

DESCRIPTION

Title of Invention: PHOTOCURABLE COMPOSITION

TECHNICAL FIELD

[0001]

The present invention relates to a photocurable composition, and particularly to a photocurable composition that can be used for natural or artificial nails.

BACKGROUND ART

[0002]

In the field of so-called gel nails, in which photocurable compositions are directly or indirectly used for human nails, the photocurable compositions are applied and cured by light irradiation. Japanese Patent Laid-Open No. 2019-119676 discloses an invention relating to a base coat, particularly describing an effect of improving adhesion, and includes the addition of a specific silane coupling agent as a feature. However, the silane coupling agent does not function as a silane coupling agent unless it is localized at the interface with the adherend, and does not contribute to adhesion unless the hydrolyzable silyl groups react. Therefore, whether the silane coupling agent exerts its effect is influenced by the surface condition of the human nail and also by the composition containing a (meth)acryloyl group-containing compound. Furthermore, in order to achieve the anchor effect known in the field of adhesion, it is known in gel nail applications to perform sanding using a file etc. to roughen the surface of the natural nail, thereby improving adhesion. However, since sanding may damage the natural nail, it is preferable to avoid sanding (non-sanding). The base coat primarily serves to ensure adhesion, but it must also be durable. If the base coat comes off, the overlying color and top coats will also detach together.

SUMMARY OF INVENTION

[0003]

Conventionally, it has been difficult to improve the durability of gel nail base coats, regardless of whether sanding is performed.

[0004]

Thus, the present invention has been made in view of the foregoing circumstances, and aims to provide a means for improving the durability, particularly a means for improving the durability of gel nail base coats regardless of whether sanding is performed.

[0005]

The present inventors have conducted intensive studies to achieve the foregoing object and have completed the present invention: a photocurable composition, particularly for use on natural or artificial nails.

[0006]

The summary of the present invention is as follows. A first embodiment of the present invention is a photocurable composition containing the following components (A) to (C), wherein the component (A) contains a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure:

component (A): a urethane-modified (meth)acrylate oligomer;

component (B): a (meth)acrylate monomer having a hydroxy group in the molecule; and

component (C): a photoinitiator.

[0007]

A second embodiment of the present invention is the photocurable composition according to the first embodiment, wherein the component (A) is a urethane-modified methacrylate oligomer.

[0008]

A third embodiment of the present invention is the photocurable composition according to the first or second embodiment, wherein the component (A) is contained in an amount of 25 to 80 mass% based on the entire composition.

[0009]

A fourth embodiment of the present invention is the photocurable composition according to any of the first to third embodiments, wherein the component (B) is contained in an amount of 10 to 60 parts by mass based on 100 parts by mass of the component (A).

[0010]

A fifth embodiment of the present invention is the photocurable composition for a natural or artificial nail according to any of the first to fourth embodiments, further containing a (meth)acrylate monomer having an acidic group in the molecule.

[0011]

A sixth embodiment of the present invention is the photocurable composition according to the fifth embodiment, wherein the (meth)acrylate monomer having an acidic group in the molecule is contained in an amount of 5 to 30 parts by mass based on 100 parts by mass of the component (A).

[0012]

A seventh embodiment of the present invention is the photocurable composition according to any of the first to sixth embodiments, wherein the component (A) is a urethane-modified (meth)acrylate oligomer in which the polyether backbone is polytetramethylene glycol.

[0013]

An eighth embodiment of the present invention is the photocurable composition for a natural or artificial nail according to any of the first to seventh embodiments, further containing an acrylamide compound and/or isobornyl methacrylate.

[0014]

A ninth embodiment of the present invention is a photocurable composition for a natural or artificial nail, containing the photocurable composition according to any of the first to eighth embodiments.

[0015]

A tenth embodiment of the present invention is a base coat agent containing the photocurable composition for a natural or artificial nail according to the ninth embodiment.

[0016]

An eleventh embodiment of the present invention is a coating film prepared by curing the photocurable composition according to any of the first to eighth embodiments by light irradiation.

DESCRIPTION OF EMBODIMENTS

[0017]

The present invention provides a photocurable composition containing the following components (A) to (C):

component (A): a urethane-modified (meth)acrylate oligomer having a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure;

component (B): a (meth)acrylate monomer having a hydroxy group in the molecule; and

component (C): a photoinitiator.

[0018]

The aforementioned photocurable composition can improve durability. In particular, the aforementioned photocurable composition can improve the durability of gel nail base coats, regardless of whether sanding is performed, especially under non-sanding conditions.

[0019]

The present invention will be described in detail below. The present invention is not limited to the following embodiments and may be variously modified within the scope of the claims. The embodiments described in the present disclosure may be appropriately combined to form other embodiments.

[0020]

Throughout the present disclosure, the singular forms include the plural forms unless the context clearly indicates otherwise. Thus, singular articles (e.g., "a," "an," and "the" in English) shall be understood to include the plural forms unless the context clearly indicates otherwise. Furthermore, the terms used in the present disclosure are to be understood as having the meanings commonly used in the relevant technical field, unless otherwise specified. Accordingly, unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present invention pertains. In the event of any inconsistency, the present disclosure (including definitions) shall prevail.

[0021]

In the present disclosure, the expression "X to Y" indicates a range that includes both X and Y, and means "X or more and Y or less." In the present disclosure, the expression "A and/or B" means at least one of A and B, encompassing both A and B, as well as A alone or B alone. Furthermore, unless otherwise specified, all procedures and measurements of physical properties and the like are conducted under conditions of room temperature (20 to 25°C) and a relative humidity of 40 to 60%RH.

[0022]

Examples of the component (A) usable in the present invention include a urethane-modified (meth)acrylate oligomer having a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure (the component (A) contains a urethane-modified (meth)acrylate oligomer having a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure). Here, the term "hydrogenated" refers to the reduction of unsaturated bonds with hydrogen to form saturated bonds. The urethane-modified (meth)acrylate oligomer refers to a (meth)acrylate oligomer having a urethane bond. As a method for synthesizing such a urethane-modified (meth)acrylate oligomer, a known approach involves forming a urethane bond from a polyol and a polyisocyanate, followed by the addition of a compound having a hydroxy group and a (meth)acryloyl group in the molecule, or (meth)acrylic acid, to the remaining isocyanate groups. Although the exact reason is not clear, the use of the component (A) enables the photocurable composition of the present invention to maintain adhesion when used as a gel nail base coat, regardless of whether sanding is performed. Furthermore, the use of the component (A) improves the durability of the photocurable composition of the present invention when used as a gel nail base coat, regardless of whether sanding is performed.

[0023]

The component (A) is a urethane-modified (meth)acrylate oligomer synthesized from the following components (A-1) to (A-4). From the viewpoint of durability, the component (A) is preferably a urethane-modified methacrylate oligomer. The component (A) has a weight-average molecular weight of preferably 1,000 to 50,000, more preferably 1,000 to 45,000, further preferably 1,000 to 20,000, and most preferably 3,000 to 15,000. Here, the weight-average molecular weight refers to the value measured by gel permeation chromatography (GPC) or the like, using polystyrene as the standard material. The component (A) has preferably 1 to 4, more preferably 2 to 4, and most preferably 2 (meth)acryloyl groups per molecule. In the following description, the acryloyl group and the methacryloyl group are collectively referred to as a (meth)acryloyl group, and compounds containing a (meth)acryloyl group are collectively referred to as (meth)acrylates, encompassing both acrylates and methacrylates. Here, the distinction between oligomers and the monomers described later is made based on whether the weight-average molecular weight (or molecular weight) is 1,000 or more, with oligomers having a weight-average molecular weight (or molecular weight) of 1,000 or more.

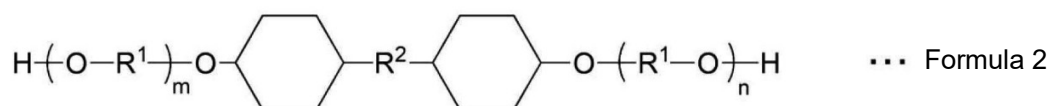
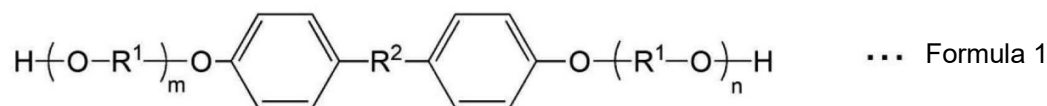
[0024]

The component (A-1) is a polyol having a bisphenol backbone of the following formula 1 or a hydrogenated bisphenol backbone of the following formula 2. In the formula 1 or 2, R^1 and R^2 are each independently a divalent alkylene group having 1 or more carbon atoms, and n and m are each independently an integer of 0 or more. From the viewpoint of durability, R^1 is preferably a divalent alkylene group having 1 to 5

carbon atoms in the formula 1 or 2. Specific examples include a methylene group (-CH₂-), an ethylene group (-CH₂CH₂-), a methyl methylene group (-CH₂(CH₃)-), a trimethylene group (-CH₂CH₂CH₂-), a 2-methylethylene group (-CH₂-CH(CH₃)-), a propylene group (-C(CH₃)₂-), a tetramethylene group (-CH₂CH₂CH₂CH₂-), a 1-methyltrimethylene group (-CH(CH₃)CH₂CH₂-), a 2-methyltrimethylene group (-CH₂CH(CH₃)CH₂-), a 1,1-dimethyldimethylene group (-C(CH₃)₂CH₂-), a 1,2-dimethyldimethylene group (-CH(CH₃)CH(CH₃)-), and a pentamethylene group (-CH₂CH₂CH₂CH₂CH₂-). R² is preferably a divalent alkylene group having 1 to 3 carbon atoms. Specific examples include a methylene group (-CH₂-), an ethylene group (-CH₂CH₂-), a methyl methylene group (-CH₂(CH₃)-), a trimethylene group (-CH₂CH₂CH₂-), a 2-methyl ethylene group (-CH₂-CH(CH₃)-), and a propylene group (-C(CH₃)₂-). Of them, R² is preferably a propylene group (-C(CH₃)₂-). n and m are preferably integers of 0 to 5, and more preferably 0. In other words, the component (A-1) preferably contains a polyol having a bisphenol A backbone or a polyol having a hydrogenated bisphenol A backbone, and the component (A-1) is preferably a polyol having a bisphenol A backbone or a polyol having a hydrogenated bisphenol A backbone. In the following formulas 1 or 2, R¹ and R² may be the same, or different from each other. Likewise, n and m may be the same or different from each other. Furthermore, when m is 2 or more [i.e., when multiple (-O-R¹-) units constitute (-O-R¹-)_m], each (-O-R¹-) may be the same or different. Likewise, when n is 2 or more [i.e., when multiple (-O-R¹-) units constitute (-O-R¹-)_n], each (-O-R¹-) may be the same or different.

[0025]

[Formula 1]



[0026]

The component (A-2) is a polyol having a polyether backbone. However, the component (A-1) is excluded. A polyether polyol having 2 or more hydroxy groups in the molecule may be used as the component (A-2). The alkylene oxide group may contain a divalent alkylene group having 1 or more carbon atoms. Specifically, a methylene oxide group (-CH₂-O-), an ethylene oxide group (-CH₂CH₂-O-), a propylene oxide group (-CH₂CH₂CH₂-O-), an isopropylene oxide group (-CH(CH₃)CH₂-O-, or -CH₂CH(CH₃)-O-), and a butylene oxide group (-CH₂CH₂CH₂CH₂-O-) may be used, but the alkylene oxide group is not limited thereto. Furthermore, the divalent alkylene group may have a linear or branched structure. From the viewpoint of

durability, the component (A-2) is preferably a polyether polyol, more preferably a linear polyether glycol having primary hydroxy groups at both ends, and most preferably polytetramethylene glycol in order to impart flexibility that allows the composition to follow changes in the external environment. That is, in an embodiment of the present invention, the component (A) is a urethane-modified (meth)acrylate oligomer in which the polyether backbone is polytetramethylene glycol. Furthermore, it is preferable that the component (A-1) and the component (A-2) are used in combination, and the components may be mixed at a weight ratio ranging from 9:1 to 1:9.

[0027]

The component (A-3) is a polyisocyanate compound. The polyisocyanate compound refers to a compound having two or more isocyanate groups in the molecule. From the viewpoint of durability, the polyisocyanate compound preferably has two isocyanate groups in the molecule. Specific examples include aromatic polyisocyanate, alicyclic polyisocyanate, and aliphatic polyisocyanate. Examples of aromatic polyisocyanates includes 2,4-tolylene diisocyanate (toluene diisocyanate), 2,6-tolylene diisocyanate, 1,3-xylylene diisocyanate, 1,4-xylylene diisocyanate, tetramethylxylylene diisocyanate, diphenylmethane diisocyanate, naphthalene-1,5-diisocyanate, and triphenylmethane triisocyanate. Examples of alicyclic polyisocyanates include isophorone diisocyanate, bis(4-isocyanatocyclohexyl)methane, 1,3-bis(isocyanatomethyl)cyclohexane, 1,4-bis(isocyanatomethyl)cyclohexane, norbornane diisocyanate, and bicycloheptane triisocyanate. Examples of aliphatic polyisocyanate include hexamethylene diisocyanate, 1,3,6-hexamethylene triisocyanate, and 1,6,11-undecatriisocyanate. They may be used alone, or in combination of two or more. From the viewpoint of durability, the component (A-3) is most preferably isophorone diisocyanate or toluene diisocyanate.

[0028]

The component (A-4) is a (meth)acrylate having a hydroxy group in the molecule. A (meth)acrylate having one or more hydroxy groups in the molecule may be used. Examples thereof include 2-hydroxyethyl (meth)acrylate, hydroxypropyl (meth)acrylate, a mono(meth)acrylate of divalent alcohol, such as ethylene glycol, propylene glycol, 1,3-propanediol, 1,3-butanediol, 1,4-butanediol, and polyethylene glycol, and a mono(meth)acrylate or di (meth)acrylate of trivalent alcohol, such as trimethylolethane, trimethylolpropane, and glycerol. They may be used alone, or in combination of two or more. From the viewpoint of durability, the component (A-4) is most preferably 2-hydroxyethyl methacrylate or hydroxypropyl methacrylate.

[0029]

The method for synthesizing the component (A) is not particularly limited, and a known method may be used. First, referring to the synthesis of the urethane prepolymer, for example, the urethane prepolymer may

be synthesized by reacting the component (A-3), which is an isocyanate compound having two or more isocyanate groups in the molecule, with a mixture of the component (A-1) and the component (A-2), which are polyol compounds having two or more hydroxy groups in the molecule. Alternatively, the isocyanate compound may be added to either the component (A-1) or the component (A-2), and then the remaining component (polyol compound) may be added sequentially. Here, the molar ratio of the polyol compound: the isocyanate compound is preferably 3:1 to 1:3, and further preferably 2:1 to 1:2. During the synthesis, a urethane prepolymer may also be obtained by reacting the components in a diluent. Subsequently, the remaining isocyanate groups in the resulting urethane prepolymer may be allowed to react with a (meth)acrylate having at least one or more hydroxy groups in the molecule, in an amount sufficient to react with the isocyanate groups, to synthesize a urethane (meth)acrylate oligomer. Examples of catalysts used during the synthesis include lead oleate, tetrabutyltin, antimony trichloride, triphenylaluminum, trioctylaluminum, dibutyltin dilaurate, copper naphthenate, zinc naphthenate, zinc octylate, zinc octenoate, zirconium naphthenate, cobalt naphthenate, tetra-n-butyl-1,3-diacetyloxydistannoxane, triethylamine, 1,4-diaza[2,2,2]bicyclooctane, and N-ethylmorpholine. In particular, dibutyltin dilaurate, zinc naphthenate, zinc octylate, and zinc octenoate are preferably used because they exhibit high catalytic activity and produce cured products with high transparency. It is preferable to use these catalysts in a proportion of 0.0001 to 10 parts by mass based on 100 parts by mass of the total reactant. The reaction temperature is usually 10 to 100°C, and particularly preferably 30 to 90°C. Prior to the start of synthesis of the component (A), a solvent such as methyl ethyl ketone or methoxyphenol, or a (meth)acrylate monomer described later and the like as a diluent may be used. The product may be used as the component (A) by evaporating the solvent.

[0030]

To impart flexibility that allows the composition to follow changes in the external environment, it is preferable that the polyether backbone contained in the molecular structure of the component (A) is polytetramethylene glycol. Furthermore, the component (A) is preferably a urethane-modified (meth)acrylate oligomer having a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure, because it can provide high hardness even when added in a small amount relative to the entire composition. More preferably, the component (A) contains at least one of a urethane-modified methacrylate oligomer having a bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure, and a urethane-modified methacrylate oligomer having a hydrogenated bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure. The component (A) is particularly preferably a urethane-modified methacrylate oligomer having a hydrogenated bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure, or a mixture of a urethane-modified methacrylate oligomer having a bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure and a urethane-modified methacrylate oligomer having a hydrogenated bisphenol A

backbone and a polytetramethylene glycol backbone in the molecular structure. This embodiment can enhance durability, especially the adhesion and durability of gel nail base coats under non-sanding conditions. When the component (A) is a mixture of a urethane-modified methacrylate oligomer having a bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure and a urethane-modified methacrylate oligomer having a hydrogenated bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure, referring to the mixing ratio of these, it is preferable that the urethane-modified methacrylate oligomer having a hydrogenated bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure is present in a greater amount than the urethane-modified methacrylate oligomer having a bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure. This embodiment can enhance adhesion and durability, especially the adhesion and durability of gel nail base coats under non-sanding conditions. More specifically, the amount of the urethane-modified methacrylate oligomer having a hydrogenated bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure is preferably 110 parts by mass or more and 300 parts by mass or less, and more preferably 120 parts by mass or more and 270 parts by mass or less based on 100 parts by mass of the urethane-modified methacrylate oligomer having a bisphenol A backbone and a polytetramethylene glycol backbone in the molecular structure.

[0031]

Furthermore, from the viewpoint of adhesion and durability, the amount of the component (A) added is preferably 25 to 80 mass% based on the entire composition (the entire composition contains 25 to 80 mass% of the component (A)). In particular, the entire composition contains more preferably 30 to 80 mass%, and more preferably 30 to 60 mass% of the component (A) from the viewpoint of the improvement in adhesion and durability of gel nail base coats when sanding is performed. The entire composition contains more preferably 50 to 80 mass%, and most preferably 50 to 60 mass% of the component (A) from the viewpoint of the improvement in adhesion and durability of gel nail base coats under non-sanding conditions in particular.

[0032]

In the present invention, a urethane-modified (meth)acrylate oligomer other than the component (A) may be contained. Examples of polyols include the aforementioned component (A-1), component (A-2), and a polyol compound having two or more hydroxy groups in the molecule. Mainly one type of polyol is used. Specific examples include polyester polyol, caprolactone diol, polyisoprene polyol, hydrogenated polyisoprene polyol, polybutadiene polyol, hydrogenated polybutadiene polyol, castor oil polyol, polycarbonate diol, and bisphenol diol. They may be used alone, or in combination of two or more. Synthesis is carried out using a polyol and the aforementioned components (A-3) and (A-4). Preferred examples of urethane-modified (meth)acrylate oligomers other than the component (A) include urethane-modified (meth)acrylate oligomers having a bisphenol backbone or a hydrogenated bisphenol backbone, but not a polyether backbone in the

molecular structure, urethane-modified (meth)acrylate oligomers having a polyether backbone, but not a bisphenol backbone or a hydrogenated bisphenol backbone in the molecular structure, urethane-modified (meth)acrylate oligomers having a polyester backbone in the molecular structure, and urethane-modified (meth)acrylate oligomers having a polycarbonate backbone in the molecular structure. They may be used alone, or in combination of two or more.

[0033]

It is preferable that the urethane-modified (meth)acrylate oligomer other than the component (A) has 2 to 5 (meth)acryloyl groups per molecule and has a weight average molecular weight of 1,000 to 20,000.

[0034]

Specific examples of urethane-modified (meth)acrylate oligomers other than the component (A) include, but are not limited to, ART RESIN UN-6303, KY-11, KY-103, UN-9000PEP, UN-6303, and UN-904 manufactured by Negami Chemical Industrial Co., Ltd., AH-600, AT-600, UA-306H, and UF-8001G manufactured by KYOEISHA CHEMICAL Co., LTD., and SHIKOH UV-3200B, UV-3300B, UV-3500BA, UV-3520TL, UV-3200B, UV-3000B, and UV-6640B manufactured by Mitsubishi Chemical Corporation.

[0035]

From the viewpoint of the improvement in durability, it is preferable that the photocurable composition of the present invention does not contain a urethane-modified (meth)acrylate oligomer other than the component (A). Alternatively, the composition contains a urethane-modified (meth)acrylate oligomer other than the component (A) in a proportion of preferably 120 parts by mass or less (lower limit: more than 0 parts by mass), and more preferably more than 30 parts by mass and less than 110 parts by mass based on 100 parts by mass of the component (A). It is particularly preferable that the photocurable composition of the present invention does not contain the urethane-modified (meth)acrylate oligomer other than the component (A).

[0036]

Examples of the component (B) usable in the present invention include a (meth)acrylate monomer having a hydroxy group in the molecule, which is a compound having one or more hydroxy groups and (meth)acryloyl groups per molecule. However, the component (A) and the urethane-modified (meth)acrylate oligomer other than the component (A) are excluded. Specific examples of the component (B) include 2-hydroxyethyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxy-1,3-di(meth)acryloxypropane, a mono(meth)acrylate of divalent alcohol, such as ethylene glycol, propylene glycol, 1,3-propanediol, 1,3-butanediol, 1,4-butanediol, and polyethylene glycol, and a mono(meth)acrylate or a di(meth)acrylate of trivalent alcohol, such as trimethylolethane, trimethylolpropane, and glycerol. They may be

used alone, or in combination of two or more. From the viewpoint of the improvement in durability, it is preferable that the component (B) contains a (meth)acrylate monomer having one hydroxy group in the molecule, and it is more preferable that the component (B) is a (meth)acrylate monomer having one hydroxy group in the molecule. The component (B) is preferably at least one selected from 2-hydroxyethyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate and 2-hydroxy-1,3-di(meth)acryloxypropane. The component (B) more preferably contains at least one of 2-hydroxypropylmethacrylate and 2-hydroxy-1,3-dimethacryloxypropane, and is particularly preferably 2-hydroxypropylmethacrylate, or a combination of 2-hydroxypropylmethacrylate and 2-hydroxy-1,3-dimethacryloxypropane.

[0037]

From the viewpoint of the improvement in adhesion, the photocurable composition of the present invention contains preferably 10 to 60 parts by mass, and more preferably 15 to 50 parts by mass of the component (B) based on 100 parts by mass of the component (A).

[0038]

In the present invention, a (meth)acrylate monomer other than the component (B) may be contained. The (meth)acrylate monomer other than the component (B) usable in the present invention refers to a compound having one or more (meth)acryloyl groups or (meth)acrylamide groups per molecule. However, the component (A), the urethane-modified (meth)acrylate oligomer other than the component (A), and the component (B) are excluded. Here, the distinction between monomers and oligomers is made based on whether the weight-average molecular weight (or molecular weight) is less than 1,000, with monomers having a weight-average molecular weight (or molecular weight) of less than 1,000. To reduce the viscosity of the composition, it is preferable that the (meth)acrylate monomer other than the component (B) is in a liquid state under 25°C atmosphere. The monomer can be used as long as it is highly compatible with the components (A) and (B) according to the present invention. In consideration of the heat generation during photocuring, it is preferable that the (meth)acrylate monomer other than the component (B) has 1 to 4 (meth)acryloyl groups per molecule. Preferably, at least one monomer is selected from the group consisting of a monofunctional (meth)acrylate, a difunctional (meth)acrylate, and a trifunctional (meth)acrylate.

[0039]

Monofunctional, difunctional, and trifunctional (meth)acrylate monomers and (meth)acrylamide monomers may be contained as the (meth)acrylate monomer other than the component (B). Furthermore, other monomers may be used in combination.

[0040]

Specific examples of monofunctional (meth)acrylate monomers include, but are not limited to, lauryl (meth)acrylate, stearyl (meth)acrylate, ethylcarbitol (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, caprolactone-modified tetrahydrofurfuryl (meth)acrylate, benzyl (meth)acrylate, phenyl (meth)acrylate, phenoxyethyl (meth)acrylate, phenoxydiethylene glycol (meth)acrylate, phenoxytetraethylene glycol (meth)acrylate, nonylphenoxyethyl (meth)acrylate, nonylphenoxytetraethylene glycol (meth)acrylate, methoxydiethylene glycol (meth)acrylate, ethoxydiethylene glycol (meth)acrylate, butoxyethyl (meth)acrylate, butoxytriethylene glycol (meth)acrylate, 2-ethylhexyl polyethylene glycol (meth)acrylate, nonylphenyl polypropylene glycol (meth)acrylate, methoxydipropylene glycol (meth)acrylate, glycerol (meth)acrylate, polyethylene glycol (meth)acrylate, polypropylene glycol (meth)acrylate, cyclohexyl (meth)acrylate, dicyclopentanyl (meth)acrylate, isobornyl (meth)acrylate, N,N-dimethylaminoethyl (meth)acrylate, and N,N-diethylaminoethyl (meth)acrylate.

[0041]

The monofunctional (meth)acrylate monomer also includes a (meth)acrylate monomer having an acidic group in the molecule. The (meth)acrylate monomer having an acidic group in the molecule particularly refers to an acrylic acid, a methacrylic acid, and a carboxylic acid and a phosphoric acid each having a (meth)acryloyl group in the molecule. Examples of carboxylic acids having a (meth)acryloyl group in the molecule include, but are not limited to, 3-(meth)acryloyloxyethylsuccinic acid, 3-(meth)acryloyloxypropylsuccinic acid, 4-(meth)acryloyloxybutylsuccinic acid, 2-(meth)acryloyloxyethylmaleic acid, 3-(meth)acryloyloxypropylmaleic acid, 4-(meth)acryloyloxybutylmaleic acid, 2-(meth)acryloyloxyethyl hexahydrophthalic acid, 3-(meth)acryloyloxypropyl hexahydrophthalic acid, 4-(meth)acryloyloxybutyl hexahydrophthalic acid, 2-(meth)acryloyloxyethylphthalic acid, 3-(meth)acryloyloxypropylphthalic acid, and 4-(meth)acryloyloxybutylphthalic acid. Examples of phosphoric acids having a (meth)acryloyl group in the molecule include, but are not limited to, 2-ethylhexyl acid phosphate, 2-hydroxyethylmethacrylate acid phosphate, and dibutyl phosphate.

[0042]

Specific examples of difunctional (meth)acrylate monomers include, but are not limited to, 1,3-butylene glycol di(meth)acrylate, 1,4-butylene glycol di(meth)acrylate, ethylene glycol di(meth)acrylate, tetraethylene glycol di(meth)acrylate, polyethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, tripropylene glycol di(meth)acrylate, tricyclodecane dimethanol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexane glycol di(meth)acrylate, dimethylol tricyclodecane di(meth)acrylate, ethylene oxide-modified neopentyl glycol di(meth)acrylate, propylene oxide-modified neopentyl glycol di(meth)acrylate, dicyclopentenyl di(meth)acrylate, bis((meth)acryloyloxyethyl)isocyanurate, ethylene oxide-modified dicyclopentenyl di(meth)acrylate, and neopentyl glycol-modified trimethylolpropane di(meth)acrylate.

[0043]

Specific examples of trifunctional (meth)acrylate monomers include, but are not limited to, trimethylol propane tri(meth)acrylate, trimethylol propane tri(meth)acrylate, pentaerythritol tri(meth)acrylate, EO-modified trimethylol propane tri(meth)acrylate, PO-modified trimethylol propane tri(meth)acrylate, and tris((meth)acryloyloxyethyl)isocyanurate.

[0044]

Specific examples of (meth)acrylamide monomers include, but are not limited to, dimethyl(meth)acrylamide, (meth)acryloylmorpholine, and diethyl(meth)acrylamide. Although the exact reason is unclear, it is preferable that the monomer includes a (meth)acrylamide monomer from the viewpoint of improved durability. In the present invention, specific examples of known (meth)acrylamide monomers include, but are not limited to, DMAA, ACOMO, and DEAA manufactured by KJ Chemicals Corporation.

[0045]

It is preferable that at least one (meth)acrylate monomer other than the component (B) is selected from the group consisting of a monofunctional (meth)acrylate, a difunctional (meth)acrylate, and a trifunctional (meth)acrylate.

[0046]

Alternatively, it is preferable that the (meth)acrylate monomer other than the component (B) contains at least one selected from the group consisting of a monofunctional (meth)acrylate and a (meth)acrylamide monomer. It is more preferable that the (meth)acrylate monomer other than the component (B) contains at least one selected from the group consisting of lauryl (meth)acrylate, isobornyl (meth)acrylate, acrylic acid, methacrylic acid, 3-(meth)acryloyloxyethylsuccinic acid, dimethyl (meth)acrylamide, and (meth)acryloylmorpholine.

[0047]

Furthermore, from the viewpoint of suppressing heat generation during application, it is preferable that the (meth)acrylate monomer other than the component (B) does not contain (meth)acrylates having four or more functional groups.

[0048]

A total of preferably 5 to 80 parts by mass, preferably 20 to 80 parts by mass, and more preferably 30 to 70 parts by mass of the (meth)acrylate monomer other than the component (B) is contained based on 100 parts by mass of the component (A). When 5 parts by mass or more (particularly 20 parts by mass or more) of the

(meth)acrylate monomer other than the component (B) is included, the viscosity of the composition is reduced, thereby facilitating application. When the amount is 80 parts by mass or less, the composition exhibits good storage stability.

[0049]

To improve adhesion, a (meth)acrylate monomer having an acidic group in the molecule is preferred as the (meth)acrylate monomer other than the component (B) (the (meth)acrylate monomer other than the component (B) preferably contains a (meth)acrylate monomer having an acidic group in the molecule). That is, in an embodiment of the present invention, the photocurable composition further contains a (meth)acrylate monomer having an acidic group in the molecule. In the present embodiment, the (meth)acrylate monomer having an acidic group in the molecule may be any of those described above. However, it more preferably contains at least one selected from the group consisting of acrylic acid, methacrylic acid, and 3-(meth)acryloyloxyethylsuccinic acid, more preferably contains at least 3-(meth)acryloyloxyethylsuccinic acid, and is particularly preferably 3-(meth)acryloyloxyethylsuccinic acid. In the present embodiment, preferably 5 to 30 parts by mass of the (meth)acrylate monomer having an acidic group in the molecule is contained based on 100 parts by mass of the component (A). More preferably, 5 to 20 parts by mass of the (meth)acrylate monomer having an acidic group in the molecule is contained based on 100 parts by mass of the component (A). Particularly preferably, 6 to 12 parts by mass of the (meth)acrylate monomer having an acidic group in the molecule is contained based on 100 parts by mass of the component (A). In the present embodiment, the (meth)acrylate monomer other than the component (B) is only the (meth)acrylate monomer having an acidic group in the molecule (particularly at least one selected from the group consisting of acrylic acid, methacrylic acid, and 3-(meth)acryloyloxyethylsuccinic acid); or an acrylamide compound (an acrylamide monomer, particularly dimethyl acrylamide or acryloylmorpholine) and/or isobornyl methacrylate are preferably used together with the (meth)acrylate monomer having an acidic group in the molecule (particularly at least one selected from the group consisting of acrylic acid, methacrylic acid, and 3-(meth)acryloyloxyethylsuccinic acid). In an embodiment of the present invention, the photocurable composition of the present invention contains only the (meth)acrylate monomer having an acidic group in the molecule as the (meth)acrylate monomer other than the component (B) (the (meth)acrylate monomer other than the component (B) is only the (meth)acrylate monomer having an acidic group in the molecule). In an embodiment of the present invention, the photocurable composition of the present invention further contains an acrylamide compound and/or isobornyl methacrylate.

[0050]

The (meth)acrylate monomer other than the component (B) is more preferably 3-(meth)acryloyloxyethylsuccinic acid, or a combination of 3-(meth)acryloyloxyethylsuccinic acid and isobornyl methacrylate. In an embodiment of the present invention, the photocurable composition of the present invention

contains only 3-(meth)acryloyloxyethylsuccinic acid as the (meth)acrylate monomer other than the component (B) (the (meth)acrylate monomer other than the component (B) is only 3-(meth)acryloyloxyethylsuccinic acid). In an embodiment of the present invention, the photocurable composition of the present invention further contains 3-(meth)acryloyloxyethylsuccinic acid and isobornyl methacrylate (the (meth)acrylate monomer other than the component (B) is only 3-(meth)acryloyloxyethylsuccinic acid and isobornyl methacrylate).

[0051]

Here, referring to the mixing ratio when using a (meth)acrylate monomer having an acidic group in the molecule and an acrylamide compound (an acrylamide monomer) and/or isobornyl methacrylate, the mass ratio of the total amount of the acrylamide compound (an acrylamide monomer) and/or isobornyl methacrylate to the (meth)acrylate monomer having an acidic group in the molecule is preferably 0.2 to 10, more preferably 1 to 8, and particularly preferably 2 to 4.

[0052]

The component (C) usable in the present invention is a photoinitiator. The component (C) is not limited as long as it is a radical photoinitiator that generates radical species by energy rays such as visible light, ultraviolet light, X rays, and electron beams. The component (C) encompasses a visible light photoinitiator and a non-visible light-responsive photoinitiator. The component (C) may contain at least one of a visible light photoinitiator and a non-visible light-responsive photoinitiator, but preferably contains a visible light photoinitiator. Here, the visible light photoinitiator refers to a photoinitiator that exhibits maximum light absorption in the visible light region, typically an acylphosphine oxide photopolymerization initiator containing a phosphorus atom. Specific examples include, but are not limited to, 2,4,6-trimethylbenzoyl-diphenylphosphine oxide and bis(2,4,6-trimethylbenzoyl)-phenyl phosphine oxide.

[0053]

Specific examples of the component (C) (non-visible light-responsive photoinitiators) include, but are not limited to, an acetophenone such as diethoxyacetophenone, 2-hydroxy-2-methyl-1-phenylpropan-1-one, benzyl dimethyl ketal, 4-(2-hydroxyethoxy)phenyl-(2-hydroxy-2-propyl)ketone, 1-hydroxycyclohexylphenyl ketone, 2-methyl-2-morpholino(4-thiomethylphenyl)propan-1-one, 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)butanone, and 2-hydroxy-2-methyl-1-[4-(1-methylvinyl)phenyl]propanone oligomer; a benzoin such as benzoin, benzoin methyl ether, benzoin ethyl ether, benzoin isopropyl ether, and benzoin isobutyl ether; a benzophenone such as benzophenone, methyl o-benzoylbenzoate, 4-phenylbenzophenone, 4-benzoyl-4'-methyl-diphenyl sulfide, 3,3',4,4'-tetra(t-butylperoxycarbonyl)benzophenone, 2,4,6-trimethylbenzophenone, 4-benzoyl-N,N-dimethyl-N-[2-(1-oxo-2-propenyloxy)ethyl]benzenemethanaminium bromide, and (4-benzoylbenzyl)trimethylammonium chloride; and a thioxanthone such as 2-isopropyl

thioxanthone, 4-isopropyl thioxanthone, 2,4-diethyl thioxanthone, 2,4-dichlorothioxanthone, 1-chloro-4-propoxythioxanthone, and 2-(3-dimethylamino-2-hydroxy)-3,4-dimethyl-9H-thioxanthen-9-one mesochloride. A plurality of components (C) may be used in combination.

[0054]

The component (C) may be contained in a proportion of 0.1 to 20 parts by mass, 3 to 20 parts by mass, 4 to 15 parts by mass, 5 to 15 parts by mass, or 5 to 10 parts by mass based on 100 parts by mass of the component (A). When the proportion of the component (C) is more than 0.1 part by mass (0.1 part by mass or more), photocurability can be maintained. On the other hand, when the proportion of the component (C) is less than 20 parts by mass (20 parts by mass or less), storage stability can be maintained without thickening during storage. It is preferable that the visible light photoinitiator is contained in an amount of 0 to 70 wt% based on the entire component (C). Alternatively, the visible light photoinitiator is contained in an amount of preferably 30 to 100 wt%, and more preferably 40 to 100 wt% based on the entire component (C). The cured product is more resistant to yellowing.

[0055]

In the present invention, appropriate amounts of additives such as a polythiol compound, a coupling agent, an inorganic or organic filler, a colorant such as pigment and dye, an antioxidant, a polymerization inhibitor, a defoaming agent, a leveling agent, a rheology modifier, and a ultraviolet absorber may be added as long as the characteristics of the present invention are not adversely affected. The addition of these additives provides a composition or its cured product with excellent resin strength, workability, and storage stability.

[0056]

In the present invention, a polythiol compound may be contained as long as the characteristics of the present invention are not adversely affected. The polythiol compound has two or more thiol groups per molecule. The addition of the polythiol compound improves photocurability. Specific examples of polythiol compounds include, but are not limited to, an aliphatic polythiol compound, an aromatic polythiol compound, and a polythiol compound having a sulfide bond.

[0057]

In the present invention, a coupling agent may be added as long as the characteristics of the present invention are not adversely affected. Examples of coupling agents include, but are not limited to, a silane coupling agent having an epoxy group, a vinyl group, an acryloyl group or a methacryloyl group together with a hydrolyzable silane group, a polyorganosiloxane having a phenyl group and a hydrolyzable silyl group, and/or a polyorganosiloxane having an epoxy group and a hydrolyzable silyl group. Specific examples of silane

coupling agents include, but are not limited to, allyl trimethoxysilane, vinyl trimethoxysilane, 3-glycidoxypropyl trimethoxysilane, 3-methacryloxypropyl trimethoxysilane, 3-acryloxypropyl trimethoxysilane, and 3-chloropropyl trimethoxysilane. However, although radical polymerization occurs during photocuring, coupling agents tend not to be incorporated into the polymer network. Therefore, it is preferable not to add a coupling agent in the present invention.

[0058]

In the present invention, a filler such as an inorganic filler and an organic filler may be appropriately added as long as the characteristics of the present invention are not adversely affected. The addition of a filler enables adjustment of not only viscosity and thixotropy but also curability and toughness. Examples of inorganic fillers include, but are not limited to, alumina, silica, and amorphous silica. On the other hand, examples of organic fillers include, but are not limited to, a styrene filler, a rubber filler, a core shell acrylic filler. Specific examples of commercially available products include, but are not limited to, FUSELEX E-1 manufactured by Tatsumori Ltd. and AO-802 manufactured by ADMAFINE, which are silica; and Aerosil series 200 (untreated), R972 (dimethyl dichlorosilane treated), R976 (dimethyl dichlorosilane treated), RY200 (dimethyl silicone treated), RX200 (hexamethyl disilazane treated), and R800 (octylsilane treated) manufactured by Nippon Aerosil Co., Ltd., which are amorphous silica.

[0059]

The photocurable composition of the present invention can be suitably used for natural or artificial nails. That is, the present invention also provides a photocurable composition for a natural or artificial nail containing the photocurable composition of the present invention.

[0060]

The present invention also provides a method for coating of a human or artificial nail, containing forming a coating film by applying the photocurable composition of the present invention to human or artificial nails and then curing it through irradiation with energy rays. Preferred conditions of coating and irradiation in this method are as follows. Here, the term "applying the photocurable composition of the present invention to a human or artificial nail" refers to applying the composition directly to the surface of the human or artificial nail, or applying the composition to the outermost surface of one or more layers formed on the surface of the human or artificial nail. In particular, because the photocurable composition of the present invention generates only a small amount of heat during curing upon light irradiation, it can be suitably used as a base coat agent that is directly applied to nails or artificial nails (particularly human nails). That is, a preferred embodiment of the present invention is the above-described photocurable composition for a natural or artificial nail as a base coat agent. The present invention also provides a base coat agent containing the photocurable composition for a

natural or artificial nail of the present invention. The photocurable composition of the present invention may also be used as a coating agent for a natural or artificial nail other than the base coat agent (e.g., a top coat agent).

[0061]

When the photocurable composition for a natural or artificial nail of the present invention is used as a so-called gel nail, the application is performed according to the following procedure. Before the application, the surface of the human nail is sanded with a file or the like, and dust, oil, moisture, and the like are removed using a nail-specific solvent containing ethanol as a main component. Sanding and wiping enhance the adhesion of gel nail to the natural nail and, in the case of a base coat, affect its subsequent durability. Furthermore, in order to shorten the application time, it is preferable not to perform sanding (non-sanding). A color coat may be applied over the base coat, and a top coat may be applied over the color coat. When the photocurable composition of the present invention is applied, a coating film having a thickness of 100 to 300 μm before curing is formed using a brush or a paint brush. A primer may be used prior to coating. When curing is performed, commercially available LED lamps for gel nails or the like may be used as an irradiation apparatus. The irradiation time is 15 seconds to 120 seconds, and in consideration of adverse effects on fingers, the irradiation time is preferably 20 to 70 seconds. The integrated light intensity is preferably 5 to 50 kJ/m^2 , and more preferably 10 to 40 kJ/m^2 .

[0062]

The photocurable composition for a natural or artificial nail of the present invention has a viscosity at 25°C of preferably 10 $\text{Pa} \cdot \text{s}$ or less, and more preferably 5 $\text{Pa} \cdot \text{s}$ or less in consideration of coatability during application. It is preferable that the photocurable composition for a natural or artificial nail of the present invention does not contain a solvent in the composition, in view of changes in coating film thickness caused by solvent evaporation.

[0063]

As described above, the photocurable composition of the present invention cures upon irradiation with light, thereby forming a coating film (cured product). Thus, the present invention also provides a coating film prepared by curing the photocurable composition of the present invention through irradiation with light. In this embodiment, the same curing conditions as described above may be applied.

Examples

[0064]

The present invention will be described in detail with reference to Examples, but the present invention is not limited to these Examples. (In the following, the photocurable composition for a natural or artificial nail will also be simply referred to as "the composition.")

[0065]

[Examples 1 to 21, Comparative Examples 1 to 6]

The following components were prepared for the preparation of the photocurable composition.

Component (A): urethane-modified (meth)acrylate oligomer having a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure

- Urethane methacrylate oligomer having a weight-average molecular weight of 14,000 and 2 (meth)acryloyl functional groups, and having a bisphenol A backbone (component (A-1)) and a polytetramethylene glycol backbone (component (A-2)) (diluted with 30 mass% of isobornyl methacrylate; concentration of synthesized product 1: 70 mass%) (hereinafter referred to as "synthesized product 1").

- Urethane methacrylate oligomer having a weight-average molecular weight of 3,000 and 2 (meth)acryloyl functional groups, and having a hydrogenated bisphenol A backbone (component (A-1)), and a polytetramethylene glycol backbone (component (A-2)) (diluted with 20 mass% of isobornyl (meth)acrylate; concentration of synthesized product 2: 80 mass%) (hereinafter referred to as "synthesized product 2")

Other oligomers: Urethane-modified (meth)acrylate oligomer other than the component (A)

- Urethane-modified acrylate oligomer having a polyether backbone (having a weight-average molecular weight of 13,000 and 2 functional groups) (SHIKOH UV-3300B manufactured by Mitsubishi Chemical Corporation) (hereinafter referred to as UV-3300B)

- Urethane-modified acrylate oligomer having a polyether backbone (having a weight-average molecular weight of 5,000 and 2 functional groups) (SHIKOH UV-6640B manufactured by Mitsubishi Chemical Corporation) (hereinafter referred to as UV-6640B)

- Urethane-modified acrylate oligomer having a polyester backbone (having a weight-average molecular weight of 10,000 and 2 functional groups) (SHIKOH UV-3200B manufactured by Mitsubishi Chemical Corporation) (hereinafter referred to as UV-3200B)

- Urethane-modified acrylate oligomer having a polycarbonate backbone (having a weight-average molecular weight of 4,500 and 2 functional groups) (UF-8001G manufactured by KYOEISHA CHEMICAL Co., LTD.) (hereinafter referred to as UF-8001G)

· Urethane-modified acrylate oligomer having a polycarbonate backbone (having a weight-average molecular weight of 5,000 and 2 functional groups) (UN-9000PEP manufactured by Negami Chemical Industrial Co., Ltd.) (hereinafter referred to as UN-9000PEP)

· Urethane-modified methacrylate oligomer having a weight-average molecular weight of 2,000 and 2 (meth)acrylate functional groups, and having a bisphenol A backbone (hereinafter referred to as synthesized product 3)

Component (B): (meth)acrylate monomer having a hydroxy group in the molecule

· 2-Hydroxypropyl methacrylate (HPMA manufactured by NIPPON SHOKUBAI CO., LTD.) (hereinafter referred to as HPMA)

· 2-Hydroxy-1,3-dimethacryloxypropane (NK Ester 701 manufactured by SHIN-NAKAMURA CHEMICAL Co., Ltd.) (liquid under 25°C atmosphere) (hereinafter referred to as 701)

(Meth)acrylate monomer having an acidic group in the molecule

· 2-Acryloyloxyethyl-succinic acid (HOA-MS(N) manufactured by KYOEISHA CHEMICAL Co., LTD.) (liquid under 25°C atmosphere)(hereinafter referred to as HOA-MS(N))

· Acrylic acid (reagent) (liquid under 25°C atmosphere)

· Methacrylic acid (reagent) (liquid under 25°C atmosphere)

Other monomers: monomers other than component (B) or (meth)acrylate monomer having an acidic group in the molecule

· N,N-dimethylacrylamide (DMAA (Registered Trademark) manufactured by KJ Chemicals Corporation) (liquid under 25°C atmosphere) (hereinafter referred to as DMAA)

· 4-Acryloylmorpholine (ACMO (Registered Trademark) manufactured by KJ Chemicals Corporation) (liquid under 25°C atmosphere) (hereinafter referred to as ACMO)

· Isobornyl methacrylate (Light Ester IB-X manufactured by KYOEISHA CHEMICAL Co., LTD.) (liquid at 25°C atmosphere) (hereinafter referred to as IB-X)

· Lauryl acrylate (Light Acrylate L-A manufactured by KYOEISHA CHEMICAL Co., LTD.) (liquid at 25°C atmosphere) (hereinafter referred to as L-A)

Component (C): photoinitiator

· 1-Hydroxycyclohexylphenyl ketone (non-visible light-responsive photoinitiator) (IRGACURE184 manufactured by BASF) (hereinafter referred to as 184)

· 2,4,6-Trimethylbenzoyl-diphenyl-phosphine oxide (visible light photoinitiator) (LUCIRIN TPO manufactured by BASF) (hereinafter referred to as TPO)

[0066]

The photocurable compositions of Examples 1 to 21 and Comparative Examples 1 to 6 (hereinafter also referred to as the compositions) were prepared. To prepare the composition, the components, excluding the component (C), were weighed into a mixing vessel and stirred for 30 minutes. Subsequently, the component (C) was weighed, and the mixture was stirred for 30 minutes while deforming under vacuum. Details of the preparation amounts are shown in Table 1. All values are expressed in parts by mass. Table 1 also shows the total amount of the oligomer components (the total amount of the components (A) for Examples, and the total amount of other oligomers for Comparative Examples), the total amount of the components (B), the total amount of the (meth)acrylate monomers having an acidic group in the molecule, and the proportion (mass%) of the total amount of the components (A) to the entire composition. The viscosity at 25°C of the photocurable compositions of Examples 1 to 21 was 5 Pa · s or less.

[0067]

[Table 1]

Table 1

Component	Raw material	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9
Component (A)	Synthesized product 1	143	143	143	143			143	143	143
	Synthesized product 2					125	125			
Other oligomers	UV-3300B							36	36	36
	UV-6640B									
	UV-3200B									
	UF-8001G									
	UN-9000PEP									
	Synthesized product 3									
Component (B)	HPMA	20			20	42	42	36	36	36
	701		20	20	10		10			
(Meth)acrylate monomer having acidic group in molecule	HOA-MS(N)		20	20	20		10		7	7
	Acrylic acid									
	Methacrylic acid	6				6		7		
Other monomers	DMAA	20	20		10			24	24	
	ACMO									
	IB-X	20		20	0	42	21			24
	L-A									
Component (C)	184	6	6	6	6	6	6	7	7	7
	TPO	4	4	4	4	4	4	5	5	5
Total amount		219	213	213	213	225	218	258	258	258
Total amount of oligomer component		100	100	100	100	100	100	100	100	100
Total amount of component (B)		20	20	20	30	42	52	36	36	36
Total amount of (meth)acrylate monomer having acidic group in molecule		6	20	20	20	6	10	7	7	7
Proportion of total amount of component (A) to entire composition		46	47	47	47	44	46	39	39	39

Component	Raw material	Example 10	Example 11	Example 12	Example 13	Example 14	Example 15	Example 16	Example 17	Example 18
Component (A)	Synthesized product 1	143	143	143	143	143	37	37		57
	Synthesized product 2						93	93	125	75
Other oligomers	UV-3300B	36	36	48	48	36				
	UV-6640B			63	63	48				
	UV-3200B									
	UF-8001G									

	UN-9000PEP									
	Synthesized product 3								50	
Component (B)	HPMA	36	24	13	13	24	19	19	25	19
	701									
(Meth)acrylate monomer having acidic group in molecule	HOA-MS(N)	7	12			29	9	9	13	9
	Acrylic acid			19						
	Methacrylic acid				19					
Other monomers	DMAA		12	19	19	12				
	ACMO	24								
	IB-X		12	13	13		28	28	38	28
	L-A			19	19					
Component (C)	184	7	7	10	10	7	6			
	TPO	5	5	6	6	5	4	4	5	4
Total amount		258	251	353	353	304	194	189	255	192
Total amount of oligomer component		100	100	100	100	100	100	100	100	100
Total amount of component (B)		36	24	13	13	24	19	19	25	19
Total amount of (meth)acrylate monomer having acidic group in molecule		7	12	19	19	29	9	9	13	9
Proportion of total amount of component (A) to entire composition		39	40	28	28	33	51	53	39	52

Component	Raw material	Example 19	Example 20	Example 21	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6
Component (A)	Synthesized product 1									
	Synthesized product 2	125	125	125						
Other oligomers	UV-3300B				100					
	UV-6640B									
	UV-3200B					100	100	100		
	UF-8001G								100	
	UN-9000PEP									100
	Synthesized product 3	94								
Component (B)	HPMA	31	36	36	36	29	14	15	20	14
	701		9	9						
(Meth)acrylate monomer having acidic group in molecule	HOA-MS(N)	16	9	9			14	23		
	Acrylic acid									
	Methacrylic acid				5	2			2	4
Other monomers	DMAA				18	14	7	15	13	14
	ACMO									
	IB-X	47			27					14
	L-A						7			
Component (C)	184		5		5	4	4	5	4	4
	TPO	6	4	4	4	3	3	3	3	3
Total amount		319	188	182	195	152	149	161	142	153
Total amount of oligomer component		100	100	100	100	100	100	100	100	100
Total amount of component (B)		31	45	45	36	29	14	15	20	14
Total amount of (meth)acrylate monomer having acidic group in molecule		16	9	9	5	2	14	23	2	4
Proportion of total amount of component (A) to entire composition		31	53	55	-	-	-	-	-	-

[0068]

Hardness measurement and adhesion and durability tests were conducted on the compositions of Examples 1 to 21 and Comparative Examples 1 to 6 according to the following methods. The results are summarized in Table 2.

[0069]

[Hardness measurement]

The thickness of each composition was set to 1 mm, and light irradiation was performed twice using a conveyor-type irradiation apparatus equipped with a high-pressure mercury lamp (the integrated light intensity of 30 kJ/m² each time), thereby producing a sheet-like cured product. When the temperature of the cured product reached 25°C, three layers of the cured product were stacked. While keeping the pressing surface of a D-type durometer (hardness tester) parallel to the sheet-like cured product, the surface was swiftly pressed against the cured product with a force of 10 N without impact, thereby ensuring close contact between the pressing surface

and the specimen. The maximum value was recorded during the measurement and defined as the "hardness (unitless)." Details are as described in JIS K 6253-3:2012. If the hardness is in the range of D55 to D80, it can be regarded as having sufficient hardness for use as a base coat.

[0070]

[Adhesion and durability tests]

Each composition was applied to the fingernails of ten subjects (10 nails each), and the subjects carried out their normal daily activities. Tests on the nails were performed under two conditions: after sanding and without sanding. Dust and oil are removed using a nail-specific solvent (containing ethanol as a main component). Each composition is applied as a base coat agent in the wet state at a thickness of about 100 μm . The composition is applied using a paint brush. Thereafter, the composition is cured by irradiation using an LED lamp for nails (rated voltage: 100 to 110 V, 50-60 Hz; power consumption: 36 W; wavelength: 350 to 400 nm) for 30 seconds. Similarly, a color coat and a top coat are sequentially cured on the surface of the base coat under the same conditions. Super Color EX (color: pastel peach) manufactured by PREGEL was used as a color coat, and CANGEL EX manufactured by PREGEL was used as a top coat. Visual observation is performed at days 30 and 60 after the application based on the following evaluation criteria. These were designated as "Adhesion and durability - Sanding" (sanding performed) and "Adhesion and durability - Non-sanding" (no sanding). The adhesion and durability are preferably "Excellent" or "Good", and particularly preferably "Excellent".

[0071]

Evaluation criteria

Excellent: No lifting or peeling at day 60.

Good: No lifting or peeling at day 30.

Poor: Lifting and peeling observed before 30 days

[0072]

[Table 2]

Table 2

Test items		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9
Hardness		D76	D74	D74	D75	D58	D60	D66	D64	D65
Adhesion and durability	Sanding	Good	Good	Good	Good	Good	Good	Good	Good	Good
	Non-sanding	Good	Good	Good	Good	Good	Good	Good	Good	Good

Test items		Example 10	Example 11	Example 12	Example 13	Example 14	Example 15	Example 16	Example 17	Example 18
Hardness		D65	D64	D73	D74	D69	D69	D69	D69	D70
Adhesion and durability	Sanding	Good	Good	Good	Good	Good	Excellent	Excellent	Excellent	Excellent
	Non-sanding	Good	Good	Good	Good	Good	Excellent	Excellent	Good	Excellent

Test items		Example 19	Example 20	Example 21	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6
Hardness		D71	D74	D74	D61	D65	D63	D75	D73	D70
Adhesion and durability	Sanding	Excellent	Excellent	Excellent	Poor	Poor	Poor	Poor	Poor	Poor
	Non-sanding	Good	Excellent	Excellent	Poor	Poor	Poor	Poor	Poor	Poor

[0073]

The photocurable compositions of Examples 1 to 6, 15, 16, 18, 20, and 21, in which the component (A) alone was used as the urethane-modified (meth)acrylate oligomer (without other oligomers), and Examples 7 to 14, 17, and 19, in which the component (A) was used together with other oligomers as the urethane-modified (meth)acrylate oligomer, showed better adhesion and durability than the photocurable compositions of Comparative Examples 1 to 6 in which the component (A) was not used. The component (A) is considered to have greatly contributed to durability regardless of whether sanding is performed, and durability can be maintained even without sanding. The photocurable compositions of Examples 15, 16, 18, 20, and 21, in which 50 mass% or more of the component (A) was added based on the entire composition as the urethane-modified (meth)acrylate oligomer, showed no difference in durability between sanding and non-sanding conditions, and yielded good results. Since there is no significant difference in hardness across Examples and Comparative Examples, the coating film obtained by photocuring the compositions of Examples is less susceptible to external humidity, temperature, or impact.

Industrial Applicability

[0074]

The photocurable composition of the present invention is less susceptible to the external environment and can be used as a base coat in nail applications.

[0075]

The present application is based on Japanese Patent Application No. 2023-085030 filed on May 24, 2023, the disclosure of which is incorporated herein by reference in its entirety.

CLAIMS

Claim 1. A photocurable composition comprising the following components (A) to (C), wherein the component (A) comprises a bisphenol backbone or a hydrogenated bisphenol backbone, and a polyether backbone in the molecular structure:

component (A): a urethane-modified (meth)acrylate oligomer;

component (B): a (meth)acrylate monomer having a hydroxy group in the molecule; and

component (C): a photoinitiator.

Claim 2. The photocurable composition according to claim 1, wherein the component (A) is a urethane-modified methacrylate oligomer.

Claim 3. The photocurable composition according to claim 1, wherein the component (A) is contained in an amount of 25 to 80 mass% based on the entire composition.

Claim 4. The photocurable composition according to claim 1, wherein the component (B) is contained in an amount of 10 to 60 parts by mass based on 100 parts by mass of the component (A).

Claim 5. The photocurable composition according to claim 1, further comprising a (meth)acrylate monomer having an acidic group in the molecule.

Claim 6. The photocurable composition according to claim 5, wherein the (meth)acrylate monomer having an acidic group in the molecule is contained in an amount of 5 to 30 parts by mass based on 100 parts by mass of the component (A).

Claim 7. The photocurable composition according to claim 1, wherein the component (A) is a urethane-modified (meth)acrylate oligomer in which the polyether backbone is polytetramethylene glycol.

Claim 8. The photocurable composition according to claim 1, further comprising an acrylamide compound and/or isobornyl methacrylate.

Claim 9. A photocurable composition for a natural or artificial nail, comprising the photocurable composition according to any one of claims 1 to 8.

Claim 10. A base coat agent comprising the photocurable composition for a natural or artificial nail according to claim 9.

Claim 11. A coating film prepared by curing the photocurable composition according to any one of claims 1 to 8 by light irradiation.