the outermost layer of the packaging bag is preferably made of a material that is strong and hard to tear, and a paper base material is suitable. Examples of such paper base material may include kraft paper.

[0053] Therefore, it is preferable that the outermost layer of the packaging bag used in the second embodiment of the present invention is a paper base material and has a gas barrier layer in the inner layer. Such a gas barrier layer may be used as a separate bag as an inner bag, or may be attached by pasting processing (for eample, lamination processing) to the outermost paper base material. It is more preferable to use the gas barrier layer as the inner bag from the viewpoint of convenience of handling.

[0054] It is important that the outermost surface of such a packaging bag have a static friction coefficient in the range of 0.2 to 0.5, preferably in the range of 0.2 to 0.45, and more preferably in the range of 0.2 to 0.4. By setting the static friction coefficient of the outermost layer surface within this range, even when the packaging bags are filled with the cellulosic polymer and stacked each other on a pallet or the like for transportation, the packaging bags are unlikely to lose balance and fall, and also the frictional force is not too strong, thus easily adjusting the stacked state by moving by sliding the packaging bags with rubbing during stacking.

[0055] Further, it is important that the outermost surface of the packaging bag have a dynamic friction coefficient in the range of 0.15 to 0.35, preferably in the range of 0.2 to 0.35, and more preferably in the range of 0.22 to 0.32. This range is appropriate because, by setting the dynamic friction coefficient of the outermost layer surface within this range, even when the packaging bags are filled with the cellulosic polymer and stacked each other on a pallet or the like for transportation, each of the stacked packaging bags can be easily moved by sliding with rubbing and also they are unlikely to lose balance and fall. It should be noted that the static friction coefficient and the dynamic friction coefficient of the outermost surface of the packaging bag can be measured in accordance with JIS P8147.

[0056] Further, the outermost layer of the packaging bag has a smoothness by the Oken method, preferably in the range of 2 to 10 seconds, more preferably in the range of 3 to 9 seconds, and still more preferably in the range of 4 to 8 seconds. The smoothness of the surface of the outermost layer in this range allows the unevenness of the surface of the outermost layer to provide a suitable balance, wherein the packaging bags are filled with cellulosic polymers and stacked each other on a pallet or the like for transportation, to prevent them from falling or move them by sliding with rubbing. The smoothness by Oken method can be measured in accordance with JIS P8155.

[0057] In the second embodiment of the present invention, the outermost layer of the packaging bag has a basis weight of preferably in the range of 50 to 100 g/m^2, more preferably in the range of 60 to 100 g/m^2, and still more preferably in the range of 65 to 95 g/m^2. Wherein the outermost layer base material of the packaging bag satisfys the above range, it is easier to achieve the optimal balance as the aforementioned outermost layer, while maintaining strength, even when filled with cellulosic polymers. The basis weight can be measured in accordance with JIS P8124.

[0058] In addition, the packaging bag used in the first embodiment of the present invention preferably has ultraviolet impermeability or light shielding properties from the viewpoint of maintaining the quality of the cellulosic polymer to be filled.

[0059] Other technical matters related to the second embodiment are the same as those of the first embodiment. In other words, the matters described in the description of the first embodiment such as: the definition of a cellulosic polymer; method of oxidation; etherification; carboxymethylated cellulose; cellulose; natural cellulose; degree of carboxymethyl substitution per anhydrous glucose unit of carboxymethylated cellulose; anhydrous glucose unit; method of measuring degree of carboxymethyl substitution; shapes of cellulosic polymers (pulp, powder, microfibril, and nanofiber, and others); dry solid content when filled in a packaging bag; and the state regarding the number of stacked layers of the packaging bags may be employed in the second embodiment as in the first embodiment.

3. COMBINATION OF FIRST EMBODIMENT AND SECOND EMBODIMENT

[0060] As another embodiment of the present invention, the first embodiment and the second embodiment described above may be combined. Such a modification may be, for example, the following embodiment.

EXAMPLE OF COMBINATION OF FIRST EMBODIMENT AND SECOND EMBODIMENT

[0061] A method for packaging a cellulosic polymer comprising: filling a packaging bag having a gas barrier property with a cellulosic polymer; and sealing the packaging bag, wherein the method satisfies the following conditions (1) to (4):

(1) the packaging bag having a gas barrier property is filled with a cellulosic polymer;
(2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packaging bag is sealed;
(3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy a relational expression of $6.1 \leq L/D \leq 10$; and
(4) the packaging bag has an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

[0062] Specific technical matters and preferred examples described in the first embodiment or the second embodiment

are similarly applicable to the combination of the first and second embodiments.

4. THIRD EMBODIMENT OF THE PRESENT INVENTION

[0063] As described above, the present invention may include some aspects, such as a method for packaging and a method for transporting, and the present invention further provide a cellulosic polymer package utilizing such a packaging method. As an embodiment of the package, for example, the following cellulosic polymer package may be provided by the packaging method described in the first embodiment.

[0064] A cellulosic polymer package comprising a sealed packaging bag and a cellulosic polymer filled in the packaging bag under the following conditions (1) to (3):

(1): the packaging bag having a gas barrier property is filled with a cellulosic polymer;
(2): the oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packaging bag is sealed; and
(3): when a packaging bag filled with a cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal placement plane (horizontal plane) and the long side L satisfy the relational expression of $6.1 \leq L/D \leq 10$.

[0065] As another embodiment of the package, for example, a cellulosic polymer package as described below is provided by the packaging method described in the second embodiment.

[0066] A cellulosic polymer package comprising a sealed packaging bag having a gas barrier property and a cellulosic polymer filled in the packaging bag,
wherein the packaging bag has an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

[0067] More specific technical matters and preferred examples described in the first embodiment or the second embodiment are applicable in the same fashion to the third embodiment. Further, a cellulosic polymer package may be prepared by combining the technical matters described in the first embodiment and the second embodiment.

Examples

FIRST EXAMPLE GROUP

EXAMPLE 1-1

[0068] Carboxymethyl cellulose (manufactured by Nippon Paper, product name: MAC500LC) was filled in an unfilled (empty) packaging bag having a length of 850 mm and a width of 565 mm, the outermost layer of which was a kraft paper base material, and the interior of which was a film base material.

[0069] After filling and vacuum degassing, nitrogen gas was injected, the oxygen concentration in the package was adjusted to 0.50%, the internal pressure indication value was adjusted to 70 kPa, and the sealing opening was sealed.

[0070] The obtained packaging bag was placed on a horizontal plane so that the content of the packaging bag was uniform in the filling area, and then the packaging bag was measured; the longest long side L was 760 mm, the depth D from the horizontal plane was 110 mm, and the short side W perpendicular to the long side L was 520 mm.

EXAMPLE 1-2

[0071] A packaging bag was obtained in the same manner as in Example 1-1 except that carboxymethyl cellulose (manufactured by Nippon Paper, product name: MAC350HC) was used.

EXAMPLE 1-3

[0072] A packaging bag was obtained in the same manner as in Example 1 except that carboxymethyl cellulose (manufactured by Nippon Paper, product name: MAC800LC) was used.

COMPARATIVE EXAMPLE 1-1

[0073] A packaging bag was obtained in the same manner as in Example 1 except that the oxygen concentration in the package was set to 0.3% and the internal pressure indication value was set to 90 kPa. The obtained packaging bag was placed on a horizontal plane so that the content of the packaging bag was uniform in the filling area, and the packaging bag was measured; the longest long side L was 760 mm, the depth D from the horizontal plane was 130 mm,

and the short side W perpendicular to the long side L was 520 mm.

[Table 1]

[0074]

Table 1

	Packaging Bag		Filled Substance	Packaging Bag After Filled					
	Outermost Layer	Inner Layer		Oxygen Concentration (%)	Internal Pressure (KPa)	L (mm)	D (mm)	W (mm)	L/D
EXAMPLE 1-1	Kraft Paper	Film	MAC500LC	0.5	70	760	110	520	6.9
EXAMPLE 1-2	Kraft Paper	Film	MAC350HC	0.5	70	760	110	520	6.9
EXAMPLE 1-3	Kraft Paper	Film	MAC800LC	0.5	70	760	110	520	6.9
COMPARATIVE EXAMPLE 1-1	Kraft Paper	Film	MAC500LC	0.3	90	760	130	520	5.8

[0075] The viscosities of 1% aqueous solution of Examples 1-1 to 1-3 and Comparative Example 1-1 were measured immediately after filling with carboxymethyl cellulose and after storage in a container at 50°C for 1, 3, and 6 months. The adjustment of the aqueous solution and the measurement of the viscosity were performed by the method described later.

[0076] In addition, the obtained packaging bags were stacked on a pallet in 4 rows and 6 layers, and the stacked state thereof was visually checked.

ADJUSTMENT OF AQUEOUS SOLUTION

[0077] About 10 g of a sample is weighed with a balance scale. The sample is gradually charged into a beaker containing 880 ml of pure water, while stirring using a dissolving stirrer, and stirred for 3 hours. The purified water calculated from the water content is corrected so as to achieve a concentration of 1%.

VISCOSITY MEASUREMENT

[0078] After stirring for 3 hours (to confirm complete dissolution), the temperature of the solution is adjusted to 25 ± 0.2°C. The viscosity is measured by using a type B viscometer. The measured value is read on the scale 3 minutes after the start of the rotor.

VISCOSITY CHANGE RATE

[0079] The rate of change in the viscosity of 1% aqueous solution of the cellulosic polymer stored (1 month, 3 months, 6 months) at 50°C in the container after packaging (Viscosity 2) with respect to the viscosity of 1% aqueous solution of the cellulosic polymer for 0 elapsed days (before packaging) (Viscosity 1) is calculated by the following formula (1).

$$[(\text{Viscosity 2} - \text{Viscosity 1}) / \text{Viscosity 1}] \times 100 \quad (\%) \quad \ldots(1)$$

[Table 2]

[0080]

Table 2

	Viscosity Change Rate				Stacking State
	Elapsed Month(s)				
	0	1 month	3 months	6 months	
EXAMPLE 1-1	0	-1	-1	-3	Each packaging bag is tightly stacked and excels in balance.
EXAMPLE 1-2	0	-3	-3	-4	Each packaging bag is tightly stacked and excels in balance.
EXAMPLE 1-3	0	-4	-1	-3	Each packaging bag is tightly stacked and excels in balance.
COMPARATIVE EXAMPLE 1-1	0	-1	-1	-2	Each packaging bag is expanded, cannot be tightly stacked, and is unbalanced.

[0081] It can be seen that, in the packaging bags of Examples 1-1 to 1-3, the filled carboxymethyl cellulose can maintain a high viscosity after storage. Further, since the inner pressure of the packaging bag is well balanced with respect to the strength of the packaging bag and does not cause expansion, the packaging bag is also well balanced during stacking.

[0082] On the contrary, although having an excellent effect of maintaining the viscosity of carboxymethyl cellulose because the oxygen concentration is kept low, the packaging bag of Comparative Example 1-1 is not suitable for transportation because the inner pressure is high and the packaging bag is expanded and unbalanced in the stacked state.

SECOND EXAMPLE GROUP

EXAMPLE 2-1

[0083] Carboxymethyl cellulose (manufactured by Nippon Paper, product name: MAC500LC) was filled in a packaging bag having a kraft paper base material (surface static friction coefficient of 0.32, dynamic friction coefficient of 0.28, Oken type smoothness of 5 seconds, and basis weight of 85 g/m^2) as the outermost layer and a film base material as an inner layer.

[0084] After filling and vacuum degassing, nitrogen gas was injected, the oxygen concentration in the package was adjusted to 0.50% and the internal pressure indication value was adjusted to 70 kPa, the sealing opening was sealed, thus obtaining a packaging bag 2-1 filled with carboxymethyl cellulose.

EXAMPLE 2-2

[0085] A packaging bag 2-2 filled with carboxymethyl cellulose was obtained in the same manner as in Example 1 except that the outermost layer was changed to a kraft paper base material (surface static friction coefficient of 0.30, dynamic friction coefficient of 0.28, Oken type smoothness of 5 seconds, and basis weight of 76 g/m^2) .

COMPARATIVE EXAMPLE 2-1

[0086] A packaging bag 3 filled with carboxymethyl cellulose was obtained in the same manner as in Example 1 except thatthe outermost layer is changed to a film base material (surface static friction coefficient of 0.12, dynamic friction coefficient of 0.1, Oken type smoothness being not measurable, and basis weight of 109 g/m^2), not using the kraft paper base material.

[Table 3]

[0087]

Table 3

	Packaging Bag		Filled Substance
	Outermost Layer	Inner Layer	
EXAMPLE 2-1	Kraft Paper	Film	MAC500LC
EXAMPLE 2-2	Kraft Paper	Film	MAC500LC
COMPARATIVE EXAMPLE 2-1	Film	-	MAC500LC

[0088] The viscosities of 1% aqueous solution of Examples 2-1 and 2-2 were measured immediately after filling with carboxymethyl cellulose and after storage in a container at 50°C for 1, 3, and 6 months. The adjustment of the aqueous solution, the measurement of the viscosity, and the calculation of the viscosity change rate were performed by the same method as that shown for the first example group.

[0089] In addition, the packaging bags of Examples 2-1 and 2-2 and Comparative Example 2-1 were stacked on a pallet in 4 rows and 6 layers, and the ease of stacking was confirmed and the stacked state was visually checked.

Table 4

	Viscosity Change Rate				Stacked State
	Elapsed Month(s)				
	0	1 month	3 months	6 months	
EXAMPLE 2-1	0	-1	-1	-3	Each packaging bag could be easily adjusted to be stacked closely by sliding with rubbing. The packaging bags also have excellent balance when stacked.

(continued)

	Viscosity Change Rate				Stacked State
	Elapsed Month(s)				
	0	1 month	3 months	6 months	
EXAMPLE 2-2	0	-1	-1	-3	Each packaging bag could be easily adjusted to be stacked closely by sliding with rubbing. The packaging bags also have excellent balance when stacked.
COMPARATIVE EXAMPLE 2-1	-	-	-	-	Each packaging bag was out of balance when it was slid with rubbing, and the packaging bags could not maintain a closely stacked state.

Claims

1. A method for packaging a cellulosic polymer, comprising: filling a packaging bag having a gas barrier property with the cellulosic polymer; and sealing the packaging bag.

2. The method for packaging a cellulosic polymer according to claim 1, wherein the method satisfies the following conditions (1) to (3):

   (1) the packaging bag having the gas barrier property is filled with a cellulosic polymer;
   (2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packaging bag is sealed; and
   (3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy a relational expression of $6.1 \leq LID \leq 10$.

3. The method for packaging a cellulosic polymer according to claim 1 or 2, wherein the longest long side L of the packaging bag filled with the cellulosic polymer has a length of 700 mm or more and 1,100 mm or less.

4. The method for packaging a cellulosic polymer according to any one of claims 1 to 3, wherein a short side W of the packaging bag perpendicular to the long side L of the packaging bag filled with the cellulosic polymer has a length of 400 mm or more and less than 700 mm.

5. The method for packaging a cellulosic polymer according to any one of claims 1 to 4, wherein the depth D of the packaging bag filled with the cellulosic polymer is less than 130 mm.

6. The method for packaging a cellulosic polymer according to any one of claims 1 to 5, comprising: filling the packaging bag having a gas barrier property with a cellulosic polymer, the packaging bag having an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

7. The method for packaging a cellulosic polymer according to claim 6, wherein the outermost layer of the packaging bag satisfies a range of a smoothness of 2 to 10 seconds.

8. The method for packaging a cellulosic polymer according to claim 6 or 7, wherein the outermost layer of the packaging bag is a paper base material.

9. The method for packaging a cellulosic polymer according to any one of claims 6 to 8, wherein the outermost layer of the packaging bag satisfies a range of a basis weight of 50 to 100 g/m^2.

10. The method for packaging a cellulosic polymer according to any one of claims 1 to 9, wherein the cellulosic polymer is carboxymethyl cellulose.

11. The method for packaging a cellulosic polymer according to any one of claims 1 to 10, wherein after the inside of the packaging bag is vacuum-treated, nitrogen substitution is conducted to adjust the oxygen concentration to 0.8%

or less.

12. The method for packaging a cellulosic polymer according to any one of claims 1 to 11, wherein the packaging bag has an internal pressure of 85 kPa or less.

13. A method for transporting a cellulosic polymer, comprising: stacking packaging bags obtained by the method for packaging a cellulosic polymer according to any one of claims 1 to 12 and transporting the packaging bags to a destination.

14. The method for transporting a cellulosic polymer according to claim 13, wherein the packaging bags are stacked in two layers or more and ten layers or less.

15. A cellulosic polymer package, comprising: a sealed packaging bag and a cellulosic polymer filled in the packaging bag under the following conditions (1) to (3):

(1) the packaging bag having a gas barrier property is filled with the cellulosic polymer;
(2) an oxygen concentration in the packaging bag is adjusted to 0.8% or less and the packing bag is sealed; and
(3) when the packaging bag filled with the cellulosic polymer is placed such that the longest long side L is horizontal, the depth D of the packaging bag from the horizontal plane and the long side L satisfy a relational expression of $6.1 \leq \mathrm{LID} \leq 10$.

16. The cellulosic polymer package according to claim 15, wherein the packaging bag has an outermost layer with a surface satisfying a range of a static friction coefficient of 0.2 to 0.5 and a dynamic friction coefficient of 0.15 to 0.35.

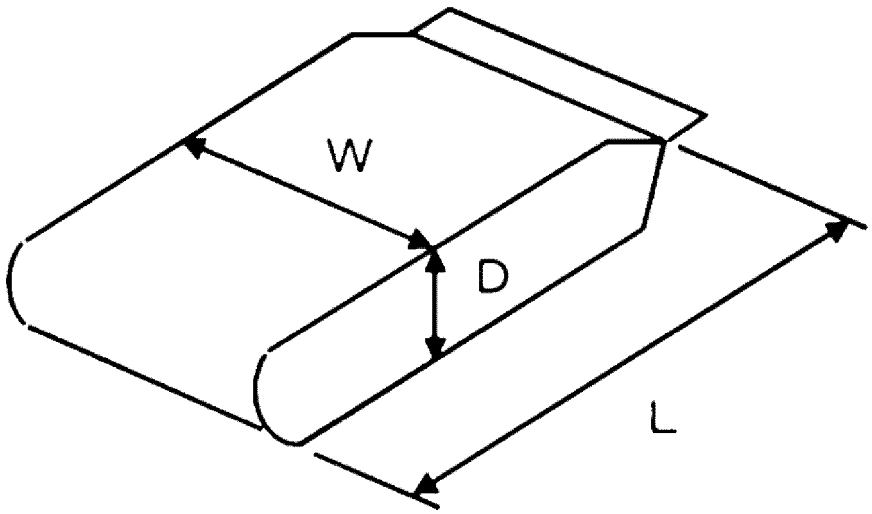
17. The cellulosic polymer package according to claim 15 or 16, wherein the cellulosic polymer is carboxymethyl cellulose.

18. The cellulosic polymer package according to any one of claims 15 to 17, wherein the packaging bag has an oxygen concentration of more than 0.3% and 0.8% or less.

19. The cellulosic polymer package according to any one of claims 15 to 18, wherein the packaging bag has an internal pressure of 85 kPa or less.

20. The cellulosic polymer package according to any one of claims 15 to 19, wherein the packaging bag has a two-layer structure or a three or more-layer structure, the outermost layer of the packaging bag is a paper base material, and at least one of the inner bag layers inside the outermost layer is a gas barrier layer.

[Fig. 1]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/015675

A. CLASSIFICATION OF SUBJECT MATTER
B65B 31/02(2006.01)i; B65B 1/00(2006.01)i; B65D 30/02(2006.01)i; B65D 65/40(2006.01)i; C08J 99/00(2006.01)i
FI: B65B31/02 A; B65B1/00; B65D30/02; B65D65/40 D; C08J99/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B31/02; B65B1/00; B65D30/02; B65D65/40; C08J99/00; B65D81/24; C08B1/00-37/18

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2016-166257 A (NIPPON PAPER INDUSTRIES CO., LTD.) 15 September 2016 (2016-09-15) paragraphs [0003], [0008]-[0014], [0016]	1, 10, 11, 13-14
Y	paragraphs [0003], [0008]-[0014], [0016]	3-5, 12
A		2, 6-9, 15-20
Y	JP 3202739 U (OJI HOLDINGS CORPORATION) 18 February 2016 (2016-02-18) paragraphs [0002], [0008]-[0009], [0024]-[0025], fig. 1-13	3-5
Y	JP 2019-73649 A (KAO CORP.) 16 May 2019 (2019-05-16) paragraphs [0007], [0017], [0074]	12
A	JP 2011-230777 A (SIKO CORPORATION) 17 November 2011 (2011-11-17) paragraph [0001], fig. 2	1-20

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

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2018/173761 A1 (NIPPON PAPER INDUSTRIES CO., LTD.) 27 September 2018 (2018-09-27) paragraph [0007]	1-20
A	JP 11-158201 A (ONDA, Akio) 15 June 1999 (1999-06-15) examples	1-20

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/015675

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2016-166257 A	15 Sep. 2016	(Family: none)	
JP 3202739 U	18 Feb. 2016	(Family: none)	
JP 2019-73649 A	16 May 2019	(Family: none)	
JP 2011-230777 A	17 Nov. 2011	(Family: none)	
WO 2018/173761 A1	27 Sep. 2018	US 2020/0071426 A1 EP 3604396 A1 CN 110382600 A	
JP 11-158201 A	15 Jun. 1999	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2012121957 A **[0005]**