MATERIAL FOR INTRAOCULAR LENS

BACKGROUND OF THE INVENTION

Technical Field

[0001] The present invention relates to a material for intraocular lens.

Related Art

[0002] An intraocular lens is a lens that is inserted into the eye instead of a crystalline lens during cataract surgery. Flexible and foldable materials have been developed in order that the material can be inserted into the eye from the possible smallest incision. Because of excellent flexibility and high refractive index, acrylic materials have become the mainstream in recent years.

[0003] For example, in patent literature 1, a material for intraocular lens is proposed which is made of a polymer obtained by polymerizing a polymerization component containing hydrophilic monomers including hydroxyl group-containing alkyl (meth)acrylate, (meth)acrylamide monomer, N-vinyllactam and the like, and which has a water absorption of 1.5 to 4.5 mass%. Because the material for intraocular lens is excellent in flexibility and has a high refractive index, the lens can be made thinner and can be inserted from an incision in a folded state. Furthermore, glistening is suppressed and the lens may have excellent transparency.

[Literature of related art]

[Patent literature]

[0004] Patent literature 1: Japanese Patent Laid-Open No. 11-56998

hydrophilic monomers may be, for example, diethylene glycol mono(meth)acrylate, triethylene glycol mono(meth)acrylate, propylene glycol mono(meth)acrylate, (meth)acrylic acid, 1-methyl-3-methylene-2-pyrrolidinone, maleic anhydride, maleic acid, maleic acid derivatives, fumaric acid, fumaric acid derivatives, aminostyrene, hydroxystyrene, and the like.

[0030] From the point of a great effect of accelerating the reduction of glistening, the hydrophilic monomer is preferably hydroxyl group-containing alkyl (meth)acrylate and (meth)acrylamide and particularly preferably 2-hydroxyethyl methacrylate.

[0031] A blending amount of the hydrophilic monomer can be 10 mol% to 40 mol% when the amount of all the monomer components contained in the monomer composition is set as 100 mol%, and the blending amount is preferably 10 mol% to 25 mol%. In the range, the occurrence of glistening can be sufficiently suppressed and the flexibility can be maintained.

[0032] A-3. Cross-likable monomer

The cross-likable monomer may contribute to the flexibility of the material for intraocular lens. Specifically, good mechanical strength may be imparted and the shape recovery property may be improved. In addition, copolymerizability of the monomers may be improved.

[0033] The cross-likable monomer may be, for example, 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, divinyl benzene, diallyl phthalate, diallyl adipate, triallyl diisocyanate, α-methylene-N-vinylpyrrolidone, 4-vinyl

sample, the sample is immersed in water of 35°C for 22 hours and then immersed in water of 25°C for 2 hours, and thereafter, the appearance is observed with a stereoscopic microscope. The observation of the appearance is performed on 2 or 3 test bodies for one kind of sample, and the number of glistening (bright spots) is examined. The magnification is about 10 to 60 times. The observation is performed with the magnification appropriately adjusted within the above range in a manner that the glistening could be easily observed.

[0055] (Water absorption)

A mass of the sample in an equilibrium hydrated state at 25°C and a dry state is measured, and the water absorption (mass%) is calculated. The water absorption is calculated by the following equation (5) using a mass Ww of the sample in the equilibrium hydrated state at 25°C and a mass Wd of the sample in the dry state. Five plates having a diameter of 6 mm and a thickness of 0.8 mm are used as samples.

Water absorption (mass%) = (Ww - Wd)/Wd × 100…Equation (5)

[0056] (Refractive index)

A refractive index of a sample according to a Hg-e line is obtained using an Abbe refract meter. The measurement is performed on a dry sample (25°C) or a water-absorbing sample (35°C). A plate having a diameter 6 mm and a thickness 0.8 mm is used as the sample.

[0057] [Examples 1 to 6 and Comparative examples 1 to 9 Preparation of plate-shaped material for intraocular lens]

A monomer composition is obtained by adding a polymerization initiator to

the monomer components with the ratios shown in Table 1. 2,2'-azobis(2,4-dimethylvaleronitrile) is used as the specific substance of the polymerization initiator. The mass part of the polymerization initiator in the monomer composition is 0.5 part by mass with respect to 100 parts by mass of the base monomer. The obtained monomer composition is poured into a mold having a desired plate shape. The mold is put in an oven at 80°C and subjected to heat polymerization molding for 40 minutes. The obtained polymer is released from the mold and subjected to an elution treatment, and then dried in an oven at 60°C to obtain a plate-shaped material for intraocular lens. At this time, according to necessary measurement items, samples having two different thicknesses are appropriately prepared as plate samples having the same formulation. The 0.5 mm or 0.8 mm thick plate described above is a plate made from a mold in which a 0.5 mm or 0.8 mm thick spacer is used. According to the objective of the test, the dried plate is hollowed out to a diameter of 6 mm or 8 mm to make a plate for measurement.

[0058] [Table 1]

		Base monomer			Hydrophilic monomer	Cross-likable monomer	Acrylate monomer (A)	Methacrylate monomer (MA)	MA/A
		POEA	EA	ETMA	HEMA	BDDA			
		Mol%	Mol%	Mol%	Mol%	Mol%	Mol%	Mol%	
Example	1	40.3	25.8	16.3	14.9	2.6	68.8	31.2	0.45
	2	38.7	24.7	15.7	19.0	1.9	65.3	34.7	0.53
	3	38.9	24.9	15.8	19.2	1.3	65.1	34.9	0.54
	4	36.7	23.5	14.9	22.6	2.4	62.6	37.4	0.60
	5	36.9	23.6	15.0	22.7	1.8	62.3	37.7	0.60
	6	37.1	23.8	15.0	22.9	1.2	62.1	37.9	0.61