

## DESCRIPTION

### Title of Invention

CLING FILM AND CLING FILM STORAGE BODY

### Technical Field

5 [0001] The present invention relates to a wrapping film and a wrapping film storage body.

### Background Art

[0002] Conventionally, wrapping films have been widely used for business use in hotels, restaurants, and the like, or when storing foods at home, during cooking, and the like. Various improvements have been made for wrapping films in order to improve convenience in use. For example, Patent Literature 1 discloses a food wrapping film containing a blue colorant. According to this film, it becomes easy to see visually whether a piece of the film has become mixed in the food. Furthermore, 10 it has been known that addition of an inorganic antibacterial agent containing a metal such as Ag, Mn, Fe, Co, Ni, Cu, or Zn (for example, see Patent Literature 2) is effective in order to impart antibacterial activity to wrapping films.

### Citation List

#### 20 Patent Literature

[0003] Patent Literature 1: International Publication WO 2017/094730

Patent Literature 2: Japanese Unexamined Patent Publication No. 2004-292334

### Summary of Invention

#### 25 Technical Problem

[0004] According to studies of the present inventors, it has been found

that, when a colored film having antibacterial activity is tried to be produced by adding a colorant and an antibacterial agent to the wrapping film, depending on types of antibacterial agents, the colorant is not satisfactorily (uniformly) dispersed in the wrapping film in some cases.

5 In addition, it has also been found that such a colored film is obtained by molding a resin composition containing a thermoplastic resin, a colorant, and an antibacterial agent into a film shape, but depending on types of antibacterial agents, the thermal stability of the resin composition is impaired and there is a concern that a desired colored film is not obtainable.

10 [0005] In this regard, an object of the present invention is to improve thermal stability when a wrapping film containing a colorant and an antibacterial agent is molded and also to improve dispersibility of the colorant in the wrapping film.

### 15 **Solution to Problem**

[0006] An aspect of the present invention is a wrapping film containing a thermoplastic resin, a colorant, and a silver-based antibacterial agent.

20 [0007] In an aspect of the present invention, by using a silver-based antibacterial agent as an antibacterial agent, a wrapping film to which antibacterial activity is imparted while a colorant is satisfactorily dispersed can be suitably obtained. That is, although reasons are not clear, the silver-based antibacterial agent does not impair the dispersibility of the colorant in the case of being used along with the colorant in the wrapping film, as compared with other inorganic antibacterial agents (for example, a zinc-based antibacterial agent).

25 Therefore, in this wrapping film, while the colorant is satisfactorily

dispersed, antibacterial activity is also imparted. Furthermore, although reasons are not clear, the silver-based antibacterial agent does not impair the thermal stability of a resin composition in the case of being used along with the thermoplastic resin and the colorant, as compared with other inorganic antibacterial agents (for example, a zinc-based antibacterial agent). Therefore, by using the silver-based antibacterial agent, a wrapping film can be produced from a resin composition excellent in thermal stability, and thus a wrapping film to which antibacterial activity is imparted while the colorant is satisfactorily dispersed is obtained.

[0008] A content of the silver-based antibacterial agent may be preferably 0.04% by mass or more based on the total amount of the wrapping film. In this case, a wrapping film particularly excellent in antibacterial activity can be further suitably obtained.

[0009] A content of the silver-based antibacterial agent may be preferably 0.18% by mass or less based on the total amount of the wrapping film. In this case, a further effect that film-forming properties of the wrapping film are also excellent is obtained.

[0010] The colorant may include at least one selected from the group consisting of a blue colorant, a red colorant, a yellow colorant, a green colorant, and a violet colorant. The thermoplastic resin may include at least one selected from the group consisting of a polyester-based resin, a polyamide-based resin, a polystyrene-based resin, a polylactic acid-based resin, a polyolefin-based resin, a polyvinyl chloride-based resin, and a polyvinylidene chloride-based resin.

[0011] The wrapping film may further contain a plasticizer. The wrapping film may have an antibacterial activity value of 5.0 or more

with respect to Escherichia coli.

[0012] Another aspect of the present invention is a wrapping film storage body including a winding core, the above-described wrapping film wound around the winding core, and a box storing the winding core and the wrapping film.

### **Advantageous Effects of Invention**

[0013] According to the present invention, thermal stability when a wrapping film containing a colorant and an antibacterial agent is molded can be improved and dispersibility of the colorant in the wrapping film can also be improved.

### **Brief Description of Drawings**

[0014] FIG. 1 is a perspective view illustrating a wrapping film storage body according to an embodiment.

### **Description of Embodiments**

[0015] Hereinafter, embodiments of the present invention will be described in detail with reference to the drawings as appropriate.

[0016] A wrapping film according to an embodiment contains a thermoplastic resin, a colorant, and a silver-based antibacterial agent. This wrapping film is a film for wrapping goods, and is suitably used particularly as a food wrapping film.

[0017] The thermoplastic resin may be a polyester-based resin such as polyethylene terephthalate, polyethylene naphthalate, or polybutylene terephthalate; a polyamide-based resin such as 6-nylon, 6,6-nylon, or 12-nylon; a polystyrene-based resin such as a butadiene-styrene copolymer, an acrylonitrile-styrene copolymer, polystyrene, a styrene-butadiene-styrene copolymer, a styrene-isoprene-styrene copolymer, or a styrene-

acrylic acid copolymer; a polylactic acid-based resin such as poly-L-lactic acid, poly-D-lactic acid, or poly-DL-lactic acid; a polyolefin-based resin such as polyethylene, polypropylene, or a saponified ethylene-vinyl acetate copolymer; a polyvinyl chloride-based resin such as polyvinyl chloride; a polyvinylidene chloride-based resin such as polyvinylidene chloride; or the like. The thermoplastic resin is used singly or in combination of two or more kinds thereof.

[0018] From the viewpoint of excellent handleability, the thermoplastic resin is preferably a polyvinyl chloride-based resin, a polyvinylidene chloride-based resin, a polylactic acid-based resin, or a polyolefin-based resin, and is more preferably a polyvinyl chloride-based resin, a polyvinylidene chloride-based resin, a polylactic acid-based resin, or a polyethylene-based resin.

[0019] The polyvinyl chloride-based resin is preferably a polyvinyl chloride-based resin having an average degree of polymerization of 700 to 1300, from the viewpoint of excellent moldability, heat resistance, and fluidity of the wrapping film. The average degree of polymerization in the present specification means an average degree of polymerization measured according to JIS K6720-2.

[0020] The polyvinyl chloride-based resin may be a vinyl chloride homopolymer (polyvinyl chloride resin) from the viewpoint of excellent mechanical properties, and may be a copolymer of vinyl chloride and other monomers copolymerizable therewith, for the purpose of imparting other properties. The copolymer may be a graft copolymer, a block copolymer, or a random copolymer. Examples of the other monomers include olefins such as ethylene, propylene, and butene; vinyl esters of

saturated acids such as vinyl acetate and vinyl laurate; alkyl esters of unsaturated acids such as methyl acrylate and methyl methacrylate; alkyl vinyl ethers such as lauryl vinyl ether; and maleic acid, acrylonitrile, styrene, methylstyrene, and vinylidene fluoride.

5 [0021] In a case where the polyvinyl chloride-based resin is a copolymer, the content of the vinyl chloride unit in the copolymer may be 10% by mass or more based on the total amount of monomer units, and is preferably 30% by mass or more and more preferably 50% by mass or more, from the viewpoint of excellent mechanical properties. The upper  
10 limit of the content of the vinyl chloride unit in the copolymer is not particularly limited, and may be, for example, 99% by mass or less based on the total amount of monomer units.

[0022] The polyvinyl chloride-based resin may be, for example, a polymer blend with a three-dimensional polymer of acrylonitrile-  
15 butadiene-styrene or the like, a post-treatment product with an alcohol or the like, or a post-treatment product with a chlorine-containing compound. In these cases, the content of the vinyl chloride unit in the polyvinyl chloride-based resin may be 10% by mass or more based on the total amount of monomer units.

20 [0023] The polyvinylidene chloride-based resin may be a vinylidene chloride homopolymer (polyvinylidene chloride resin), and may be, for example, a copolymer containing vinylidene chloride and other monomers copolymerizable with vinylidene chloride as monomer units. The other monomers may be vinyl chloride, an acrylic acid ester of  
25 acrylic acid and an alcohol having 1 to 8 carbon atoms, a methacrylic acid ester of methacrylic acid and an alcohol having 1 to 8 carbon atoms, a

vinyl ester of an aliphatic carboxylic acid, an unsaturated aliphatic carboxylic acid, an olefin, a vinyl ether, or the like. Incidentally, the copolymer of vinylidene chloride and vinyl chloride shall belong to the polyvinylidene chloride-based resin.

5 [0024] The content of the vinylidene chloride unit in the polyvinylidene chloride-based resin may be, for example, 60% by mass or more, 70% by mass or more, or 80% by mass or more based on the total amount of monomer units, from the viewpoint of moldability and heat resistance of the wrapping film. The upper limit of the content of the vinylidene chloride unit in the polyvinylidene chloride-based resin is not particularly limited, and may be, for example, 99% by mass or less based on the total amount of monomer units. The content of the vinylidene chloride unit can be measured by a nuclear magnetic resonance (NMR) apparatus.

10 [0025] The weight average molecular weight of the polyvinylidene chloride-based resin may be, for example, 40000 or more, 60000 or more, or 80000 or more, may be 180000 or less, 160000 or less, or 140000 or less, and may be 40000 to 180000, 60000 to 160000, or 80000 to 140000. The weight average molecular weight of the polyvinylidene chloride-based resin can be measured by a GPC method using polystyrene whose molecular weight is known as a standard substance.

20 [0026] The conditions of the GPC method used for measuring the weight average molecular weight of the polyvinylidene chloride-based resin are as follows. A gel chromatograph Alliance GPC 2000 model manufactured by Waters Corporation is used as a measuring device. A solution prepared by dissolving the polyvinylidene chloride-based resin in tetrahydrofuran so as to be 0.5% by mass is used as a sample.

Column: TSKgel GMHHR-H(S) HT 30 cm × 2, TSKgel GMH6-HTL 30 cm × 2 manufactured by Tosoh Corporation

Mobile phase: Tetrahydrofuran

Detector: Differential refractometer

5 Flow rate: 1.0 mL/min

Column temperature: 20°C

Injection amount: 500 µL

[0027] The polyolefin-based resin may be, for example, a polyethylene-based resin. The polyethylene-based resin may be a copolymer using  
10 low density polyethylene, linear low density polyethylene, linear ultra-low density polyethylene, medium density polyethylene, high density polyethylene, ethylene, or the like as monomer units. Specifically, the polyethylene-based resin may be a copolymer of ethylene and one or two or more kinds selected from  $\alpha$ -olefins having 3 to 10 carbon atoms, such  
15 as propylene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene, 1-heptene, and 1-octene, vinyl esters such as vinyl acetate and vinyl propionate, unsaturated carboxylic acid esters such as methyl acrylate, ethyl acrylate, methyl methacrylate, and ethyl methacrylate; unsaturated compounds such as conjugated diene and non-conjugated diene; and the  
20 like. The content of the ethylene unit in the polyethylene-based resin may be 50% by mass or more based on the total amount of monomer units.

[0028] The content of the thermoplastic resin may be 60% by mass or more, 70% by mass or more, or 75% by mass or more, and may be 90%  
25 by mass or less, 85% by mass or less, or 80% by mass or less, based on the total amount of the wrapping film, from the viewpoint of excellent

productivity.

[0029] The colorant may be, for example, a blue colorant, a red colorant, a yellow colorant, a green colorant, a violet colorant, or the like. The colorant is used singly or in combination of two or more kinds thereof.

5 [0030] The blue colorant is, for example, a colorant having a maximum absorption wavelength in a visible light region (wavelength: the total wavelength range of 380 to 750 nm) of 600 to 750 nm. The absorbance at the maximum absorption wavelength in the visible light region of the blue colorant is preferably 2 times or more and more preferably 3 times  
10 or more the absorbance at a wavelength of 470 nm. Specifically, the blue colorant may be copper phthalocyanine (copper phthalocyanine blue), iron(III) hexacyanoferrate(II), a mixture of cobaltous oxide and aluminum oxide, indigo, or ultramarine. The blue colorant is preferably a blue pigment from the viewpoint of more improving a strength,  
15 dispersibility, and solvent resistance.

[0031] The red colorant is, for example, a colorant having a maximum absorption wavelength in a visible light region (wavelength: the total wavelength range of 380 to 750 nm) of 500 to 599 nm. From the viewpoint of excellent visibility, the absorbance at the maximum  
20 absorption wavelength in the visible light region of the red colorant is preferably 2 times or more and more preferably 3 times or more the absorbance at a wavelength of 650 nm. Specifically, the red colorant may be quinacridone red, quinacridone scarlet, dimethyl quinacridone, a mixture of 4-nitroaniline and 2-naphthol, a mixture of 2-nitro-4-toluidine  
25 and 2-naphthol, a mixture of 2-nitro-p-toluidine and 3-oxy-3'-nitronaphtanilide, a mixture of o-anisidine and 2-naphthol, a mixture of

2,4,5-trichloroaniline and 3-oxy-2-naphto-o-toluidide, a mixture of 4-chloro-o-toluidine and 4'-chloro-3-hydroxy-2-naphto-o-toluidide, a mixture of 2,5-dichloroaniline and 3-oxy-2-naphto-p-toluidide, a mixture of 2,5-dichloroaniline and 3-oxy-2-naphto-o-anisidide, a mixture of N,N'-diethyl-4-methoxymetanilamide and 5'-chloro-3-hydroxy-2',4'-dimethoxy-2-naphthanilide, a mixture of 4-nitro-o-anisidine and 3-oxy-N-1-naphthyl-2-naphthamide, a mixture of 1-naphthylamine and 1-naphthol-5-sulfonic acid (calcium salt), a mixture of 2-amino-naphthalene-1-sulfonic acid and 2-naphthol (calcium salt), a mixture of 6-amino-m-toluenesulfonic acid and 3-oxy-2-naphthoic acid (calcium salt), a mixture of 2-amino-5-chloro-p-toluenesulfonic acid and 3-oxy-2-naphthoic acid (calcium salt), a mixture of 6-amino-4-chloro-m-toluenesulfonic acid and 3-oxy-2-naphthoic acid (calcium salt), a mixture of 2-aminonaphthalene-1-sulfonic acid and 3-oxy-2-naphthoic acid (calcium salt), a mixture of 3,3'-dichlorobenzidine and 3-carboxy-1-phenyl-5-pyrazolone, a mixture of o-dianisidine and 3-methyl-1-p-tolyl-5-pyrazolone, 1,2'-dioxyanthraquinone (calcium lake, iron lake, aluminum lake), 4,4'-dimethyl-6,6'-dichloro-2,2'-bisthio naphthene indigo, 4,4'-dimethyl-6,5',7'-trichloro-2,2'-bisthio naphthene indigo, a mixture of naphthionic acid and R acid (aluminum salt), erythrosine (aluminum salt), or the like. The red colorant is preferably a red pigment from the viewpoint of more improving a strength, dispersibility, and solvent resistance.

[0032] The yellow colorant is, for example, a colorant having a maximum absorption wavelength in a visible light region (wavelength: the total wavelength range of 380 to 750 nm) of 380 to 499 nm. From

the viewpoint of excellent visibility, the absorbance at the maximum absorption wavelength in the visible light region of the yellow colorant is preferably 2 times or more and more preferably 3 times or more the absorbance at a wavelength of 600 nm. Specifically, the yellow colorant may be a mixture of o-nitroaniline and acetoacetanilide, a mixture of p-nitroaniline and acetoacetanilide, a mixture of 4-chloro-2-nitroaniline and acetoacetanilide, a mixture of o-nitro-p-toluidine and acetoacetanilide, a mixture of p-chloro-o-nitroaniline and o-chloro-acetoacetanilide, a mixture of 4-chloro-2-nitroaniline and acetoacet-m-xylidide, a mixture of sulfanilic acid and 3-carboxy-1-(p-sulfophenyl)-5-pyrazolone, a mixture of sulfanilic acid and 3-carboxy-1-(p-sulfophenyl)-5-pyrazolone (aluminum lake), a mixture of 3,3'-dichlorobenzidine and acetoacet-o-toluidide, a mixture of 3,3'-dichlorobenzidine and acetoacet-p-toluidide, a mixture of 3,3'-dichlorobenzidine and acetoacet-m-xylidide, a mixture of 1-amino-5-benzamide-anthraquinone and oxiral chloride, N,N-bis-(1-anthraquinolyl)-isophthalic amide, a mixture of 3,3'-dichlorobenzidine and 4-chloro-2,5-dimethoxy-acetoacetanilide, a mixture of sulfanilic acid and 2-naphthol-6-sodium sulfonate, a mixture of 3,3'-dichlorobenzidine and 3-methyl-1-phenyl-5-pyrazolone, a mixture of o-dianisidine and acetoacetanilide, 4,11-bis(benzoylamino)-16H-dinaphtho[2,3-a:2',3'-i]carbazole-5,10,15,17-tetraone, a mixture of naphthalenetetracarboxylic acid and 1,2-diaminobenzene, or the like. The yellow colorant is preferably a yellow pigment from the viewpoint of more improving a strength, dispersibility, and solvent resistance.

[0033] The green colorant may be an  $\alpha$ -nitroso- $\beta$ -naphthol iron complex, a 4-nitrobenzeneazo-2-naphthol copper complex, octachlorocopper

phthalocyanine, polychlorocopper phthalocyanine, or the like.

[0034] The violet colorant may be 6,15-dibromo-isoviolanthrone, 5,5'-dichloro-4,4,7,7'-tetramethyl-2,2'-bis(thio naphthene indigo), dioxazine violet, quinacridone violet, or the like.

5 [0035] The content of the colorant may be 0.5% by mass or more or 0.6% by mass or more, and may be 2.0% by mass or less or 1.9% by mass or less, based on the total amount of the wrapping film.

[0036] The silver-based antibacterial agent may be a known silver-based antibacterial agent, and is an antibacterial agent containing metallic  
10 silver, silver ions, or a silver compound. The silver-based antibacterial agent may be, for example, an antibacterial agent in which a silver compound, a silver complex salt, or silver ions are supported on an inorganic compound having a porous structure. Such a silver-based antibacterial agent may be, depending on the types of inorganic  
15 compounds having a porous structure, a zeolite-silver-based antibacterial agent, a calcium phosphate-silver-based antibacterial agent, a zirconium phosphate-silver-based antibacterial agent, a silicate-silver-based antibacterial agent, or the like.

[0037] The zeolite-silver-based antibacterial agent is obtained, for  
20 example, by adding an aqueous silver nitrate solution to an aqueous suspension of A-type synthetic zeolite, substituting a certain amount of silver ions for the position of Na in the crystalline structure by ion-exchange reaction, and performing drying and then calcining. The zeolite-silver-based antibacterial agent is available as "Zeomic"  
25 manufactured by Sinanen Zeomic Co., Ltd. (for example, "Zeomic AJ10D"), "Bactekiller BM-102GA" manufactured by Fuji Chemical

Industries, Ltd., or the like.

[0038] A glass-silver-based antibacterial agent is obtained, for example, by supporting silver on silicate glass. The glass-silver-based antibacterial agent is available as "IONPURE" manufactured by  
5 ISHIZUKA GLASS CO., LTD., "Million Guard" manufactured by KOA GLASS CO., LTD., or the like.

[0039] The calcium phosphate-silver-based antibacterial agent is obtained, for example, by mixing an aqueous suspension of calcium phosphate, hydroxyapatite, calcium silicate, or the like with a silver  
10 nitrate solution and supporting metallic silver or silver ions on calcium phosphate. The calcium phosphate-silver-based antibacterial agent is available as "Apacider" manufactured by SANGI CO., LTD., "Silver Ace" manufactured by Taihei Chemical Industrial Co., Ltd., or the like.

[0040] The zirconium phosphate-silver-based antibacterial agent is obtained, for example, by substituting lithium in crystalline lithium  
15 zirconium phosphate, which is obtained by hydrothermal synthesis, with protons by an acid treatment, further substituting protons with silver ions, and then performing drying and calcining. The zirconium phosphate-silver-based antibacterial agent is available as "NOVARON AG300",  
20 "NOVARON AG1100", "NOVARON AGZ330", or "NOVARON AGT330" manufactured by TOAGOSEI CO., LTD., or the like.

[0041] The silicate-silver-based antibacterial agent is obtained, for example, by supporting silver ions on magnesium aluminometasilicate, and then performing drying and calcining. The silicate-silver-based  
25 antibacterial agent is available as "AIS-NAZ320" manufactured by JGC Catalysts and Chemicals Ltd., or the like.

[0042] The content of the silver-based antibacterial agent may be, for example, 0.01% by mass or more or 0.02% by mass or more based on the total amount of the wrapping film, and is preferably 0.03% by mass or more, 0.04% by mass or more, 0.05% by mass or more, or 0.10% by mass or more, from the viewpoint that a wrapping film particularly excellent in antibacterial activity can be obtained.

[0043] The content of the silver-based antibacterial agent may be, for example, 0.50% by mass or less, 0.40% by mass or less, or 0.30% by mass or less based on the total amount of the wrapping film, is preferably 0.28% by mass or less, 0.26% by mass or less, 0.24% by mass or less, 0.22% by mass or less, or 0.21% by mass or less, from the viewpoint of further excellent dispersibility of the colorant, is more preferably 0.19% by mass or less or 0.18% by mass or less, from the viewpoint of excellent film-forming properties of the wrapping film, and is further preferably 0.16% by mass or less, 0.14% by mass or less, 0.13% by mass or less, or 0.12% by mass or less, from the viewpoints of particularly excellent film-forming properties of the wrapping film and particularly excellent dispersibility of the colorant.

[0044] Although reasons are not clear, the silver-based antibacterial agent dose not impair the dispersibility of the colorant in the case of being used along with the colorant in the wrapping film, as compared with other inorganic antibacterial agents (for example, a zinc-based antibacterial agent). Therefore, in this wrapping film, while the colorant is satisfactorily dispersed, antibacterial activity is also imparted. Furthermore, although reasons are not clear, the silver-based antibacterial agent dose not impair the thermal stability of a resin composition in the

case of being used along with the thermoplastic resin and the colorant, as compared with other inorganic antibacterial agents (for example, a zinc-based antibacterial agent). Therefore, by using the silver-based antibacterial agent, a wrapping film to which antibacterial activity is imparted while the colorant is satisfactorily dispersed is obtained.

[0045] The wrapping film may have, for example, an antibacterial activity value of preferably 5.0 or more and more preferably 5.5 or more with respect to *Escherichia coli* (*Escherichia coli* NBRC 3972). The wrapping film may have, for example, an antibacterial activity value of preferably 5.5 or more and more preferably 6.0 or more with respect to *Staphylococcus aureus* (*Staphylococcus aureus* NBRC 12732). The antibacterial activity value is measured by a method described in Examples.

[0046] The wrapping film may further contain other components in addition to the thermoplastic resin, the colorant, and the silver-based antibacterial agent. Examples of the other components include a plasticizer, an anti-fogging agent, a stabilizer (a heat stabilizer or a light stabilizer), a lubricant, a filler, a plate-out preventing agent, an antioxidant, a releasing agent, a viscosity reducing agent, a surfactant, a fluorescent agent, a surface treatment agent, a crosslinking agent, a processing aid, a pressure sensitive adhesive, an antistatic agent, an ultraviolet absorber, and an anti-blocking agent. In a case where the wrapping film contains other components, the content (total content) of the other components may be, for example, 1% by mass or more and 30% by mass or less based on the total amount of the wrapping film.

[0047] The wrapping film preferably further contains a plasticizer. The

plasticizer may be, for example, adipic acid ester, epoxidized vegetable oil, or the like.

[0048] The adipic acid ester may be, for example, a diester of adipic acid and a linear or branched aliphatic alcohol having 6 to 10 carbon atoms (adipic acid diester). The adipic acid ester may be, for example, dioctyl adipate, diisononyl adipate, or the like.

[0049] The epoxidized vegetable oil may be, for example, epoxidized soybean oil, epoxidized linseed oil, epoxidized castor oil, epoxidized corn oil, epoxidized rapeseed oil, epoxidized safflower oil, epoxidized sunflower oil, epoxidized palm oil, epoxidized cotton oil, epoxidized olive oil, or the like.

[0050] The content of the plasticizer may be, for example, 15% by mass or more or 20% by mass or more, and may be 35% by mass or less or 30% by mass or less based on the total amount of the wrapping film.

[0051] The wrapping film preferably further contains an anti-fogging agent. The anti-fogging agent may be, for example, glycerin fatty acid ester. The glycerin fatty acid ester may be monoglycerin fatty acid ester, and may be polyglycerin fatty acid ester. The fatty acid constituting the glycerin fatty acid ester may be, for example, a saturated or unsaturated fatty acid having 12 to 18 carbon atoms.

[0052] The monoglycerin fatty acid ester may be, for example, monoglycerin laurate, monoglycerin myristate, monoglycerin palmitate, monoglycerin stearate, monoglycerin oleate, monoglycerin linoleate, and the like. The polyglycerin fatty acid ester may be, for example, polyglycerin laurate, polyglycerin myristate, polyglycerin palmitate, polyglycerin stearate, polyglycerin oleate, polyglycerin linoleate, and the

like.

[0053] The content of the anti-fogging agent may be, for example, 0.1% by mass or more or 0.5% by mass or more, and may be 5% by mass or less or 3% by mass or less based on the total amount of the wrapping film.

5 [0054] The wrapping film preferably further contains a stabilizer. The stabilizer may be, for example, a Ca/Zn-based stabilizer. The Ca/Zn-based stabilizer is a mixture of a fatty acid salt of calcium and a fatty acid salt of zinc. Examples of the fatty acid include behenic acid, stearic acid, lauric acid, oleic acid, palmitic acid, and ricinoleic acid.

10 [0055] The content of the stabilizer may be, for example, 0.1% by mass or more or 0.5% by mass or more, and may be 5% by mass or less or 3% by mass or less based on the total amount of the wrapping film.

[0056] The wrapping film may consist of only one layer containing the thermoplastic resin, the colorant, and the silver-based antibacterial agent, or may consist of a plurality of layers. In a case where the wrapping film consists of a plurality of layers, each of the thermoplastic resin, the colorant, and the silver-based antibacterial agent may be contained in any of layers, may be contained in the same layer, and may be contained in different layers.

20 [0057] In a case where the wrapping film consists of a plurality of layers, the wrapping film may include, for example, a first surface layer, an intermediate layer, and a second surface layer in this order. In this case, for example, the first and second surface layers may contain the thermoplastic resin, the silver-based antibacterial agent, and other components which are added as necessary, and the intermediate layer may contain the thermoplastic resin, the colorant, and other components

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which are added as necessary. The wrapping film may further include, for example, an adhesive layer containing an acid-modified polyolefin resin or the like in order to improve the adhesion between layers, and may further include a heat resistant layer containing a polyamide-based resin in order to improve the heat resistance of the wrapping film.

[0058] The thickness of the wrapping film may be preferably 5  $\mu\text{m}$  or more and more preferably 6  $\mu\text{m}$  or more from the viewpoint of efficiently shielding the food from the outside air, and may be preferably 25  $\mu\text{m}$  or less and more preferably 12  $\mu\text{m}$  or less from the viewpoint of excellent handleability.

[0059] From the viewpoint of excellent visibility, the total light transmittance of the wrapping film is preferably 75% or more and more preferably 80% or more, and may be, for example, 90% or less. An incident light amount and a total transmitted light amount are measured according to JIS K7361-1 and the total light transmittance can be calculated as  $\text{Total light transmittance} = (\text{Total transmitted light amount}) / (\text{Incident light amount}) \times 100$ .

[0060] The wrapping film is produced, for example, by mixing a thermoplastic resin, a colorant, a silver-based antibacterial agent, and as necessary, the aforementioned other components with a mixer such as a V-type blender, a ribbon blender, a Henschel mixer, or a super mixer, and further kneading the mixture with a kneading machine such as a mixing roll, a Banbury mixer, or a kneader as necessary, to obtain a composition, followed by extrusion molding, for example. Specifically, the composition is supplied to a hopper of an extruder, and a target wrapping film is obtained by an inflation method, a T-die method, or the like.

[0061] In a case where the wrapping film consists of a plurality of layers, the wrapping film is obtained by putting constituent raw materials of each layer into separate extruders, melt-extruding the constituent raw materials, co-extruding each layer by an inflation method, a T-die method, or the like, and laminating the layers. At this time, it is preferable to form a wrapping film by directly drawing the molten substance extruded from the T-die while rapidly cooling the molten substance with a casting roll or the like.

[0062] For the wrapping film obtained in this way, depending on the purpose such as reduction in thermal shrinkage, natural shrinkage, etc. and suppression of occurrence of width contraction, longitudinal stretching between heating rolls, various heat treatments such as heat setting and aging may be performed, and for the purpose of improving anti-fogging property, antistatic property, tackiness, and the like, a corona treatment; an aging treatment; a surface treatment such as printing or coating; surface processing; and the like may be performed.

[0063] The wrapping film is, for example, molded in an elongated shape and wound up, and the wound wrapping film is then further rewound (rolled) for each desired length such as 20 m or 50 m, packed in a box, thereby forming a product. That is, the wrapping film in the present embodiment may be in the form of a wrapping film wound around a winding core, and may be in the form of a wrapping film stored in a box.

[0064] FIG. 1 is a perspective view illustrating a wrapping film storage body according to an embodiment. As illustrated in FIG. 1, a wrapping film storage body 1 according to an embodiment includes a wrapping film 2, a winding core 3 around which the wrapping film is wound, and a box

4 storing the wrapping film 2 and the winding core 3. A blade part 5 for cutting the wrapping film 2 may be provided in the box 4. Materials for the winding core 3 and the box 4 are not particularly limited. From the viewpoint of easily recognizing the color of the wrapping film from the outside, at least a part of the box 4 is preferably transparent, or has a hole in such a degree as not to impair the function as a box and the inside can be visually recognized from the outside.

[0065] Incidentally, the "film" is generally a thin flat product having an extremely small thickness relative to a length and a width of the product, and a maximum thickness that is defined as an optional value, which may be supplied in the form of a roll (as necessary, refer to Japanese Industrial Standards JIS K6900), and the "sheet" is generally a thin flat product generally having a comparatively small thickness relative to a length and a width of the product on the basis of the definitions of JIS. However, there is no clear boundary between the sheet and the film, and since it is not necessary that the sheet and the film are literally distinguished from each other in the present embodiment, in the present specification, even though the product is referred to as the "film", the product also encompasses the "sheet"; on the contrary, even though the product is referred to as the "sheet", the product also encompasses the "film". Furthermore, the "film" is the concept particularly encompassing a wrapping film of the above-described definitions.

### **Examples**

[0066] Hereinafter, the present invention will be described in more detail based on Examples; however, the present invention is not limited to Examples.

[0067] [Example 1]

(1) Preparation of resin composition

A polyvinyl chloride-based resin (thermoplastic resin, "TH-1000" manufactured by TAIYO VINYL CORPORATION, average degree of polymerization: 1000), 1.0% by mass of copper phthalocyanine (blue colorant, "NX-053 Blue" manufactured by Dainichiseika Color & Chemicals Mfg. Co., Ltd., maximum absorption wavelength: 620 nm), 0.05% by mass of a silver-based antibacterial agent A (zirconium phosphate-silver-based antibacterial agent, "NOVARON AG300" manufactured by TOAGOSEI CO., LTD.), 7.0% by mass of dioctyl adipate ("SANSO CIZER DOA" manufactured by New Japan Chemical Co., Ltd.), 7.0% by mass of diisononyl adipate ("DINA" manufactured by Taoka Chemical Co., Ltd.), 8.0% by mass of epoxidized soybean oil ("Chemicizer SE-100" manufactured by Sanwa Goseikagaku K.K.), 1.0% by mass of glycerin monooleate ("XO-100" manufactured by RIKEN VITAMIN CO., LTD.), and 1.0% by mass of a Ca/Zn-based stabilizer ("SC-308E" manufactured by ADEKA Corporation) were put into a super mixer, the material temperature was then increased from normal temperature to 130°C under stirring, and the materials were mixed, thereby obtaining a resin composition. Incidentally, the rest obtained by subtracting the total content of respective components other than the polyvinyl chloride-based resin (thermoplastic resin) from 100% by mass is the content of the polyvinyl chloride-based resin (thermoplastic resin). Furthermore, the content of each component means % by mass in terms of solid content.

[0068] (2) Evaluation of thermal stability

60 g of the aforementioned resin composition was put into a roller mixer R60 model attached to Labo Plastomill ("4C150-01" manufactured by Toyo Seiki Seisaku-sho, Ltd.) and kneaded at 210°C and 60 rpm, and thereby the dynamic thermal stability of the resin composition was evaluated. Time from the numerical value of steady torque until the torque value reached 150% was regarded as dynamic thermal stability time. As the dynamic thermal stability time is longer, it can be said that the wrapping film is excellent in thermal stability.

[0069] (3) Production of wrapping film

The resin composition cooled to 70°C was extruded with a single screw extruder having a diameter of 40 mm ( $L/D = 20$ ) equipped with a T-die (width: 350 mm, gap: 0.4 mm) in a state where the temperature of the resin composition became 200°C, and thereby a wrapping film having a thickness of 8  $\mu\text{m}$  was produced.

[0070] (4) Evaluation of dispersibility

The obtained wrapping film was cut into a size of 20 cm  $\times$  20 cm to obtain a test piece. The test piece was visually observed, and presence or absence of color unevenness was observed to evaluate the dispersibility of the blue colorant. Evaluation criteria are as follows.

Incidentally, when it is evaluated as A, B, or C, it can be said that the wrapping film is excellent in dispersibility, a case evaluated as A or B is more preferred, and a case evaluated as A is further preferred.

A: The color unevenness was not recognized in the test piece.

B: The color unevenness was recognized in one portion of the test piece.

C: The color unevenness was recognized in two or three portions of the test piece.

D: The color unevenness was recognized in four or more portions of the test piece.

[0071] (5) Evaluation of antibacterial activity

The antibacterial activity was evaluated by the method according to "Antibacterial products-Test for antibacterial activity and efficacy" (JIS Z 2801:2000). Specifically, 0.4 mL of a bacterial suspension was inoculated on an analyte sample (culture medium) and left to stand at 35°C ± 1°C and RH 90% or more for 24 hours in a state where each wrapping film was covered thereon as a lid. Thereafter, the bacterial suspension was recovered, the number of viable bacteria was measured, and the antibacterial activity value was calculated according to the following equation. As the antibacterial activity value is larger, it can be said that the wrapping film is excellent in antibacterial activity.

$$\text{Antibacterial activity value} = \log(C/A) - \log(D/A) = \log(C/D)$$

A: Number of bacteria in the control section before and after inoculation

C: Number of bacteria in the test section not covered with the wrapping film

D: Number of bacteria in the test section covered with the wrapping film

Incidentally, the details of respective conditions are as follows.

Analyte sample: 50 mm × 50 mm

Culture medium: 1/500-fold nutrition

Meat extract 10 mg/L + Peptone 20 mg/L + Sodium chloride 10 mg/L

Test bacteria: Escherichia coli (Escherichia coli NBRC 3972)

Staphylococcus aureus (Staphylococcus aureus NBRC  
12732)

[0072] (6) Evaluation of film-forming properties

The aforementioned resin composition was extruded at a resin  
5 temperature of 200°C with a T-die extruder to mold a wrapping film, and  
the appearance of the obtained wrapping film was observed to evaluate  
film-forming properties. Evaluation criteria are as follows.  
Incidentally, when it is evaluated as A or B, it can be said that the  
wrapping film is excellent in film-forming properties, and a case  
10 evaluated as A is more preferred.

A: A wrapping film having a substantially uniform thickness was  
obtained, and no scorch occurred by extrusion for 24 hours.

B: Slight unevenness in the wrapping film thickness was observed, and a  
scorch occurred by extrusion for 24 hours.

15 C: Unevenness in the wrapping film thickness was large, and a scorch  
occurred by extrusion for 8 hours.

[0073] [Comparative Example 1]

The above (1) to (6) were performed in the same manner as in  
Example 1, except that the silver-based antibacterial agent was not used.

20 [0074] [Comparative Example 2]

The above (1) to (6) were performed in the same manner as in  
Example 1, except that a zinc-based antibacterial agent ("NOVARON  
VZF-200" manufactured by TOAGOSEI CO., LTD.) was used instead of  
the silver-based antibacterial agent A.

25 [0075] [Examples 2 to 17]

The above (1) to (6) were performed in the same manner as in

Example 1, except that the content of the silver-based antibacterial agent A was changed as shown in Tables 1 to 3.

[0076] [Example 18]

5 The above (1) to (6) were performed in the same manner as in Example 1, except that quinacridone red (red colorant, "NX-032 Red" manufactured by Dainichiseika Color & Chemicals Mfg. Co., Ltd.) was used instead of the copper phthalocyanine (blue colorant).

[0077] [Example 19]

10 The above (1) to (6) were performed in the same manner as in Example 1, except that a silver-based antibacterial agent B (zeolite-silver-based antibacterial agent, "Zeomic AJ10D" manufactured by Sinanen Zeomic Co., Ltd.) was used instead of the silver-based antibacterial agent A.

15 [0078] Evaluation results of the thermal stability, the dispersibility, the antibacterial activity with respect to Escherichia coli and Staphylococcus aureus, and the film-forming properties in each of Examples and Comparative Examples are shown in Tables 1 to 3.

[0079] [Table 1]

|                                                | Example 1                          | Comparative Example 1 | Comparative Example 2 | Example 2 | Example 3 | Example 4 | Example 5 |
|------------------------------------------------|------------------------------------|-----------------------|-----------------------|-----------|-----------|-----------|-----------|
| Content (% by mass)                            | Blue colorant                      | 1.0                   | 1.0                   | 1.0       | 1.0       | 1.0       | 1.0       |
|                                                | Silver-based antibacterial agent A | 0.05                  | -                     | 0.01      | 0.02      | 0.03      | 0.04      |
|                                                | Zinc-based antibacterial agent     | -                     | 0.05                  | -         | -         | -         | -         |
| Thermal stability                              | 24.5                               | 22.5                  | 20.0                  | 22.6      | 23.0      | 23.5      | 24.0      |
| Dispersibility                                 | A                                  | A                     | D                     | A         | A         | A         | A         |
| Antibacterial activity (Escherichia coli)      | 5.5                                | 0                     | 4.5                   | 1.2       | 2.7       | 4.5       | 5.2       |
| Antibacterial activity (Staphylococcus aureus) | 6.3                                | 0                     | 5.3                   | 1.8       | 3.8       | 5.7       | 6.2       |
| Film-forming properties                        | A                                  | A                     | C                     | A         | A         | A         | A         |

[0080] [Table 2]

|                                                   |                                          | Example 6 | Example 7 | Example 8 | Example 9 | Example 10 | Example 11 | Example 12 |
|---------------------------------------------------|------------------------------------------|-----------|-----------|-----------|-----------|------------|------------|------------|
| Content<br>(% by mass)                            | Blue<br>colorant                         | 1.0       | 1.0       | 1.0       | 1.0       | 1.0        | 1.0        | 1.0        |
|                                                   | Silver-based<br>antibacterial<br>agent A | 0.06      | 0.07      | 0.08      | 0.09      | 0.10       | 0.12       | 0.14       |
| Thermal stability                                 |                                          | 25.0      | 25.0      | 25.5      | 25.5      | 26.0       | 26.0       | 26.5       |
| Dispersibility                                    |                                          | A         | A         | A         | A         | A          | A          | A          |
| Antibacterial activity<br>(Escherichia coli)      |                                          | 5.8       | 6.0       | 6.0       | 6.1       | 6.0        | 6.0        | 6.0        |
| Antibacterial activity<br>(Staphylococcus aureus) |                                          | 6.3       | 6.3       | 6.3       | 6.3       | 6.2        | 6.4        | 6.5        |
| Film-forming properties                           |                                          | A         | A         | A         | A         | A          | A          | B          |

[0081] [Table 3]

|                                                            | Example 13                         | Example 14 | Example 15 | Example 16 | Example 17 | Example 18 | Example 19 |
|------------------------------------------------------------|------------------------------------|------------|------------|------------|------------|------------|------------|
| Content<br>(% by mass)                                     | Blue colorant                      | 1.0        | 1.0        | 1.0        | 1.0        | -          | 1.0        |
|                                                            | Red colorant                       | -          | -          | -          | -          | 1.0        | -          |
|                                                            | Silver-based antibacterial agent A | 0.16       | 0.18       | 0.20       | 0.25       | 0.30       | -          |
|                                                            | Silver-based antibacterial agent B | -          | -          | -          | -          | -          | 0.05       |
| Thermal stability                                          | 26.5                               | 26.5       | 26.5       | 26.5       | 26.5       | 23.5       | 24.5       |
| Dispersibility                                             | A                                  | B          | B          | B          | C          | A          | A          |
| Antibacterial activity<br>( <i>Escherichia coli</i> )      | 6.0                                | 6.1        | 6.0        | 5.9        | 6.0        | 5.3        | 5.2        |
| Antibacterial activity<br>( <i>Staphylococcus aureus</i> ) | 6.3                                | 6.3        | 6.2        | 6.4        | 6.5        | 6.0        | 6.2        |
| Film-forming properties                                    | B                                  | B          | C          | C          | C          | A          | A          |

### **Reference Signs List**

[0082] 1: wrapping film storage body, 2: wrapping film, 3: winding core,  
4: box, 5: blade part.

## CLAIMS

1. A wrapping film comprising:  
a thermoplastic resin;  
a colorant; and  
5 a silver-based antibacterial agent.
2. The wrapping film according to claim 1, wherein a content of the silver-based antibacterial agent is 0.04% by mass or more based on the total amount of the wrapping film.
3. The wrapping film according to claim 1 or 2, wherein a content  
10 of the silver-based antibacterial agent is 0.18% by mass or less based on the total amount of the wrapping film.
4. The wrapping film according to any one of claims 1 to 3, wherein the colorant comprises at least one selected from the group consisting of a blue colorant, a red colorant, a yellow colorant, a green colorant, and a  
15 violet colorant.
5. The wrapping film according to any one of claims 1 to 4, wherein the thermoplastic resin comprises at least one selected from the group consisting of a polyester-based resin, a polyamide-based resin, a polystyrene-based resin, a polylactic acid-based resin, a polyolefin-based  
20 resin, a polyvinyl chloride-based resin, and a polyvinylidene chloride-based resin.
6. The wrapping film according to any one of claims 1 to 5, further comprising a plasticizer.
7. The wrapping film according to any one of claims 1 to 6, wherein  
25 the wrapping film has an antibacterial activity value of 5.0 or more with respect to *Escherichia coli*.

8. A wrapping film storage body comprising:  
a winding core;  
the wrapping film according to any one of claims 1 to 7 wound  
around the winding core; and  
5 a box storing the winding core and the wrapping film.