

## Description

Title of Invention: CONTACT LENS PACKAGE

### Technical Field

[0001] The present invention relates to a contact lens package.

### Background Art

[0002] A conventional disposable contact lens is generally stored in a state of being accommodated together with a storage solution in a lens storage space of a package having a lid member and a base member, the package having the lens storage space higher than the natural sagittal height of the contact lens.

[0003] In recent years, from the viewpoints of the reduction of plastic waste, space savings, and the like, a thin contact lens package in which a contact lens is stored in a thin package having a thickness smaller than the natural sagittal height of the contact lens has been proposed (e.g., Patent Literature 1).

### Citation List

#### Patent Literature

[0004] [PTL 1] JP 2005-234576 A

### Summary of Invention

#### Technical Problem

[0005] When a contact lens is removed from a thin contact lens package and worn, visibility may be poor at the initial stage of the wearing. A primary object of the present invention is to improve poor visibility at the initial stage of the wearing of the contact lens removed from the thin contact lens package.

#### Solution to Problem

[0006] [1] According to one aspect of the present invention, there is provided a contact lens package, including: a package having a lid member and a base member; and a contact lens stored in a deformed state in a storage space sealed by the above-mentioned lid member and the above-mentioned base member, wherein the above-mentioned contact lens has a relaxation modulus of 1.6 MPa or less, and wherein the relaxation modulus of the above-mentioned contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[2] In the contact lens package according to the above-mentioned item [1], the above-mentioned contact lens may have a loss tangent in tension of 0.14 or less, which is obtained by

dynamic tensile viscoelasticity measurement in the aqueous medium at 35°C.

[3] In the contact lens package according to the above-mentioned item [1] or [2], the relaxation modulus of the above-mentioned contact lens may be 1.3 MPa or less.

[4] According to another aspect of the present invention, there is provided a contact lens package, including: a package having a lid member and a base member; and a contact lens stored in a deformed state in a storage space sealed by the above-mentioned lid member and the above-mentioned base member, wherein the above-mentioned contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C.

[5] In the contact lens package according to the above-mentioned item [4], the loss tangent in tension of the above-mentioned contact lens may be 0.06 or less.

[6] In the contact lens package according to the above-mentioned item [4] or [5], the relaxation modulus of the above-mentioned contact lens may be 1.8 MPa or less, and the relaxation modulus of the above-mentioned contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when

measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[7] According to another aspect of the present invention, there is provided a contact lens package, including: a package having a lid member and a base member; and a contact lens stored in a deformed state in a storage space sealed by the above-mentioned lid member and the above-mentioned base member, wherein the above-mentioned contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C, wherein the above-mentioned contact lens has a relaxation modulus of 1.6 MPa or less, and wherein the relaxation modulus of the above-mentioned contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% to the contact lens piece with respect to an upper limit of a linear elastic region in a tensile test in the aqueous medium at 35°C.

[8] In the contact lens package according to the above-mentioned item [7], the loss tangent in tension of the above-

mentioned contact lens may be 0.06 or less.

[9] In the contact lens package according to the above-mentioned item [7] or [8], the relaxation modulus of the above-mentioned contact lens may be 1.2 MPa or less.

[10] In the contact lens package according to any one of the above-mentioned items [1] to [9], the above-mentioned contact lens may have an oxygen transmissibility (Dk/t) of 24 or more.

[11] In the contact lens package according to any one of the above-mentioned items [1] to [10], the above-mentioned contact lens may be a silicone hydrogel lens.

[12] In the contact lens package according to any one of the above-mentioned items [1] to [11], the above-mentioned contact lens may be stored in the above-mentioned storage space under a state in which a height thereof is smaller than a natural sagittal height thereof.

[13] In the contact lens package according to any one of the above-mentioned items [1] to [12], the above-mentioned storage space may have a height of 2 mm or less.

[14] According to another aspect of the present invention, there is provided a method of improving wrinkle recoverability of a contact lens when a contact lens package is opened, the method including producing the contact lens package by joining a lid member and a base member facing each other so that the a lid member and the base member form a storage space in a sealed state in which the contact lens is arranged, wherein the above-mentioned storage space has a height smaller than a natural sagittal height of the above-mentioned contact lens, wherein the above-mentioned contact lens has a relaxation modulus of 1.6 MPa or less, and wherein the relaxation modulus of the above-mentioned contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[15] According to another aspect of the present invention, there is provided a method of suppressing generation of wrinkles of a contact lens in a contact lens package, the method including producing the contact lens package by joining a lid member and a base member facing each other so that the a lid member and the base member form a storage space in a sealed state in which the contact lens is arranged, wherein the above-mentioned storage

space has a height smaller than a natural sagittal height of the above-mentioned contact lens, and wherein at least one of the following (i) or (ii) is satisfied: (i) the above-mentioned contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C; and (ii) a ratio of the latter of the following energies to the former thereof is 90% or more: energy absorbed when the contact lens is stretched at a stretching ratio of 100% in the aqueous medium at 35°C; and energy released for shrinking the contact lens from the stretched state to a stretching ratio of 0%.

[16] According to another aspect of the present invention, there is provided a contact lens package, including: a package having a lid member and a base member; and a contact lens stored in a storage space sealed by the above-mentioned lid member and the above-mentioned base member, wherein the above-mentioned storage space is defined by a convex curved surface part of the above-mentioned lid member protruding toward the above-mentioned base member side and a concave curved surface part of the above-mentioned base member protruding toward a side opposite to the above-mentioned lid member, wherein the above-mentioned package is configured such that the above-mentioned contact lens adheres to the above-mentioned lid member or the above-mentioned base member when the above-mentioned package is opened, and wherein

at least one of the following (i) or (ii) is satisfied: (i) the above-mentioned contact lens has a relaxation modulus of 1.6 MPa or less, and the relaxation modulus of the above-mentioned contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the above-mentioned contact lens piece in an aqueous medium at 35°C; and (ii) the above-mentioned contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in the aqueous medium at 35°C.

#### Advantageous Effects of Invention

[0007] According to the embodiment of the present invention, the contact lens having predetermined physical properties is used as a contact lens to be stored in a thin package. Thus, even when the contact lens is removed from the thin package and worn immediately, poor visibility at an initial stage after the wearing can be improved.

[0008] The thinning of a package leads to the reduction of waste such as plastic, and hence the thin contact lens package according to the embodiment of the present invention contributes particularly to "12. Responsible Consumption and Production" and

"14. Life Below Water" out of the 17 goals and 169 targets of the Sustainable Development Goals (SDGs).

#### Brief Description of Drawings

[0009] FIG. **1A** is a schematic top view of a contact lens package according to one embodiment of the present invention.

FIG. **1B** is a schematic bottom view of the contact lens package illustrated in FIG. **1A**.

FIG. **1C** is a schematic cross-sectional view taken along the line A-A of the contact lens package illustrated in FIG. **1A**.

FIG. **1D** is an exploded perspective view of the contact lens package illustrated in FIG. **1A**.

FIG. **2** is a schematic perspective view of an example of a package in an opened state.

FIG. **3** is a view for describing the natural sagittal height of a contact lens.

FIG. **4A** is a schematic cross-sectional view of a lens loading base material used in the contact lens package illustrated in FIG. **1A**.

FIG. **4B** is a schematic cross-sectional view of an example of the lens loading base material.

FIG. **5** is a schematic cross-sectional view of a contact lens package according to one embodiment of the present invention.

FIG. **6** is a schematic cross-sectional view of the base member of the contact lens package illustrated in FIG. **5**.

FIG. **7** is a schematic cross-sectional view of a contact lens package according to one embodiment of the present invention.

FIG. **8(a)** is a schematic cross-sectional view of the lid member of the contact lens package illustrated in FIG. **7**, and FIG. **8(b)** is a schematic cross-sectional view of the base member of the contact lens package illustrated in FIG. **7**.

FIG. **9** is a view for describing a method of producing a measurement sample.

FIG. **10(a)** is a view for illustrating the diopter distribution of a contact lens in which the Q values of all ring regions are 2 or more, and FIG. **10(b)** is a view for illustrating the diopter distribution of a contact lens in which the Q values

of all ring regions are 2 or less.

#### Description of Embodiments

[0010] Typical embodiments of the present invention are described below, but the present invention is not limited to these embodiments. The respective embodiments may be appropriately combined unless clearly inappropriate. For ease of viewing, the drawings are schematically illustrated, and the thickness and size of each component, and a mutual ratio between, for example, the thicknesses of the components in the drawings differ from actual ones.

[0011] Herein, the surface of a contact lens on a side in contact with an eye may be referred to as "inner surface," and the surface on an opposite side thereof may be referred to as "outer surface."

[0012] As used herein, the term "monomer" means a polymerizable compound having one or more polymerizable groups. The polymerizable group may be preferably, for example, an ethylenically unsaturated group, and the polymerizable group may be, for example, a (meth)acryloyl group, a vinyl group, a styryl group, or an allyl group. Herein, the description "(meth)" means optional methyl substitution. Accordingly, the description "(meth)acryloyl" means methacryloyl and/or acryloyl. Other

descriptions such as "(meth)acrylic" have similar meanings.

[0013]            [Contact Lens Package]

According to one aspect of the present invention, there is provided a contact lens package, including: a package having a lid member and a base member; and a contact lens stored in a storage space sealed by the above-mentioned lid member and the above-mentioned base member. In the above-mentioned sealed storage space, the contact lens may be in a state in which at least a part thereof is deformed. The deformation of the contact lens may be deformation within the range in which the contact lens can recover to a wearable state after the storage space is opened, and at least a part of a hemispherical shape formed along a corneal curve may be in a folded state, a twisted state, a bent state, a compressed state, a rolled state, or the like. The contact lens may be, for example, in a state in which its height is smaller than its natural sagittal height and/or a state in which its diameter is smaller than a natural diameter (DIA) in the sealed storage space.

[0014]            The standard deviation of a diopter distribution in a predetermined region of the contact lens immediately after the opening of the contact lens package according to an embodiment of the present invention (e.g., within 15 seconds after the opening) is typically 3 or less, for example, 2 or less,

preferably 1.5 or less, more preferably 1 or less, still more preferably 0.5 or less. The lower limit of the standard deviation of the above-mentioned diopter distribution is not particularly limited, but may be, for example, 0.01 or more. The fact that the standard deviation of the above-mentioned diopter distribution is small means that diopter unevenness on a contact lens surface is small, and as a result, the above-mentioned poor visibility can be reduced. The standard deviation of the above-mentioned diopter distribution may be obtained as a Q value by, for example, measurement using an underwater power measurement instrument ("VC-2001" manufactured by Visionix). The predetermined region serving as the measurement target of the above-mentioned diopter distribution may be, for example, a ring region within a radius of 5 mm from the center of the contact lens, a spot region within a radius of 5 mm, or a spot region within a radius of 3 mm.

[0015] The standard deviation of a diopter distribution in the predetermined region of the contact lens at a time point when 900 seconds have elapsed after the opening of the contact lens package according to the embodiment of the present invention is typically 3 or less, for example, 2 or less, preferably 1.5 or less, more preferably 1 or less, still more preferably 0.5 or less. The lower limit of the standard deviation of the above-mentioned diopter distribution is not particularly limited, but

may be, for example, 0.01 or more.

[0016] FIG. **1A** is a schematic top view of the contact lens package according to one embodiment of the present invention, FIG. **1B** is a schematic bottom view of the contact lens package illustrated in FIG. **1A**, FIG. **1C** is a schematic cross-sectional view taken along the line A-A of the contact lens package illustrated in FIG. **1A**, and FIG. **1D** is an exploded perspective view of the contact lens package illustrated in FIG. **1A**. In addition, FIG. **2** is a schematic perspective view of an example of a package in an opened state.

[0017] As illustrated in FIG. **1A** to FIG. **1D**, a contact lens package **200A** includes: a package **100** having a lid member **10** and a base member **20**; and a contact lens **120** stored in a storage space **110** sealed by the lid member **10** and the base member **20**. A contact lens storage solution is also stored in the storage space **110**, though the solution is not shown. Thus, the contact lens **120** is maintained in a hydrated state. The contact lens **120** is stored in the storage space **110** in a deformed state, specifically, under a state in which its height is smaller than its natural sagittal height, and may be, for example, in a flatly compressed state. Herein, the natural sagittal height of the contact lens means the height of a lens outer surface when the contact lens in the hydrated state is arranged on a horizontal plane with its

inner surface facing downward, and is a height indicated by "**T**" in FIG. 3.

[0018] As illustrated in FIG. **1A** to FIG. **1D** and FIG. **2**, the package **100** has the lid member **10** and the base member **20**.

[0019] The lid member **10** is formed of, for example, a film base material having flexibility. A material for forming the film base material is, for example, an inorganic material such as aluminum, or a resin material, for example, a polyolefin-based resin, such as polyethylene (PE) or polypropylene (PP), a polyester-based resin such as polyethylene terephthalate (PET), or a polyamide-based resin.

[0020] The film base material may have a single-layer structure or may have a laminated structure. In one embodiment, the film base material may have a single-layer structure formed of a resin film (e.g., a PP film or a PET film) or a metal foil (e.g., an aluminum foil). In another embodiment, the film base material may have a two-layer structure including a resin layer (e.g., a PP film or a PET film) and an aluminum layer (e.g., an aluminum vapor deposition layer) arranged on one side thereof. In another embodiment, the film base material may have a three-layer structure including a first resin layer, an aluminum layer, and a second resin layer.

[0021] In the illustrated example, the base member **20** includes a supporting base material **22** and a lens loading base material **24** arranged on the inner surface of the supporting base material **22**. The lens loading base material **24** is fixed to a predetermined position of the supporting base material **22** with, for example, an adhesive. However, the lens loading base material **24** is an optional member and may be omitted in accordance with purposes.

[0022] The supporting base material **22** is formed of, for example, a film base material having flexibility similar to that of the film base material for forming the lid member **10**.

[0023] The lens loading base material **24** of the illustrated example has a disc-shaped lens loading part **24a** and an edge part **24b**, which is arranged so as to surround its outer periphery and has a maximum height **T2** higher than the maximum height **T1** of the lens loading part **24a** (FIG. **1D**, FIG. **2**, and FIG. **4A**). In the contact lens package in a sealed state, the contact lens is typically loaded on the lens loading part **24a** of the lens loading base material **24**. The lens loading base material **24** is formed of a resin material, such as PE, PP, or PET, and has mechanical strength capable of supporting the contact lens and shape retainability.

[0024] The shape of the lens loading base material **24** is not limited to the illustrated example. For example, the lens loading base material may be non-circular (e.g., elliptical or polygonal). In addition, for example, the lens loading part may be flat, or may be curved convexly or concavely upward in accordance with purposes. Specifically, as illustrated in FIG. **4B**, the lens loading part **24a** may be curved convexly upward. In addition, for example, the lens loading base material may be free of an edge part.

[0025] The thickness of the lens loading part **24a** is, for example, from 0.1 mm to 1.0 mm, preferably from 0.2 mm to 0.9 mm.

[0026] The lens loading base material **24** may have a through-hole **24c** penetrating the lens loading part **24a** in a thickness direction as in the illustrated example. One or two or more through-holes may be arranged.

[0027] The storage space **110** sealed by the lid member **10** and the base member **20** may be formed by joining the lid member **10** and the base member **20** (more specifically, the lid member **10** and the supporting base material **22**) so that the members surround a predetermined region. For example, under a state in which the

contact lens is arranged at a predetermined position of the base member (e.g., on the lens loading part of the lens loading base material), the lid member and the base member are joined in at least a predetermined region (e.g., a region **S** in FIG. **2**) surrounding the lens loading base material. Thus, a contact lens package in which the contact lens is stored in a storage space sealed by the lid member and the base member can be obtained. From the viewpoints of sealability and easy openability, the joining is preferably performed by heat sealing or ultrasonic sealing, and heat sealing is more preferred. In the contact lens package **200A** of the illustrated example, the portions of the top surface (lid member **10**) and the bottom surface (base member **20**) corresponding to the lens loading base material **24** protrude, but the contact lens package according to this embodiment is not limited to the above-mentioned configuration. For example, the contact lens package may be configured so that one surface has a convex part corresponding to the contact lens or the lens loading base material **24**, and the other surface is flat.

[0028] The height of the storage space **110** may correspond to a value obtained by subtracting the total thickness of the lid member and the base member from the maximum thickness of the portion of the contact lens package **200A** corresponding to the storage space **110**. Herein, when the base member **20** includes the

supporting base material **22** and the lens loading base material **24**, the thickness of the base member **20** may be the sum of the thickness of the supporting base material **22** and the maximum height **T1** of the lens loading part **24a**.

[0029] The height (maximum height) of the storage space is typically smaller than the natural sagittal height of the contact lens, and is, for example, 4.5 mm or less, preferably 3 mm or less, more preferably 2.5 mm or less, and may be 2 mm or less, 1.5 mm or less, 1.2 mm or less, 1 mm or less, or 0.9 mm or less. The height of the above-mentioned storage space is, for example, 0.2 mm or more, and may be 0.3 mm or more, 0.4 mm or more, 0.5 mm or more, 0.6 mm or more, 0.8 mm or more, 1 mm or more, 1.2 mm or more, 1.4 mm or more, 1.6 mm or more, 1.8 mm or more, or 2 mm or more. When the height of the storage space falls within the above-mentioned ranges, both the thinning of the contact lens package and the suppression of the wrinkles of the lens can be achieved in a well-balanced manner, and as a result, the effects of the present invention can be suitably obtained. The package having such height of the storage space is not limited to the configuration of the illustrated example, and for example, a package described in JP 2005-234576 A may be used.

[0030] FIG. **5** is a schematic cross-sectional view for illustrating the configuration of a contact lens package

according to another embodiment of the present invention. A contact lens package **200B** includes: the package **100** having the lid member **10** and the base member **20**; and the contact lens **120** stored in the storage space **110** sealed by the lid member **10** and the base member **20**. A contact lens storage solution is also stored in the storage space **110**, though the solution is not shown. Thus, the contact lens **120** is maintained in a hydrated state. The contact lens **120** is stored in the storage space **110** in a deformed state, specifically, under a state in which its height is smaller than its natural sagittal height, and may be, for example, in a flatly compressed state.

[0031] The lid member **10** is formed of, for example, a film base material having flexibility. Materials for forming the film base material are as described for the contact lens package **200A**.

[0032] The base member **20** typically has a relatively large thickness and has shape retainability. As illustrated in, for example, FIG. **6**, the base member **20** has a concave storage recess **26** for storing a contact lens and a storage solution, and a flat flange part **27** arranged so as to surround the storage recess **26**. The storage recess **26** and the flange part **27** are integrally formed by, for example, injection molding using a synthetic resin, such as polyethylene (PE), polypropylene (PP), or polyethylene

terephthalate (PET). The thickness of the base member **20** may be, for example, from 0.1 mm to 2 mm, preferably from 0.2 mm to 1 mm.

[0033] The lid member **10** is arranged so as to substantially flatly cover the top surface of the base member **20**. The lid member **10** is peelably joined to the base member **10** in at least a region surrounding the entire periphery of the storage recess **26**, and is laminated on the base member **10** without being joined in at least one end region. The joining between the base member and the lid member may be performed by, for example, heat sealing or ultrasonic sealing.

[0034] The storage space **110** is a space defined by the storage recess **26** and the lid member **10**. The height (maximum height) of the storage space is typically smaller than the natural sagittal height of the contact lens, and is, for example, 4.5 mm or less, preferably 3 mm or less, more preferably 2.5 mm or less, and may be 2 mm or less, or 1.5 mm or less. The height of the above-mentioned storage space is, for example, 0.2 mm or more, and may be 0.3 mm or more, 0.4 mm or more, 0.5 mm or more, 0.6 mm or more, 0.8 mm or more, 1 mm or more, 1.2 mm or more, 1.4 mm or more, 1.6 mm or more, 1.8 mm or more, or 2 mm or more. When the height of the storage space falls within the above-mentioned ranges, both the thinning of the contact lens package

and the suppression of the wrinkles of the lens can be achieved in a well-balanced manner, and as a result, the effects of the present invention can be suitably obtained.

[0035] FIG. 7 is a schematic cross-sectional view for illustrating the configuration of a contact lens package according to still another embodiment of the present invention. A contact lens package **200C** includes: the package **100** having the lid member **10** and the base member **20**; and the contact lens **120** stored in the storage space **110** sealed by the lid member **10** and the base member **20**. A contact lens storage solution is also stored in the storage space **110**, though the solution is not shown. Thus, the contact lens **120** is maintained in a hydrated state.

[0036] As illustrated in FIG. 7 and FIGS. 8, the lid member **10** has a convex curved surface part **12** having a substantially circular shape in a top view protruding toward the base member **20** side and a flat flange part **14** arranged so as to surround the convex curved surface part **12**. The base member **20** has a concave curved surface part **28** having a shape in a top view corresponding to the convex curved surface part **12** and protruding toward a side opposite to the lid member **10**, and the flat flange part **27** arranged so as to surround the concave curved surface part **28**. The storage space **110** is formed by arranging and joining the lid

member **10** and the base member **20** so that the convex curved surface part **12** and the concave curved surface part **28** overlap each other. In the storage space **110**, the contact lens **120** is typically arranged so that its inner surface is on the lid member **10** side.

[0037] As described above, the storage space **110** is defined by the convex curved surface part **12** and the concave curved surface part **28**. Such storage space has a small volume, and hence, even in the case where the space has a shape capable of storing a contact lens in a state of maintaining its natural sagittal height, the contact lens may be adsorbed to and deformed by one member during autoclaving or the like, and visibility may be poor at an initial stage after its wearing. Accordingly, according to the above-mentioned contact lens package, the effects of the present invention can be suitably obtained.

[0038] The contact lens package **200C** may be configured so that the contact lens **120** adheres (is adsorbed) to the lid member **10** when the lid member **10** is rolled up upward to open the package **100**. Such configuration is not particularly limited, and for example, the concave curved surface part **28** may have a radius of curvature (e.g., about 13 mm to about 19 mm) smaller than the radius of curvature of the convex curved surface part **12**, and the maximum separation distance between the concave curved

surface part **28** and the convex curved surface part **12** may be less than 7 mm. Alternatively, the contact lens package **200C** may be arranged upside down and configured so that the contact lens **120** adheres (is adsorbed) to the lid member **10** when the base member **20** is rolled up upward to open the package **100** (in this case, the lid member **10** can function as a base member and the base member **20** can function as a lid member). The volume of the storage space **110** may be, for example, from 0.1 mL to 0.6 mL, preferably from 0.2 mL to 0.5 mL, more preferably from 0.3 mL to 0.4 mL. In addition, the height of the storage space **110** (the maximum value of a separation distance between the convex curved surface part and the concave curved surface part) may be, for example, 5 mm or less, preferably from 1 mm to 3 mm. For details of the contact lens package having such configuration, reference may be made to, for example, JP 2023-532254 A or WO 2013/153582 A1.

[0039] The contact lens **120** is typically a hydrogel contact lens (so-called soft contact lens). The Young's modulus of the contact lens to be obtained by a tensile test performed in an aqueous medium at 35°C is, for example, 1.6 MPa or less, preferably 1.2 MPa or less, 1.0 MPa or less, or 0.8 MPa or less. When the Young's modulus falls within the above-mentioned ranges, the lens is flexible, and hence hyperemia or the like that may be caused by rubbing between the lens and an eye surface can be

suppressed. In addition, the Young's modulus of the contact lens is, for example, 0.1 MPa or more, preferably 0.2 MPa or more, and may be, for example, 0.3 MPa or more, 0.4 MPa or more, or 0.5 MPa or more. When the Young's modulus falls within the above-mentioned ranges, a problem in that handling during lens wearing becomes inconvenient because the lens is too flexible (e.g., a problem in that it is necessary to adjust the shape of the lens at the time of its wearing because the lens easily sticks to a finger or is easily folded) can be solved. In addition, when the Young's modulus falls within the range of from the above-mentioned lower limit to the above-mentioned upper limit, both the solution of the above-mentioned problem related to the flexibility of the lens and the suppression of the deformation (wrinkles) of the lens can be achieved. Distilled water, physiological saline, or the like may be suitably used as the aqueous medium.

[0040] The relaxation modulus of the contact lens to be obtained by a stress relaxation test performed in an aqueous medium at 35°C is, for example, 1.8 MPa or less, preferably 1.6 MPa or less, more preferably 1.5 MPa or less, still more preferably 1.4 MPa or less, even still more preferably 1.3 MPa or less, even still more preferably 1.2 MPa or less, even still more preferably 1.1 MPa or less, even still more preferably 1 MPa or less, and may be 0.9 MPa or less, 0.8 MPa or less, 0.7

MPa or less, 0.6 MPa or less, or 0.5 MPa or less. The above-mentioned relaxation modulus may be, for example, 0.1 MPa or more, 0.2 MPa or more, or 0.3 MPa or more. Herein, the relaxation modulus of the above-mentioned contact lens is an elastic modulus after the lapse of 1 second from the start of measurement when the measurement of stress required for holding a contact lens piece is started simultaneously with the application of a strain of 75% with respect to the upper limit of a linear elastic region in a tensile test to the above-mentioned contact lens piece in the aqueous medium at 35°C. When the relaxation modulus falls within the above-mentioned ranges, poor visibility at the initial stage of the wearing of the contact lens removed from the contact lens package can be improved. The reason why such effect is exhibited is presumed as described below, though the presumption is not intended to limit the present invention. That is, fine deformation (wrinkles) may be present on the surface of the contact lens immediately after its removal from the contact lens package because the contact lens has been stored in a deformed state (e.g., a flat state) in the storage space. Diopter unevenness occurs on the contact lens surface owing to such wrinkles, and the unevenness may lead to the above-mentioned poor visibility. However, according to the contact lens having the above-mentioned relaxation modulus, deformation (wrinkles) is easily eliminated over time, and as a result, it is presumed that poor visibility at the initial stage of its wearing can be

quickly eliminated. Such effect can be more suitably obtained when a contact lens having a relaxation modulus of 1.6 MPa or less is used. For example, when the relaxation modulus is 1.6 MPa or less, poor visibility at the initial stage of the wearing can be suitably eliminated even in the case where a loss tangent in tension to be described later exceeds 0.1.

[0041] The loss tangent ( $\tan\delta$ ) in tension of the contact lens to be obtained by dynamic tensile viscoelasticity measurement performed in an aqueous medium at 35°C is, for example, 0.14 or less, preferably 0.1 or less, more preferably 0.09 or less, still more preferably 0.08 or less, even still more preferably 0.07 or less, even still more preferably 0.06 or less, and may be 0.05 or less, or 0.04 or less. The above-mentioned loss tangent ( $\tan\delta$ ) may be, for example, 0.001 or more, 0.005 or more, or 0.01 or more. When the  $\tan\delta$  falls within the above-mentioned ranges, the generation of wrinkles in the contact lens stored in a deformed state in the storage space tends to be suppressed, and as a result, it is presumed that poor visibility at the initial stage of its wearing can be reduced. Such effect can be more suitably obtained when a contact lens having a  $\tan\delta$  of 0.1 or less is used. For example, when the  $\tan\delta$  is 0.1 or less, poor visibility at the initial stage of the wearing can be suitably eliminated even in the case where the relaxation modulus exceeds 1.6 MPa.

[0042] In one embodiment, the contact lens has a relaxation modulus of 1.6 MPa or less and a  $\tan\delta$  of 0.1 or less. According to such contact lens, the generation of wrinkles during its storage in a deformed state in the storage space can be suitably suppressed, and after its removal from the package, the generated wrinkles can be quickly eliminated, and as a result, poor visibility at the initial stage of its wearing can be more suitably eliminated.

[0043] The resilience (at 100%) of the contact lens to be obtained by a recoverability evaluation test performed in an aqueous medium at 35°C is, for example, 85% or more, preferably 90% or more, more preferably from 92% to 100%. The above-mentioned resilience (at 100%) is the ratio of the latter of the following energies to the former thereof: energy absorbed when the contact lens is stretched at a stretching ratio of 100% (twice the original length); and energy released for shrinking the contact lens from the stretched state to a stretching ratio of 0% (original length). When the resilience (at 100%) falls within the above-mentioned ranges, the generation of wrinkles in the contact lens stored in a deformed state in the storage space tends to be suppressed, and as a result, it is presumed that poor visibility at the initial stage of its wearing can be reduced. Such effect can be suitably obtained when a contact

lens having a resilience (at 100%) of 90% or more is used. For example, when the resilience (at 100%) is 90% or more, poor visibility at the initial stage of the wearing can be suitably eliminated even in the case where the relaxation modulus exceeds 1.7 MPa.

[0044] The water content of the contact lens is, for example, from 10% to 90%, and is, for example, from 20% to 80%, and may be 30% or more, 35% or more, 40% or more, 45% or more, or 50% or more. When the water content falls within the above-mentioned ranges, the contact lens can function as a hydrogel contact lens having high flexibility and excellent wearing comfort. In addition, physical properties, such as the relaxation modulus,  $\tan\delta$ , and resilience of a contact lens, can be adjusted by changing the water content. As a result, the generation of wrinkles in the contact lens can be suppressed, and the generated wrinkles can be suitably eliminated. The water content may be measured by, for example, a method described in ISO 18369-4.

[0045] From the viewpoint of achieving both the suppression or elimination of deformation (wrinkles) and oxygen permeability, the oxygen permeability coefficient ( $Dk: \times 10^{-11} \text{ (cm}^2/\text{sec)} \cdot (\text{mL O}_2/\text{mL} \cdot \text{mmHg})$ ) of the contact lens is, for example, 12 or more, preferably 24 or more, more preferably 30 or more, still more preferably 36 or more, even still more preferably 48 or more,

even still more preferably 60 or more, and may be, for example, 140 or less, 130 or less, 120 or less, 110 or less, or 100 or less. The oxygen permeability coefficient is a value calculated in conformity with ISO 18369-4. In addition, from the viewpoint of achieving both the suppression or elimination of deformation (wrinkles) and an oxygen transmissibility, the oxygen permeability coefficient per unit thickness (oxygen transmissibility) ( $Dk/t$ :  $\times 10^{-9}$  (cm $\cdot$ mL O<sub>2</sub>/sec $\cdot$ mL $\cdot$ mmHg)) of the contact lens is, for example, 12 or more, preferably 24 or more, more preferably 36 or more, still more preferably 40 or more, even still more preferably 48 or more, even still more preferably 60 or more, and may be, for example, 170 or less, 150 or less, 140 or less, 130 or less, 120 or less, 110 or less, or 100 or less. The oxygen transmissibility ( $Dk/t$ ) of the contact lens may be calculated by dividing the oxygen permeability coefficient ( $Dk$ ) by the center thickness (cm) of the lens.

[0046] The contact lens includes any appropriate polymer material capable of satisfying the above-mentioned characteristics. The polymer material for forming the contact lens is obtained by polymerizing a polymerizable composition containing monomer components, and includes constituent units derived from the respective monomers in the monomer components. In this description, the content ratio of the constituent unit derived from each monomer in the polymer material is regarded as

corresponding to the blending ratio of the monomer in the monomer components.

[0047] The above-mentioned monomer components typically include a hydrophilic monomer and a crosslinkable monomer. The monomer components may further include a hydrophobic monomer and/or a siloxane monomer as required. The use of the monomer components including the siloxane monomer can provide a silicone hydrogel contact lens.

[0048] A monofunctional monomer having a polar group, such as a hydroxyl group-containing monomer, a carboxyl group-containing monomer, a nitrogen atom-containing monomer, or an alkoxy group-containing monomer (excluding a monomer having a siloxane bond), may be preferably used as the hydrophilic monomer. When the monomer components include the hydrophilic monomer, a polymer material having desired physical properties (e.g., flexibility, a relaxation modulus, and a  $\tan\delta$ ), a desired water content, and the like can be suitably obtained. The hydrophilic monomers may be used alone or in combination thereof. The solubility of the hydrophilic monomer in water at 25°C may be, for example, 0.03 g/mL or more.

[0049] The hydroxyl group-containing monomer is preferably, for example, a hydroxyl group-containing alkyl (meth)acrylate.

Specific examples thereof include: hydroxyl group-containing alkyl (meth)acrylates each having an alkyl group having 1 to 4 carbon atoms, such as hydroxymethyl (meth)acrylate, hydroxyethyl (meth)acrylate, hydroxypropyl (meth)acrylate, hydroxybutyl (meth)acrylate, dihydroxyethyl (meth)acrylate, dihydroxypropyl (meth)acrylate, and dihydroxybutyl (meth)acrylate; and glyceryl (meth)acrylate.

Examples of the carboxyl group-containing monomer include (meth)acrylic acid, itaconic acid, maleic acid, fumaric acid, and crotonic acid, and acid anhydrides thereof may also be preferably used.

Examples of the nitrogen atom-containing monomer include: (meth)acrylamides, such as N,N-dimethyl(meth)acrylamide, N-ethyl(meth)acrylamide, N-2-hydroxyethyl(meth)acrylamide, and N-isopropyl(meth)acrylamide; N-vinyl lactams, such as N-vinylpyrrolidone, N-vinylpiperidone, and N-vinylcaprolactam; N-methyl lactams such as 1-methyl-3-methylene-2-pyrrolidinone; (meth)acrylonitrile; and N-(meth)acryloylmorpholine.

The alkoxy group-containing monomer is preferably, for example, an alkoxyalkyl (meth)acrylate. Specific examples thereof include alkoxyalkyl (meth)acrylates each having an alkoxyalkyl group having 2 to 4 carbon atoms, such as

methoxymethyl (meth)acrylate, methoxyethyl (meth)acrylate, ethoxymethyl (meth)acrylate, and ethoxyethyl (meth)acrylate.

[0050] A polyfunctional monomer having two or more polymerizable groups (excluding a monomer having a siloxane bond) may be used as the crosslinkable monomer. When the monomer components include the crosslinkable monomer, a polymer material having desired physical properties (e.g., flexibility, mechanical strength, a relaxation modulus, and a  $\tan\delta$ ) can be suitably obtained. Specific examples of the crosslinkable monomer include butanediol di(meth)acrylate, ethylene glycol di(meth)acrylate, diethylene glycol di(meth)acrylate, triethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, dipropylene glycol di(meth)acrylate, diallyl fumarate, allyl (meth)acrylate, vinyl (meth)acrylate, trimethylolpropane tri(meth)acrylate, methacryloyloxyethyl (meth)acrylate, divinylbenzene, diallyl phthalate, diallyl adipate, triallyl diisocyanate,  $\alpha$ -methylene-N-vinylpyrrolidone, 4-vinylbenzyl (meth)acrylate, 3-vinylbenzyl (meth)acrylate, 2,2-bis((meth)acryloyloxyphenyl)hexafluoropropane, 2,2-bis((meth)acryloyloxyphenyl)propane, 1,4-bis(2-(meth)acryloyloxyhexafluoroisopropyl)benzene, 1,3-bis(2-(meth)acryloyloxyhexafluoroisopropyl)benzene, 1,2-bis(2-(meth)acryloyloxyhexafluoroisopropyl)benzene, 1,4-bis(2-(meth)acryloyloxyisopropyl)benzene, 1,3-bis(2-

(meth)acryloyloxyisopropyl)benzene, and 1,2-bis(2-(meth)acryloyloxyisopropyl)benzene. Of those, butanediol di(meth)acrylate and ethylene glycol di(meth)acrylate may each be preferably used because each of the di(meth)acrylates is excellent in copolymerizability, and can easily adjust the flexibility and mechanical strength of the polymer material. The crosslinkable monomers may be used alone or in combination thereof.

[0051] A monofunctional monomer having no polar group, such as an alkyl (meth)acrylate, a fluorine-containing alkyl (meth)acrylate, an aromatic ring-containing (meth)acrylate, or a styrene-based monomer (excluding a monomer having a siloxane bond), may be preferably used as the hydrophobic monomer. When the monomer components include the hydrophobic monomer, a polymer material having desired mechanical strength, a desired water content, and the like can be suitably obtained. The hydrophobic monomers may be used alone or in combination thereof. The solubility of the hydrophobic monomer in water at 25°C may be, for example, less than 0.03 g/mL.

[0052] The alkyl (meth)acrylate may be preferably, for example, an alkyl (meth)acrylate having an alkyl group having 1 to 20 carbon atoms. Specific examples thereof include linear, branched, or cyclic alkyl (meth)acrylates, such as methyl

(meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, pentyl (meth)acrylate, hexyl (meth)acrylate, heptyl (meth)acrylate, nonyl (meth)acrylate, stearyl (meth)acrylate, octyl (meth)acrylate, decyl (meth)acrylate, lauryl (meth)acrylate, pentadecyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, cyclopentyl (meth)acrylate, and cyclohexyl (meth)acrylate. Of those, an alkyl (meth)acrylate having an alkyl group having 1 to 5 carbon atoms is preferred. Methyl acrylate has a solubility in water at 25°C of more than 0.03 g/mL, but is treated as a hydrophobic monomer in this description because methyl acrylate has no polar group.

Examples of the fluorine-containing alkyl (meth)acrylate include alkyl (meth)acrylates obtained by introducing fluorine into the alkyl groups of the above-mentioned alkyl (meth)acrylates. Specific examples thereof include 2,2,2-trifluoroethyl (meth)acrylate, 2,2,3,3-tetrafluoropropyl (meth)acrylate, 2,2,3,3-tetrafluoro-t-pentyl (meth)acrylate, 2,2,3,4,4,4-hexafluorobutyl (meth)acrylate, 2,2,3,4,4,4-hexafluoro-t-hexyl (meth)acrylate, 2,3,4,5,5,5-hexafluoro-2,4-bis(trifluoromethyl)pentyl (meth)acrylate, 2,2,3,3,4,4-hexafluorobutyl (meth)acrylate, 2,2,2,2',2',2'-hexafluoroisopropyl (meth)acrylate, 2,2,3,3,4,4,4-heptafluorobutyl (meth)acrylate, and 2,2,3,3,4,4,5,5-

octafluoropentyl (meth)acrylate.

Examples of the aromatic ring-containing (meth)acrylate include phenoxyethyl (meth)acrylate, phenylethyl (meth)acrylate, benzyl (meth)acrylate, phenyl (meth)acrylate, and pentabromophenyl (meth)acrylate.

Examples of the styrene-based monomer include styrene,  $\alpha$ -methylstyrene, methylstyrene, ethylstyrene, acetoxystyrene, methoxystyrene, ethoxystyrene, propioxystyrene, and butoxystyrene.

[0053] Any appropriate monomer may be used as the siloxane monomer as long as the monomer has a siloxane bond (Si-O-Si) and a polymerizable group. When the monomer components include the siloxane monomer, a polymer material having high oxygen permeability can be suitably obtained. The number of siloxane bonds in the siloxane monomer is, for example, from 1 to 100, and may be from 2 to 20, from 2 to 10, or from 2 to 5. The above-mentioned number of siloxane bonds means the total number of all siloxane bonds in a monomer molecule rather than the number of repetitions of a siloxane bond in one chain. The number of polymerizable groups in the siloxane monomer may be one, or two or more. The siloxane monomers may be used alone or in combination thereof.

[0054] Examples of the siloxane monomer include monomers that have heretofore been used in ophthalmic device applications, such as siloxane monomers described in paragraph 0039 to paragraph 0044 of JP 2015-503631 A, siloxane monomers described in paragraph 0060 to paragraph 0065 of JP 2014-40598 A, and siloxane monomers described in paragraph 0024 to paragraph 0037 of WO 2015/92858 A1.

[0055] Other specific examples of the siloxane monomer include: siloxane-containing alkyl (meth)acrylates, such as

|                                                                               |                 |
|-------------------------------------------------------------------------------|-----------------|
| trimethylsiloxydimethylsilylmethyl                                            | (meth)acrylate, |
| trimethylsiloxydimethylsilylpropyl                                            | (meth)acrylate, |
| methylbis(trimethylsiloxy)silylpropyl                                         | (meth)acrylate, |
| tris(trimethylsiloxy)silylpropyl                                              | (meth)acrylate, |
| mono[methylbis(trimethylsiloxy)siloxy]bis(trimethylsiloxy)silylpropyl         | (meth)acrylate, |
| tris[methylbis(trimethylsiloxy)siloxy]silylpropyl                             | (meth)acrylate, |
| methylbis(trimethylsiloxy)silylpropylglyceryl                                 | (meth)acrylate, |
| tris(trimethylsiloxy)silylpropylglyceryl                                      | (meth)acrylate, |
| mono[methylbis(trimethylsiloxy)siloxy]bis(trimethylsiloxy)silylpropylglyceryl | (meth)acrylate, |
| trimethylsilylethyltetramethyldisiloxypropylglyceryl                          | (meth)acrylate, |
| trimethylsilylmethyl                                                          | (meth)acrylate, |

trimethylsilylpropylglyceryl (meth)acrylate,  
 trimethylsilylpropyl (meth)acrylate,  
 trimethylsiloxydimethylsilylpropylglyceryl (meth)acrylate,  
 methylbis(trimethylsiloxy)silylethyltetramethyldisiloxymethyl  
 (meth)acrylate,  
 tetramethyltriisopropylcyclotetrasiloxanylpropyl (meth)acrylate,  
 and  
 tetramethyltriisopropylcyclotetrasiloxybis(trimethylsiloxy)sil  
 ylpropyl (meth)acrylate; siloxane-containing styrene  
 derivatives, such as tris(trimethylsiloxy)silylstyrene,  
 bis(trimethylsiloxy)methylsilylstyrene,  
 (trimethylsiloxy)dimethylsilylstyrene,  
 tris(trimethylsiloxy)siloxydimethylsilylstyrene,  
 [bis(trimethylsiloxy)methylsiloxy]dimethylsilylstyrene,  
 (trimethylsiloxy)dimethylsilylstyrene,  
 heptamethyltrisiloxanylstyrene, nonamethyltetrasiloxanylstyrene,  
 pentadecamethylheptasiloxanylstyrene,  
 heneicosamethyldecasiloxanylstyrene,  
 heptacosamethyltridecasiloxanylstyrene,  
 hentriacontamethylpentadecasiloxanylstyrene,  
 trimethylsiloxy pentamethyl disiloxymethylsilylstyrene,  
 tris(pentamethyldisiloxy)silylstyrene,  
 tris(trimethylsiloxy)siloxybis(trimethylsiloxy)silylstyrene,  
 bis(heptamethyltrisiloxy)methylsilylstyrene,  
 tris[methylbis(trimethylsiloxy)siloxy]silylstyrene,

heptakis(trimethylsiloxy)trisilylstyrene,  
 trimethylsiloxybis[tris(trimethylsiloxy)siloxy]silylstyrene,  
 nonamethyltetrasiloxylundecylmethylpentasiloxymethylsilylstyrene,  
 tris[tris(trimethylsiloxy)siloxy]silylstyrene,  
 (tristrimethylsiloxyhexamethyl)tetrasiloxyl[tris(trimethylsiloxy)siloxy]trimethylsiloxy-silylstyrene,  
 nonakis(trimethylsiloxy)tetrasilylstyrene,  
 bis(tridecamethylhexasiloxyl)methylsilylstyrene,  
 heptamethylcyclotetrasiloxanylstyrene,  
 heptamethylcyclotetrasiloxylbis(trimethylsiloxy)silylstyrene,  
 tripropyltetramethylcyclotetrasiloxanylstyrene, and  
 trimethylsilylstyrene; and siloxane-containing fumaric acid  
 diesters, such as bis(3-(trimethylsilyl)propyl) fumarate, bis(3-(pentamethyldisiloxanyl)propyl) fumarate, and  
 bis(tris(trimethylsiloxy)silylpropyl) fumarate. Of those, a  
 siloxane-containing styrene derivative may be preferably used  
 because both high oxygen permeability and hardness are easily  
 achieved.

[0056] Still other specific examples of the siloxane  
 monomer include mono(meth)acryloyloxypropyl-terminated mono-n-  
 butyl-terminated polydimethylsiloxane,  
 mono(meth)acryloyloxypropyl-terminated mono-n-methyl-terminated  
 polydimethylsiloxane, mono(meth)acryloyloxypropyl-terminated  
 mono-n-butyl-terminated polydiethylsiloxane,

mono(meth)acryloyloxypropyl-terminated mono-n-methyl-terminated polydiethylsiloxane, mono(meth)acryloylaminopropyl-terminated mono-n-butyl-terminated polydimethylsiloxane, mono(meth)acryloylaminopropyl-terminated mono-n-methyl-terminated polydimethylsiloxane, mono(meth)acryloylaminopropyl-terminated mono-n-butyl-terminated polydiethylsiloxane, and mono(meth)acryloylaminopropyl-terminated mono-n-methyl-terminated polydiethylsiloxane. In those siloxane monomers, the number of repetitions of (Si-O) may be, for example, from 4 to 20, preferably from 4 to 12, more preferably from 4 to 10.

[0057] The blending ratio of the hydrophilic monomer in the monomer components except the crosslinkable monomer is, for example, 30 wt% or more, 40 wt% or more, preferably 50 wt% or more, more preferably 60 wt% or more, and is, for example, 100 wt% or less, and may be, for example, 95 wt% or less, or 90 wt% or less.

[0058] The blending ratio of the hydrophobic monomer in the monomer components except the crosslinkable monomer is, for example, 5 wt% or less, preferably 3 wt% or less, and may be from 0 wt% to 1 wt%.

[0059] The blending ratio of the siloxane monomer in the monomer components except the crosslinkable monomer is, for

example, 60 wt% or less, preferably 50 wt% or less, more preferably 40 wt% or less, and may be 30 wt% or less, 20 wt% or less, or 15 wt% or less. In addition, the lower limit of the blending ratio of the above-mentioned siloxane monomer may be 0 wt% or more, 3 wt% or more, or 5 wt% or more.

[0060] The blending ratio of the crosslinkable monomer in the monomer components is, for example, 0.05 wt% or more, and is, for example, 0.1 wt% or more, and may be typically 10 wt% or less, for example, 3 wt% or less, preferably 1 wt% or less, more preferably 0.8 wt% or less.

[0061] When the kinds and/or blending ratios of the above-mentioned respective monomers are changed, physical properties, such as the mechanical strength, water content, relaxation modulus,  $\tan\delta$ , and resilience of the contact lens, can be adjusted. The physical properties of a polymer to be obtained may change in accordance with the kinds of the monomers and the like, but when, for example, the blending ratio of the hydrophilic monomer is increased or the blending ratio of the hydrophobic monomer is reduced, a contact lens having physical properties, such as mechanical strength, a water content, a relaxation modulus, a  $\tan\delta$ , and a resilience, which fall within the above-mentioned desired ranges can be suitably obtained. For example, when the blending ratio of the hydrophilic monomer

is increased and/or the blending ratio of the hydrophobic monomer is reduced, the mechanical strength, the relaxation modulus, and the  $\tan\delta$  may reduce, and the water content and the resilience may increase. In addition, when the blending ratio of the siloxane monomer is high, oxygen permeability can be improved, but the deformation tends to be liable to remain as wrinkles in a deformed contact lens. Accordingly, when the siloxane monomer is incorporated at the above-mentioned blending ratio, while preferred oxygen permeability is ensured, a desired relaxation modulus, a desired  $\tan\delta$ , a desired resilience, and the like can be achieved, and the generation of wrinkles can be suppressed or the wrinkles can be quickly eliminated. As a result, a contact lens package including a contact lens having excellent wearing comfort and improved visibility at the initial stage of its wearing can be suitably obtained.

[0062] The monomer components may further include a functional monomer. Examples of the functional monomer include a polymerizable UV absorber, a polymerizable dye, and a polymerizable UV absorbing dye. For specific examples thereof, reference may be made to [0087] to [0089] of WO 2022/044117 A1. In addition, various functional monomers are commercially available, and the functional monomer may be appropriately selected from these monomers in accordance with purposes. The functional monomer is a monomer that imparts a predetermined

function to the polymer to be obtained, and the monomer is not included in the hydrophobic monomer, the hydrophilic monomer, the crosslinkable monomer, and the siloxane monomer described above.

[0063] The total blending ratio of the functional monomer in the monomer components is, for example, 5 wt% or less, preferably from 0.0001 wt% to 5 wt%, more preferably from 0.05 wt% to 3 wt%.

[0064] The polymerizable composition typically further includes a polymerization initiator in addition to the above-mentioned monomer components, and may further include a solvent and/or an additive as required. Examples of the additive include a cooling agent, a thickener, a surfactant, a non-polymerizable dye, and a non-polymerizable UV absorber.

[0065] The blending amount of the above-mentioned additive in the polymerizable composition may be set to, for example, from 0.01 part by weight to 5 parts by weight, preferably from 0.01 part by weight to 3 parts by weight with respect to 100 parts by weight of the monomer components.

[0066] Photopolymerization, thermal polymerization, and a combination thereof may each be applied as a polymerization

method.

[0067] When the polymerizable composition is polymerized by photopolymerization, it is preferred that the polymerizable composition be loaded or applied into a mold, and then the mold be irradiated with light (e.g., UV light). Specifically, the contact lens may be produced by any appropriate production method, such as a cast molding method or a spin casting method. A material for the mold to be used in the photopolymerization is not particularly limited as long as the material can transmit light required for the polymerization. The wavelength of the light with which the polymerizable composition in the mold is irradiated is appropriately set in accordance with, for example, the kind of the photopolymerization initiator to be used. In addition, the light illuminance and irradiation time of the light may be appropriately set in accordance with, for example, the composition of the polymerizable composition.

[0068] When the polymerizable composition is polymerized by thermal polymerization, it is preferred that the polymerizable composition be loaded or applied into a mold, and then the mold be gradually heated. A heating temperature and a heating time in the heating of the polymerizable composition in the mold may be appropriately set in accordance with, for example, the composition of the polymerizable composition.

[0069] After the polymerization, a contact lens can be obtained by removing the polymer material from the mold. A residue, such as an unreacted monomer component or a solvent, may be eluted as required by immersing the resultant contact lens in water, an organic solvent, or a mixed liquid thereof. The elution treatment of the residue may be repeatedly performed. In addition, the resultant contact lens may be subjected to surface treatment such as plasma treatment.

[0070] As described above, the contact lens package can be obtained by joining the lid member and the base member in at least a predetermined region surrounding the contact lens under a state in which the contact lens is arranged at a predetermined position of the base member (e.g., on a lens loading part or a storage recess). The joining between the lid member and the base member may be performed by, for example, heat sealing or ultrasonic sealing. The contact lens package may be sterilized as required. The sterilization may be performed by any appropriate method, such as pressure sterilization (e.g., high-temperature steam sterilization) or  $\gamma$ -ray sterilization.

[0071] [Method of improving Wrinkle Recoverability and Method of suppressing Occurrence of Wrinkles]

As described above, according to the above-mentioned

contact lens having a small relaxation modulus, when deformation (wrinkles) occurs in the contact lens owing to its storage in a deformed state in a sealed storage space, poor visibility at the initial stage of its wearing can be quickly eliminated because the wrinkles are easily eliminated over time after the opening of the package of the contact lens. Accordingly, according to another aspect of the present invention, there is provided a method of improving the wrinkle recoverability of a contact lens when a contact lens package is opened, the method including producing the contact lens package by joining a lid member and a base member facing each other so that the lid member and the base member form a storage space in a sealed state in which the contact lens is arranged, in which: the above-mentioned storage space has a height smaller than the natural sagittal height of the above-mentioned contact lens; and the above-mentioned contact lens has a relaxation modulus of 1.6 MPa or less.

[0072] As described above, according to the above-mentioned contact lens having a small  $\tan\delta$  or a large resilience, poor visibility at the initial stage of its wearing can be reduced because the generation of wrinkles can be suppressed during its storage in a deformed state in a sealed storage space. Accordingly, according to another aspect of the present invention, there is provided a method of suppressing the generation of the wrinkles of a contact lens in a contact lens

package, the method including producing the contact lens package by joining a lid member and a base member facing each other so that the lid member and the base member form a storage space in a sealed state in which the contact lens is arranged, in which: the above-mentioned storage space has a height smaller than the natural sagittal height of the above-mentioned contact lens; and at least one of the following (i) or (ii) is satisfied: (i) the above-mentioned contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C; and (ii) the ratio of the latter of the following energies to the former thereof is 90% or more: energy absorbed when the contact lens is stretched at a stretching ratio of 100% in the aqueous medium at 35°C; and energy released for shrinking the contact lens from the stretched state to a state corresponding to a stretching ratio of 0%.

#### Examples

[0073] The present invention is specifically described below by way of Examples. However, the present invention is not limited to these Examples. The terms "part(s)" and "%" in Examples and Comparative Examples are by weight unless otherwise stated.

[0074] [Experimental Examples 1 to 7]

A lid member and a base member as illustrated in each of

FIG. 1A to FIG. 1D were prepared. Specifically, the lid member was formed of a flexible aluminum-deposited PP film. The base member included: a supporting base material formed of a flexible aluminum-deposited PP film; and a lens loading base material fixed to the aluminum-deposited surface thereof with an adhesive. The lens loading base material was made of PP, and had a disc-shaped lens loading part including through-holes and an edge part formed on its outer peripheral part.

A contact lens obtained by polymerizing monomer components shown in Table 1 was used as a contact lens.

After the dropping of one drop of physiological saline with a dropper onto the lens loading part of the above-mentioned supporting base material, various contact lenses were each arranged thereon so that its inner surface faced downward, and one drop of the physiological saline was further dropped thereon with the dropper.

Next, the lid member was placed so as to cover the lens loading base material and the contact lens, and the lid member and the lens loading base material were heat-sealed at the region surrounding the outer periphery of the lens loading base material under a state in which the outer edges of the lid member and the base member were aligned. Thus, there was obtained a contact

lens package in which the contact lens was enclosed in a flatly compressed state in a storage space between the lid member and the base member. The top surface of the contact lens package was flat, and the height of the storage space was 1 mm.

Next, the contact lens package was pressure-sterilized with a small retort high-pressure steam sterilizer. The sterilization temperature was 121°C, the sterilization pressure was 0.20 MPa, and the sterilization time was 20 min.

In Table 1, the center thickness of a contact lens is the average value of the center thicknesses of three contact lenses in a hydrated state.

[0075] [Physical Property Evaluation of Contact Lens]

<Production of Measurement Sample>

The contact lens was removed from the contact lens package after the pressure sterilization, and was cut with a processing jig in which four razor blades were arranged in parallel at intervals of 2 mm. Thus, as illustrated in FIG. 9, three strip-shaped contact lens pieces were produced from one contact lens. A contact lens piece passing through a lens center (C in FIG. 9) was used as a measurement sample to perform a tensile measurement test, a dynamic tensile viscoelasticity measurement test, a resilience evaluation test, and the measurement of an oxygen

permeability coefficient ( $D_k$  value). A contact lens piece at a peripheral part (**S1** or **S2** in FIG. 9) was used as a measurement sample to perform a stress relaxation test.

[0076]        <Tensile Test>

In a tensile test in which the measurement sample was pulled at a constant speed, a stress-strain curve was obtained from raw data of a stretching distance versus a detected load. The Young's modulus of the sample was calculated from an initial slope (strain range=0% to 10%) in the stress-strain curve, and the average value of the measured values of the three samples was obtained. Measurement conditions are as described below.

- Measurement instrument: viscoelasticity measurement apparatus "RSA3" (manufactured by TA Instruments)

- Measurement environment: distilled water at 35°C (physiological saline at 35°C for Experimental Examples 1 and 2)

- Number of measurement samples:  $n=3$

- Measurement mode: Transient

- Measurement item name: Multiple Extension Mode Test

- Tensile speed: 0.01 mm/sec, 140 seconds (140 data points obtained, stretching: 1.4 mm)

- Young's modulus calculation: Strain range of from 0% to 10%

[0077]        <Stress Relaxation Test>

A strain (initial strain) of 75% with respect to the upper limit of a linear elastic region in the above-mentioned tensile test was applied to the measurement sample, and at the same time, the measurement of a change (relaxation) in stress required for holding the measurement sample having applied thereto the initial strain was started. An elastic modulus (stress/strain) after the lapse of 1 second from the start of the measurement was calculated as a relaxation modulus (MPa), and the average value of the measured values of the three samples was determined. Measurement conditions are as described below.

- Measurement instrument: viscoelasticity measurement apparatus "RSA3" (manufactured by TA Instruments)
- Measurement environment: distilled water at 35°C (physiological saline at 35°C for Experimental Examples 1 and 2)
- Number of measurement samples: n=3
- Measurement mode: Transient
- Measurement item name: Stress Relaxation
- Initial strain: a strain of 75% with respect to the upper limit of the linear elastic region in the above-mentioned tensile test

[0078]        <Dynamic Tensile Viscoelasticity Measurement Test>

The elastic component ( $E'$ ) and viscous component ( $E''$ ) of the measurement sample were calculated from response when a stretching-shrinkage strain was applied to the sample while a

tensile state of a constant load was maintained. Next, a loss tangent in tension ( $\tan\delta$ ) was calculated from the ratio  $E''/E'$  at 1.0 Hz, and the average value of the measured values of the three samples was obtained. Measurement conditions are as described below.

- Measurement instrument: viscoelasticity measurement apparatus "RSA3" (manufactured by TA Instruments)

- Measurement environment: distilled water at 35°C (physiological saline at 35°C for Experimental Examples 1 and 2)

- Number of measurement samples:  $n=3$

- Measurement mode: Dynamic

- Measurement item name: Dynamic Frequency Sweep Test

- Measurement frequency: 0.628 rad/sec (=0.1 Hz) to 62.8 rad/sec (=10 Hz)

- Initial static force: A load corresponding to 75% of a linear elastic region was calculated from a Young's modulus and a sample cross-sectional area.

- Dynamic strain: 2.5%

[0079] <Resilience Evaluation Test>

The following stretching-shrinkage measurement was repeatedly performed while different stretching ratios were applied: the sample was stretched at a constant stretching speed and then shrunk to an original size. Thus, stress-strain curves

at a plurality of stretching ratios were obtained. Measurement conditions are as described below.

The resilience of the sample was calculated by the equation "resilience (%)=area under "stress-strain curve" in a shrinkage process/area under "stress-strain curve" in a stretching process×100," and the average value of resiliences at a stretching ratio of 100% (n=3) was obtained.

- Measurement instrument: viscoelasticity measurement apparatus "RSA3" (manufactured by TA Instruments)
- Measurement environment: distilled water at 35°C (physiological saline at 35°C for Experimental Examples 1 and 2)
- Number of measurement samples: n=3
- Measurement mode: Transient
- Measurement item name: Multiple Extension Mode Test
- Stretching speed: 0.1 mm/sec
- Stretching ratio: about 25%→ 50% → 75% → 100% → 125% → 150% (end)

[0080] <Measurement of Oxygen Permeability Coefficient (Dk Value)>

The oxygen permeability coefficient of the measurement sample was calculated in conformity with ISO 18369-4.

[0081]           <Measurement of Water Content>

The water content of the measurement sample was measured in conformity with ISO 18369-4.

[0082]           [Dioptric Distribution Evaluation Test]

Each of the contact lenses removed from the contact lens packages produced in Experimental Examples was subjected to measurement for Q values after 15 seconds and 900 seconds from the opening of the package under the following measurement conditions, and the average value of the measured values of the three samples was obtained. The Q value refers to a quality factor proportional to the amount of wavefront deformation in units of diopter in an analysis target region of the lens, and is a value indicating the standard deviation of a diopter distribution in the region. A small Q value means that diopter unevenness on a lens surface is small. For example, the diopter distribution of a contact lens in which the Q values of all ring regions are 2 or more is illustrated in FIG. 10(a), and the diopter distribution of a contact lens in which the Q values of all ring regions are 2 or less is illustrated in FIG. 10(b). It is understood that the contact lens of FIG. 10(b) has smaller diopter unevenness than that of the contact lens of FIG. 10(a).

•Measurement instrument: underwater power measurement instrument "VC-2001" (manufactured by Visionix)

- Measurement temperature: from about 20°C to about 25°C (indoor temperature control)
- Environmental solution (solution in which a lens is immersed at the time of measurement): phosphate-buffered physiological saline
- Analysis target region: ring regions each having a radius of from 1.5 mm to 5.0 mm from a lens center in a top view (specifically, a ring region having a radius of from 1.5 mm to 2.0 mm, a ring region having a radius of from 2.0 mm to 2.5 mm, a ring region having a radius of from 2.5 mm to 3.0 mm, a ring region having a radius of from 3.0 mm to 4.0 mm, and a ring region having a radius of from 4.0 mm to 5.0 mm)
- Number of measurement lenses: 3 lenses/sample

[0083]

Table 1

| Monomer components except crosslinkable monomer | Siloxane monomer                             | Experimental Example 1                                                                | Experimental Example 2                                                   | Experimental Example 3                                      | Experimental Example 4                                                      | Experimental Example 5                                                  | Experimental Example 6                    | Experimental Example 7                   |
|-------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------|------------------------------------------|
|                                                 |                                              | Not included                                                                          | Not included                                                             | Included (35 wt%)                                           | Included                                                                    | Included (55 wt%)                                                       |                                           |                                          |
|                                                 |                                              | Methacrylic acid<br>2-Hydroxyethyl methacrylate<br>Trimethylolpropane trimethacrylate | Methacrylic acid<br>2-Hydroxyethyl methacrylate<br>Glycol dimethacrylate | 2-Methoxyethyl acrylate<br>N-Vinyl-2-pyrrolidinone (65 wt%) | N,N-Dimethylacrylamide<br>N-Vinylpyrrolidone<br>2-Hydroxyethyl methacrylate | N,N-Dimethylacrylamide<br>1-Methyl-3-methylene-2-pyrrolidinone (45 wt%) | lotrafilcon B (siloxane monomer included) | senofilcon A (siloxane monomer included) |
|                                                 | B.C./DIA.                                    | 9.0 mm/14.2 mm                                                                        | 8.6 mm/14.2 mm                                                           | 8.4 mm/14.2 mm                                              | 8.7 mm/14.0 mm                                                              | 8.3 mm/14.0 mm                                                          | 8.6 mm/14.2 mm                            | 8.8 mm/14.0 mm                           |
|                                                 | Water content                                | 58%                                                                                   | 55%                                                                      | 56%                                                         | 47%                                                                         | 39%                                                                     | 33%                                       | 35%                                      |
|                                                 | Relaxation modulus (after 1 second)          | 0.96                                                                                  | 1.24                                                                     | 1.19                                                        | 1.54                                                                        | 1.74                                                                    | 1.61                                      | 1.80                                     |
|                                                 | $\tan\delta$ (at 1.0 Hz tensile $E^*$ (MPa)) | 0.056                                                                                 | 0.053                                                                    | 0.090                                                       | 0.134                                                                       | 0.056                                                                   | 0.105                                     | 0.140                                    |
|                                                 | Resilience (at 100%) (%)                     | 92.8                                                                                  | 91.8                                                                     | 85.9                                                        | 75.7                                                                        | 90.4                                                                    | 86.2                                      | 75.2                                     |
|                                                 | Young's modulus (MPa)                        | 0.27                                                                                  | 0.56                                                                     | 0.41                                                        | 0.38                                                                        | 1.16                                                                    | 0.82                                      | 0.52                                     |
|                                                 | Oxygen permeability coefficient (Dk)         | 28                                                                                    | 20                                                                       | 62                                                          | 76                                                                          | 131                                                                     | 107                                       | 114                                      |
|                                                 | Center thickness of lens (mm)                | 0.092                                                                                 | 0.095                                                                    | 0.065                                                       | 0.058                                                                       | 0.094                                                                   | 0.079                                     | 0.053                                    |
|                                                 | Oxygen transmissibility (Dk/t)               | 30                                                                                    | 21                                                                       | 95                                                          | 131                                                                         | 139                                                                     | 135                                       | 215                                      |
| After 900 seconds                               | Ring_5.0-4.0 mm                              | 0.10                                                                                  | 0.23                                                                     | 1.87                                                        | 2.50                                                                        | 1.46                                                                    | 3.32                                      | 15.14                                    |
|                                                 | Ring_4.0-3.0 mm                              | 0.09                                                                                  | 0.15                                                                     | 1.49                                                        | 2.53                                                                        | 1.16                                                                    | 3.04                                      | 14.93                                    |
|                                                 | Ring_3.0-2.5 mm                              | 0.07                                                                                  | 0.10                                                                     | 0.85                                                        | 2.07                                                                        | 1.28                                                                    | 3.87                                      | 10.52                                    |
|                                                 | Ring_2.5-2.0 mm                              | 0.05                                                                                  | 0.10                                                                     | 0.55                                                        | 1.59                                                                        | 1.45                                                                    | 3.08                                      | 9.87                                     |
|                                                 | Ring_2.0-1.5 mm                              | 0.06                                                                                  | 0.10                                                                     | 0.47                                                        | 1.49                                                                        | 1.32                                                                    | 2.40                                      | 10.41                                    |

|                        |                 |      |      |      |      |      |      |       |
|------------------------|-----------------|------|------|------|------|------|------|-------|
| After<br>15<br>seconds | Ring_5.0-4.0 mm | 0.37 | 0.57 | 6.70 | 9.75 | 1.60 | 7.38 | 8.87  |
|                        | Ring_4.0-3.0 mm | 0.35 | 0.56 | 3.06 | 9.27 | 1.25 | 5.33 | 12.46 |
|                        | Ring_3.0-2.5 mm | 0.29 | 0.33 | 2.12 | 6.33 | 1.50 | 5.45 | 11.52 |
|                        | Ring_2.5-2.0 mm | 0.28 | 0.30 | 1.56 | 4.94 | 1.72 | 4.46 | 12.95 |
|                        | Ring_2.0-1.5 mm | 0.21 | 0.28 | 0.97 | 4.21 | 1.53 | 3.25 | 14.54 |
|                        |                 |      |      |      |      |      |      |       |

[0084] As shown in Table 1, according to each of the contact lenses each having a  $\tan\delta$  of 0.1 or less, a Q value of 2 or less was achieved in the ring region having a radius of from 1.5 mm to 2.5 mm after 15 seconds from the removal of the lens from the thin package (Experimental Examples 1 to 3 and 5). In each of the contact lenses of Experimental Examples 3 and 5 each prepared by using a siloxane monomer out of those lenses, there was a ring region where the Q value after 15 seconds exceeded 1. However, in each of the contact lenses of Experimental Examples 1 and 2 prepared without using a siloxane monomer, the Q values after 15 seconds were 1 or less in all ring regions.

In addition, according to the contact lens having a relaxation modulus after 1 second of 1.6 MPa or less, even when its  $\tan\delta$  exceeded 0.1, a Q value of 2 or less in the ring region having a radius of from 1.5 mm to 2.5 mm and Q values of 3 or less in each of the ring regions having radii within the range from 1.5 mm to 5.0 mm were achieved after 900 seconds from the removal of the lens from the thin package (Experimental Example 4).

It is understood from the foregoing that when a contact lens having a small  $\tan\delta$  (e.g.,  $\tan\delta \leq 0.1$ ) is stored in a thin package, the generation of the wrinkles (deformation) of the contact lens during its storage in a storage space can be

suppressed. In addition, it is understood that when a contact lens having a small relaxation modulus (e.g., relaxation modulus  $\leq 1.6$  MPa) is stored in a thin package, the eliminability (recoverability) of the wrinkles (deformation) of the contact lens after the opening of the package can be improved.

Further, as shown in the table below, contact lenses each having a small relaxation modulus (e.g., a relaxation modulus of 1.6 MPa or less, or 1.3 MPa or less) each tended to have a large wrinkle recovery rate [reduction rate of Q value =  $(1 - \text{Q value after 900 seconds} / \text{Q value after 15 seconds}) \times 100$ ] between 15 seconds and 900 seconds. In addition, it is understood that in the case of a contact lens having a large resilience (e.g., resilience  $\geq 90\%$ ), the generation of the wrinkles (deformation) of the contact lens during its storage in a storage space can be suppressed.

[0085]

Table 2

| Experimental Example 1<br>(relaxation modulus:<br>0.96, tanδ: 0.056) | Wrinkle<br>recovery<br>rate<br>(%) | Experimental Example 2<br>(relaxation modulus:<br>1.24, tanδ: 0.053) | Wrinkle<br>recovery rate<br>(%)    |
|----------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------|------------------------------------|
| Ring_5.0-4.0 mm                                                      | 73.0                               | Ring_5.0-4.0 mm                                                      | 59.6                               |
| Ring_4.0-3.0 mm                                                      | 74.3                               | Ring_4.0-3.0 mm                                                      | 73.2                               |
| Ring_3.0-2.5 mm                                                      | 75.9                               | Ring_3.0-2.5 mm                                                      | 69.7                               |
| Ring_2.5-2.0 mm                                                      | 82.1                               | Ring_2.5-2.0 mm                                                      | 66.7                               |
| Ring_2.0-1.5 mm                                                      | 71.4                               | Ring_2.0-1.5 mm                                                      | 64.3                               |
| Experimental Example 3<br>(relaxation modulus:<br>1.19, tanδ: 0.09)  | Wrinkle<br>recovery<br>rate<br>(%) | Experimental Example 5<br>(relaxation modulus:<br>1.74, tanδ: 0.056) | Wrinkle<br>recovery<br>rate<br>(%) |
| Ring_5.0-4.0 mm                                                      | 72.1                               | Ring_5.0-4.0 mm                                                      | 8.8                                |
| Ring_4.0-3.0 mm                                                      | 51.3                               | Ring_4.0-3.0 mm                                                      | 7.2                                |
| Ring_3.0-2.5 mm                                                      | 59.9                               | Ring_3.0-2.5 mm                                                      | 14.7                               |
| Ring_2.5-2.0 mm                                                      | 64.7                               | Ring_2.5-2.0 mm                                                      | 15.7                               |
| Ring_2.0-1.5 mm                                                      | 51.5                               | Ring_2.0-1.5 mm                                                      | 13.7                               |
| Experimental Example 6<br>(relaxation modulus:<br>1.61, tanδ: 0.105) | Wrinkle<br>recovery rate<br>(%)    |                                                                      |                                    |
| Ring_5.0-4.0 mm                                                      | 55.0                               |                                                                      |                                    |
| Ring_4.0-3.0 mm                                                      | 43.0                               |                                                                      |                                    |
| Ring_3.0-2.5 mm                                                      | 29.0                               |                                                                      |                                    |
| Ring_2.5-2.0 mm                                                      | 30.9                               |                                                                      |                                    |
| Ring_2.0-1.5 mm                                                      | 26.2                               |                                                                      |                                    |

[0086] [Experimental Examples 8 to 10]

Contact lens packages were produced in the same manner as in Experimental Examples 1 to 7 above by using contact lenses produced by polymerizing polymerizable compositions having the following compositions. A diopter distribution was evaluated in

the same manner as in Experimental Examples 1 to 7 except that a spot region within 3 mm from a lens center in a top view was set as a measurement region for each of the resultant contact lens packages. As a result, all the contact lenses showed low Q values equal to or less than those of Experimental Examples 1 to 3. It is understood from the foregoing that according to each of the contact lens packages of Experimental Examples 8 to 10, poor visibility at an initial stage after its wearing can be improved even when the contact lens is removed from the thin package and worn immediately because the eliminability (recoverability) of the wrinkles (deformation) of the contact lens after the opening of the package is improved, or the generation of the wrinkles (deformation) of the contact lens during its storage in the storage space is suppressed.

Table 3

|                                                        | Component                                     |                   | Experimental<br>Example 8 | Experimental<br>Example 9 | Experimental<br>Example 10 |
|--------------------------------------------------------|-----------------------------------------------|-------------------|---------------------------|---------------------------|----------------------------|
| Polymerizable<br>composition<br>(part(s) by<br>weight) | Monomer                                       | HEMA              | 52                        | 0                         | 87                         |
|                                                        | Monomer                                       | GMA               | 35                        | 87                        | 0                          |
|                                                        | Polymerization<br>initiator                   | BME               | 0.1                       | 0.5                       | 0.1                        |
|                                                        | Crosslinking<br>agent                         | EDMA              | 0.25                      | 0.25                      | 0.5                        |
|                                                        | Coloring agent                                | RB-19             | 0.0075                    | 0.0075                    | 0.0075                     |
|                                                        | Solvent                                       | Glycerol          | 6                         | 6                         | 6                          |
|                                                        | Additive                                      | Poloxamer-<br>407 | 0.2                       | 0.2                       | 0.2                        |
| Physical<br>properties                                 | Relaxation modulus (after<br>1 second)        |                   | 0.652                     | 0.528                     | 1.013                      |
|                                                        | tan $\delta$ (at 1.0 Hz tensile E*<br>(Mpa) ) |                   | 0.0455                    | 0.0233                    | 0.1197                     |
|                                                        | Recoverability (at 100%)<br>(%)               |                   | 90.5                      | 90.8                      | 90.9                       |
|                                                        | Young's modulus (MPa)                         |                   | 0.214                     | 0.091                     | 0.480                      |
|                                                        | Water content (%)                             |                   | 62                        | 81                        | 41                         |

## Industrial Applicability

[0087] The contact lens package according to the embodiment of the present invention may be suitably used in the production and sale of contact lenses.

## Reference Signs List

|        |            |                            |
|--------|------------|----------------------------|
| [0088] | <b>10</b>  | lid member                 |
|        | <b>20</b>  | base member                |
|        | <b>22</b>  | supporting base material   |
|        | <b>24</b>  | lens loading base material |
|        | <b>100</b> | package                    |
|        | <b>110</b> | storage space              |
|        | <b>120</b> | contact lens               |

**200**    contact lens package

## Claims

[Claim 1] A contact lens package, comprising:

a package having a lid member and a base member; and

a contact lens stored in a deformed state in a storage space sealed by the lid member and the base member,

wherein the contact lens has a relaxation modulus of 1.6 MPa or less, and

wherein the relaxation modulus of the contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[Claim 2] The contact lens package according to claim 1, wherein the contact lens has a loss tangent in tension of 0.14 or less, which is obtained by dynamic tensile viscoelasticity measurement in the aqueous medium at 35°C.

[Claim 3] The contact lens package according to claim 1, wherein the relaxation modulus of the contact lens is 1.3 MPa or less.

[Claim 4] A contact lens package, comprising:

a package having a lid member and a base member; and

a contact lens stored in a deformed state in a storage space sealed by the lid member and the base member,

wherein the contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C.

[Claim 5] The contact lens package according to claim 4, wherein the loss tangent in tension of the contact lens is 0.06 or less.

[Claim 6] The contact lens package according to claim 4,

wherein the contact lens has a relaxation modulus of 1.8 MPa or less, and

wherein the relaxation modulus of the contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[Claim 7] A contact lens package, comprising:

a package having a lid member and a base member; and

a contact lens stored in a deformed state in a storage space sealed by the lid member and the base member,

wherein the contact lens has a loss tangent in tension of

0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C,

wherein the contact lens has a relaxation modulus of 1.6 MPa or less, and

wherein the relaxation modulus of the contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[Claim 8] The contact lens package according to claim 7, wherein the loss tangent in tension of the contact lens is 0.06 or less.

[Claim 9] The contact lens package according to claim 7, wherein the relaxation modulus of the contact lens is 1.2 MPa or less.

[Claim 10] The contact lens package according to claim 1, 4, or 7, wherein the contact lens has an oxygen transmissibility ( $Dk/t$ ) of 24 or more.

[Claim 11] The contact lens package according to claim 1, 4, or 7, wherein the contact lens is a silicone hydrogel lens.

[Claim 12] The contact lens package according to claim 1, 4, or 7, wherein the contact lens is stored in the storage space under a state in which a height thereof is smaller than a natural sagittal height thereof.

[Claim 13] The contact lens package according to claim 1, 4, or 7, wherein the storage space has a height of 2 mm or less.

[Claim 14] A method of improving wrinkle recoverability of a contact lens when a contact lens package is opened, the method comprising producing the contact lens package by joining a lid member and a base member facing each other so that the lid member and the base member form a storage space in a sealed state in which the contact lens is arranged,

wherein the storage space has a height smaller than a natural sagittal height of the contact lens,

wherein the contact lens has a relaxation modulus of 1.6 MPa or less, and

wherein the relaxation modulus of the contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C.

[Claim 15] A method of suppressing generation of wrinkles of a contact lens in a contact lens package, the method comprising producing the contact lens package by joining a lid member and a base member facing each other so that the lid member and the base member form a storage space in a sealed state in which the contact lens is arranged,

wherein the storage space has a height smaller than a natural sagittal height of the contact lens, and

wherein at least one of the following (i) or (ii) is satisfied:

(i) the contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in an aqueous medium at 35°C; and

(ii) a ratio of the latter of the following energies to the former thereof is 90% or more: energy absorbed when the contact lens is stretched at a stretching ratio of 100% in the aqueous medium at 35°C; and energy released for shrinking the contact lens from the stretched state to a stretching ratio of 0%.

[Claim 16] A contact lens package, comprising:

a package having a lid member and a base member; and

a contact lens stored in a storage space sealed by the lid member and the base member,

wherein the storage space is defined by a convex curved surface part of the lid member protruding toward the base member side and a concave curved surface part of the base member protruding toward a side opposite to the lid member,

wherein the package is configured such that the contact lens adheres to the lid member or the base member when the package is opened, and

wherein at least one of the following (i) or (ii) is satisfied:

(i) the contact lens has a relaxation modulus of 1.6 MPa or less, and the relaxation modulus of the contact lens is an elastic modulus after a lapse of 1 second from a start of measurement when measurement of stress required for holding a contact lens piece is started simultaneously with application of a strain of 75% with respect to an upper limit of a linear elastic region in a tensile test to the contact lens piece in an aqueous medium at 35°C; and

(ii) the contact lens has a loss tangent in tension of 0.1 or less, which is obtained by dynamic tensile viscoelasticity measurement in the aqueous medium at 35°C.