

DESCRIPTION

Title of Invention: RESIN COMPOSITION FOR AQUEOUS COATING
MATERIAL AND COATING FILM

Technical Field

5 [0001] The present invention relates to a resin
composition for an aqueous coating material and a coating
film.

Background Art

[0002] Conventionally, solvent-based coating materials
10 have been widely used for coating surfaces of building
materials such as exterior materials used for construction of
buildings. As solvent-based resins used in solvent-based
coating materials, styrene-(meth)acrylate copolymers with
styrene and (meth)acrylate serving as main monomer units are
15 generally used because of its excellent initial gloss and
initial water resistance.

[0003] On the other hand, in recent years, also in the
field of coating materials, in order to improve the burden on
the use environment and the global environment caused by
20 volatile organic compounds, a transition from solvent-based
coating materials including organic solvents to aqueous
coating materials including aqueous solvents has been rapidly
accelerated. Although development of resins for aqueous
coating materials has been advanced with this transition to
25 aqueous coating materials, a problem regarding resins for

aqueous coating materials exists in that initial gloss and initial water resistance are inferior to those of solvent-based resins such as styrene-(meth)acrylate copolymers.

[0004] Accordingly, Patent Literature 1 discloses a resin composition for a coating material including a resin emulsion obtained by emulsion polymerization of monomer components. The resin composition uses a plurality of emulsifiers when the monomer components are subjected to emulsion polymerization.

Citation List

10 Patent Literature

[0005] Patent Literature 1: Japanese Patent Application Laid-Open No. 2017-125219

Summary of Invention

Technical Problem

15 [0006] However, coating films of aqueous coating materials produced using the above-mentioned resin compositions for coating material have a problem in which the initial gloss is still insufficient.

[0007] In addition, the coating films of aqueous coating materials produced using the above-mentioned resin compositions for coating material has a problem in which the gloss deteriorates with time due to adhesion of water or the like (meaning that its initial water resistance is insufficient).

25 [0008] The present invention provides a resin composition

for an aqueous coating material that can be used for producing an aqueous coating material capable of forming a coating film which has excellent initial gloss and initial water resistance.

5 Solution to Problem

[0009] A resin composition for an aqueous coating material of the present invention includes a copolymer that includes a styrene-based monomer unit, an acrylic monomer unit, and an unsaturated fatty acid salt unit, and has a glass transition
10 temperature of -4 to 40°C.

[0010] A coating film of the present invention is a solidified product of an applied layer of the above-mentioned resin composition for an aqueous coating material on an object to be coated.

15 Advantageous Effects of Invention

[0011] The resin composition for an aqueous coating material of the present invention can produce an aqueous coating material capable of forming a coating film which has excellent initial gloss and excellent initial water
20 resistance.

Description of Embodiments

[0012] The resin composition for an aqueous coating material of the present invention includes a copolymer that includes a styrene-based monomer unit, an acrylic monomer unit,
25 and an unsaturated fatty acid salt unit, and has a glass

transition temperature of -4 to 40°C.

[0013] The resin composition for an aqueous coating material includes a copolymer that includes a styrene-based monomer, an acrylic monomer unit, and an unsaturated fatty acid salt unit.

[0014] Examples of the styrene-based monomer constituting the copolymer include, but are not particularly limited to, styrene, α -methylstyrene, p-methylstyrene, methylstyrene, tert-butylstyrene, chlorostyrene, and vinyltoluene. Styrene is preferably used from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material. Note that the styrene-based monomers may be used alone, or two or more kinds thereof may be used in combination.

[0015] A benzene ring of the styrene-based monomer may have a functional group such as an alkyl group such as a methyl group and a tert-butyl group, a nitro group, a nitrile group, an alkoxyl group, an acyl group, a sulfone group, a hydroxyl group and a halogen atom.

[0016] The content of the styrene-based monomer unit in the copolymer is preferably 5% by mass or more, more preferably 10% by mass or more, still more preferably 15% by mass or more, still more preferably 20% by mass or more, and particularly preferably 25% by mass or more, from the viewpoint of the initial gloss of the coating film formed from

the resin composition for an aqueous coating material. The content of the styrene-based monomer unit in the copolymer is preferably 50% by mass or less, more preferably 45% by mass or less, still more preferably 40% by mass or less, and particularly preferably 35% by mass or less, from the viewpoint of the weather resistance of the coating film formed from the resin composition for an aqueous coating material.

[0017] Examples of the acrylic monomer that constitutes the copolymer include, but are not particularly limited to, an

alkyl (meth)acrylate such as methyl (meth)acrylate, ethyl (meth)acrylate, n-propyl (meth)acrylate, isopropyl (meth)acrylate, n-butyl (meth)acrylate, isobutyl (meth)acrylate, tert-butyl (meth)acrylate, sec-butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, n-octyl (meth)acrylate, tridecyl (meth)acrylate, n-lauryl (meth)acrylate, dodecyl (meth)acrylate, and stearyl (meth)acrylate; an alicyclic (meth)acrylate such as cyclohexyl (meth)acrylate, isobornyl (meth)acrylate, dicyclopentenyl (meth)acrylate, dicyclopentenylloxyethyl (meth)acrylate, dicyclopentanyl (meth)acrylate, and adamantanyl (meth)acrylate, a nitrogen-containing (meth)acrylic monomer such as (meth)acrylonitrile, (meth)acrylamide, and diacetone (meth)acrylamide, acrylic acid, methacrylic acid, itaconic acid, crotonic acid, rheic acid, fumaric acid, citraconic acid, maleic acid (anhydride), and citraconic acid

(anhydride).

[0018] The acrylic monomer is preferably an alkyl (meth)acrylate or (meth)acrylic acid, more preferably includes an alkyl (meth)acrylate and methacrylic acid, and particularly preferably includes an alkylacrylate, an alkyl methacrylate, and methacrylic acid. Note that the acrylic monomer may be used alone, or two or more kinds thereof may be used in combination. (Meth)acrylate means acrylate or methacrylate. (Meth)acrylic acid means acrylic acid or methacrylic acid.

[0019] The content of the acrylic monomer unit in the copolymer is preferably 30% by mass or more, more preferably 40% by mass or more, still more preferably 50% by mass or more, and particularly preferably 55% by mass or more, from the viewpoint of the weather resistance of the coating film formed from the resin composition for an aqueous coating material. The content of the acrylic monomer unit in the copolymer is preferably 80% by mass or less, more preferably 75% by mass or less, and particularly preferably 70% by mass or less, from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0020] The number of carbon atoms of the alkyl group in the alkyl (meth)acrylate is preferably 1 or more, more preferably 2 or more, and particularly preferably 3 or more, from the viewpoint of the initial gloss of the coating film

formed from the resin composition for an aqueous coating material. The number of carbon atoms of the alkyl group in the alkyl (meth)acrylate is preferably 15 or less, more preferably 12 or less, and particularly preferably 10 or less, from the viewpoint of the drying property of the aqueous coating material formed from the resin composition for an aqueous coating material.

[0021] The alkyl (meth)acrylate preferably includes methyl (meth)acrylate, isobutyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, and n-butyl (meth)acrylate, and more preferably includes methyl methacrylate, isobutyl methacrylate, 2-ethylhexyl acrylate, and n-butylacrylate.

[0022] The content of the alkyl (meth)acrylate unit in the copolymer is preferably 30% by mass or more, more preferably 40% by mass or more, still more preferably 50% by mass or more, and particularly preferably 55% by mass or more, from the viewpoint of the weather resistance of the coating film formed from the resin composition for an aqueous coating material. The content of the alkyl (meth)acrylate unit in the copolymer is preferably 80% by mass or less, more preferably 75% by mass or less, and particularly preferably 70% by mass or less, from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0023] The content of the (meth)acrylic acid unit in the

copolymer is preferably 0.01% by mass or more, more preferably 0.05% by mass or more, and particularly preferably 0.1% by mass or more, from the viewpoint of the stability of the emulsion particles in the aqueous coating material. The content of the (meth)acrylic acid unit in the copolymer is preferably 4% by mass or less, more preferably 3% by mass or less, still more preferably 2% by mass or less, and particularly preferably 1% by mass or less, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0024] The content of the methacrylic acid unit in the copolymer is preferably 0.01% by mass or more, more preferably 0.05% by mass or more, and particularly preferably 0.1% by mass or more, from the viewpoint of the stability of the emulsion particles in the aqueous coating material. The content of the methacrylic acid unit in the copolymer is preferably 4% by mass or less, more preferably 3% by mass or less, still more preferably 2% by mass or less, and particularly preferably 1% by mass or less, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0025] The unsaturated fatty acid salt constituting the copolymer is a reactive emulsifier. The reactive emulsifier has an emulsifying property. The unsaturated fatty acid salt is a salt of a monocarboxylic acid represented by RCOOH,

wherein the substituent represented by R includes at least one unsaturated bond. The unsaturated fatty acid salt is incorporated into the polymer chain of the copolymer by radical polymerization with the unsaturated bonds. The unsaturated fatty acid salts may be used alone, and two or more kinds thereof may be used in combination.

[0026] Since the copolymer includes the unsaturated fatty acid salt unit, the copolymer has a hydrophobic moiety and a hydrophilic moiety. The copolymer can take a micellar structure in which the hydrophobic moiety is located inside and the hydrophilic moiety is located outside, so that the copolymer can be dispersed in an aqueous medium to constitute an aqueous coating material. Note that the aqueous medium is not particularly limited, and examples thereof include water, an alcohol-based solvent (e.g., methanol, ethanol, propanol, isopropanol, butanol, and the like), and a glycol ether-based solvent (e.g., an ethylene glycol monoethyl ether, a propylene glycol monomethyl ether, a butyl diglycol, and the like). Among these, water is preferable.

[0027] The unsaturated fatty acid salt includes an unsaturated bond in the substituent R. The substituent R takes a bent structure in the unsaturated bond moiety. The substituent R with the bent structure can cause the copolymer to be brought into a state in which the copolymer is accommodated into the micelle in place while the hydrophobic

moiety thereof is bent, so that the dispersibility of the copolymer in an aqueous medium is improved.

[0028] The unsaturated bond in the substituent R is not particularly limited, but is preferably an ethylenically unsaturated bond such as an ethylenically unsaturated double bond (carbon-carbon double bond) and an ethylenically unsaturated triple bond (carbon-carbon triple bond), and is more preferably an ethylenically unsaturated double bond.

Although the ethylenically unsaturated double bond can be a cis-double bond or a trans-double bond, a cis-double bond is preferable because it can cause the copolymer to be brought into a state in which the copolymer is accommodated into the micelle in place while the hydrophobic moiety thereof is encapsulated.

[0029] The number of the unsaturated bonds in the substituent R is preferably 1 to 6, more preferably 1 to 5, and particularly preferably 1 to 4. When the number of carbon atoms of the substituent R is 11 or more, it is preferable to have the unsaturated bond between carbon atoms at the third or subsequent positions counted from the carbon atom at the terminal of the substituent R (the terminal of the longest chain in the substituent R). It is more preferable to have the unsaturated bond between carbon atoms at the fifth or subsequent positions counted from the carbon atom at the terminal of the substituent R, and it is particularly

preferable to have the unsaturated bond between carbon atoms at the sixth or subsequent positions counted from the carbon atom at the terminal of the substituent R.

[0030] The number of carbon atoms of the unsaturated fatty acid salt (the total number of carbon atoms possessed by the unsaturated fatty acid salt) is preferably 4 or more, more preferably 12 or more, and particularly preferably 16 or more, from the viewpoint of the stability of the emulsion particles in the aqueous coating material. The number of carbon atoms of the unsaturated fatty acid salt (the total number of carbon atoms possessed by the unsaturated fatty acid salt) is preferably 30 or less, more preferably 28 or less, and particularly preferably 26 or less, from the viewpoint of the water solubility of the unsaturated fatty acid salt.

[0031] The unsaturated fatty acid (named according to IUPAC) used as a raw material for the unsaturated fatty acid salt is not particularly limited. Examples thereof include butenoic acid (C4), pentenoic acid (C5), hexenoic acid (C6), heptenoic acid (C7), octenoic acid (C8), nonenoic acid (C9), decenoic acid (C10), undecenoic acid (C11), dodecenoic acid (C12), tridecenoic acid (C13), tetradecenoic acid (C14), pentadecenoic acid (C15), hexadecenoic acid (C16), heptadecenoic acid (C17), octadecenoic acid (C18), nonadecenoic acid (C19), icosenoic acid (C20), henicosenoic acid (C21), docosenoic acid (C22), tricosenoic acid (C23),

tetracosenoic acid (C24), pentacosenoic acid (C25),
 hexacosenoic acid (C26), heptacosenoic acid (C27),
 octacosenoic acid (C28), nonacosenoic acid (C29), and
 triacontenoic acid (C30). Among these, it is preferable to
 5 include octadecenoic acid. Note that the symbol in parentheses
 represents the total number of carbon atoms possessed by each
 unsaturated fatty acid.

[0032] Specific examples (trivial names) of the
 unsaturated fatty acid used as a raw material of the
 10 unsaturated fatty acid salt include myristoleic acid (C14, 1
 bond, B5), palmitoleic acid (C16, 1 bond, B7), stearidonic
 acid (C18, 4 bonds, B3, 6, 9, 12), vaccenic acid (C18, 1 bond,
 B7), oleic acid (C18, 1 bond, B9), elaidic acid (C18, 1 bond,
 B9), linoleic acid (C18, 2 bonds, B6, 9), α -linolenic acid
 15 (C18, 3 bonds, B3, 6, 9), γ -linolenic acid (C18, 3 bonds, B6,
 9, 12), gadoleic acid (C20, 1 bond, B11), eicosenoic acid
 (C20, 1 bond, B11), eicosadienoic acid (C20, 2 bonds, B6, 9),
 arachidonic acid (C20, 3 bonds, B6, 9, 12), eicosapentaenoic
 acid (C20, 5 bonds, B3, 6, 9, 12, 15), erucic acid (C22, 1
 20 bond, B9), docosaheptaenoic acid (C22, 6 bonds, B3, 6, 9, 12,
 15, 18), and nervonic acid (C24, 1 bond, B9). Among these, it
 is preferable to include palmitoleic acid, oleic acid and
 linoleic acid, more preferable to include oleic acid and
 linoleic acid, and particularly preferable to include oleic
 25 acid. Note that the symbols in parentheses represent, in

order, the total number of carbon atoms, the number of ethylenically unsaturated double bonds, and the position of the ethylenically unsaturated double bond(s). The symbols of Bn , m, .. , p indicates that the unsaturated fatty acid has an ethylenically unsaturated double bond(s) between carbon atoms at the nth position and (n+1)th position, at the mth position and (m+1)th position, ..., and the pth position and (p+1)th position counted from the carbon atom at the terminal of the substituent R.

10 [0033] As described above, the unsaturated fatty acid salt may be used alone, and two or more kinds thereof may be used in combination. A salt of an animal or vegetable oil fatty acid containing a plurality of kinds of unsaturated fatty acids may be used.

15 [0034] Examples of the animal or vegetable oil fatty acid salts include a soybean oil fatty acid salt, a cottonseed oil fatty acid salt, a tall oil fatty acid salt (a salt of a mixture of palmitic acid, stearic acid, oleic acid, and linoleic acid), a corn oil fatty acid salt, a rice bran oil fatty acid salt, a safflower oil fatty acid salt, a sunflower oil fatty acid salt, a linseed oil fatty acid salt, a fish oil fatty acid salt, a dehydrated castor oil fatty acid salt, a palm oil fatty acid salt, a beef fat acid salts, a rapeseed oil fatty acid salt, and an olive oil fatty acid salt. Among
20 these, a tall oil fatty acid salt is preferable.
25

[0035] The unsaturated fatty acid salt may be a derivative thereof. The derivative of the unsaturated fatty acid salt is not particularly limited, and examples thereof include a polymerized fatty acid salt, a salt of an unsaturated carboxylic acid adduct, a salt of an epoxidized unsaturated fatty acid, a salt of a hydroxylated unsaturated fatty acid, a salt of an epoxidized and hydroxylated unsaturated fatty acid, and a salt of a sulfonated unsaturated fatty acid. Among these, a polymerized fatty acid salt is preferable, a dimer acid salt and a trimer acid salt are more preferable, and a dimer acid salt is particularly preferable. Note that derivatives of unsaturated fatty acid salts need to have an unsaturated bond in its molecule.

[0036] The polymerized fatty acid salt is a salt of a compound obtained by polymerizing an unsaturated fatty acid, as necessary, in the presence of a catalyst such as clay. Examples thereof include a dimer acid salt (a salt of a dimer of an unsaturated fatty acid), a trimer acid (a salt of a trimer of an unsaturated fatty acid), and a tetramer acid (a salt of a tetramer of an unsaturated fatty acid). Among these, a dimer acid salt and a trimer acid salt are preferable. It is preferable to include a dimer acid salt and a trimer acid salt. Note that the polymerized fatty acid salts may be used alone, and two or more kinds thereof may be used in combination.

[0037] The polymerized fatty acid salt may be partially

hydrogenated, but it is necessary that the polymerized fatty acid salt still have an unsaturated bond.

[0038] Examples of the salt of the unsaturated carboxylic acid adduct include a salt of a compound obtained by

5 subjecting an unsaturated bond of the above-mentioned unsaturated fatty acid to an addition reaction with an α,β -unsaturated carboxylic acid. Specific examples thereof include a salt of an adduct of maleic acid or an anhydride thereof with an unsaturated fatty acid, and a salt of an acrylic acid
10 adduct with an unsaturated fatty acid. It is necessary that the salt of the unsaturated carboxylic acid adduct still have an unsaturated bond.

[0039] The salt of the epoxidized unsaturated fatty acid is a salt of a compound obtained by subjecting an unsaturated
15 bond of an unsaturated fatty acid to an epoxidation reaction with, for example, peracetic acid or hydrogen peroxide. The salt of the hydroxylated unsaturated fatty acid is one obtained by hydrolyzing a salt of an epoxidized unsaturated fatty acid, which may lead to introduce two hydroxyl groups.

20 The salt of the sulfonated unsaturated fatty acid is a salt of a compound obtained by subjecting an unsaturated bond of an unsaturated fatty acid to a sulfonation reaction with a sulfuric acid or the like. It is necessary that the salt of the epoxidized unsaturated fatty acid, the salt of the
25 hydroxylated unsaturated fatty acid, and the salt of the

sulfonated unsaturated fatty acid still have an unsaturated bond.

[0040] The content of the unsaturated fatty acid salt unit in the copolymer is preferably 0.5% by mass or more, more preferably 0.7% by mass or more, and particularly preferably 1.0% by mass or more, because of the stability of the emulsion particles in the aqueous coating material. The content of the unsaturated fatty acid salt unit in the copolymer is preferably 5.0% by mass or less, and more preferably 4.5% by mass or less, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0041] In the polymerized fatty acid salt, the content of the dimer acid salt is preferably 5% by mass or more, more preferably 15% by mass or more, more preferably 40% by mass or more, more preferably 60% by mass or more, more preferably 70% by mass or more, and particularly preferably 80% by mass or more, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0042] In the polymerized fatty acid salt, the content of the dimer acid salt is preferably 99% by mass or less, more preferably 97% by mass or less, more preferably 95% by mass or less, and particularly preferably 87% by mass or less, from the viewpoint of the initial gloss of the coating film formed

from the resin composition for an aqueous coating material.

[0043] In the polymerized fatty acid salt, the content of the trimer acid salt is preferably 1% by mass or more, more preferably 3% by mass or more, more preferably 5% by mass or more, more preferably 7% by mass or more, more preferably 10% by mass or more, and particularly preferably 13% by mass or more, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

10 [0044] In the polymerized fatty acid salt, the content of the trimer acid salt is preferably 95% by mass or less, more preferably 85% by mass or less, more preferably 40% by mass or less, more preferably 30% by mass or less, and particularly preferably 20% by mass or less, from the viewpoint of the
15 initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0045] It is preferable that the unsaturated fatty acid salt include a monomer unsaturated fatty acid salt (monomer acid salt), a dimer acid salt, and a trimer acid salt. Note
20 that the "monomer unsaturated fatty acid salt (monomer acid salt)" refers to an unsaturated fatty acid salt which has not been polymerized.

[0046] When the unsaturated fatty acid salt includes a monomer acid salt, a dimer acid salt, and a trimer acid salt,
25 the content of the monomer acid salt in the unsaturated fatty

acid salt is preferably 0.5% by mass or more, more preferably 1% by mass or more, more preferably 2% by mass or more, and particularly preferably 3% by mass or more, from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material. The content of the monomer acid salt in the unsaturated fatty acid salt is preferably 10% by mass or less, more preferably 8% by mass or less, more preferably 6% by mass or less, and particularly preferably 5% by mass or less, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0047] When the unsaturated fatty acid salt includes a monomer acid salt, a dimer acid salt, and a trimer acid salt, the content of the dimer acid salt in the unsaturated fatty acid salt is preferably 10% by mass or more, more preferably 20% by mass or more, more preferably 50% by mass or more, and particularly preferably 70% by mass or more, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material. The content of the dimer acid salt in the unsaturated fatty acid salt is preferably 95% by mass or less, more preferably 90% by mass or less, and particularly preferably 85% by mass or less, from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0048] When the unsaturated fatty acid salt includes a monomer acid salt, a dimer acid salt, and a trimer acid salt, the content of the trimer acid salt in the unsaturated fatty acid salt is preferably 0.5% by mass or more, more preferably 1% by mass or more, more preferably 10% by mass or more, and particularly preferably 70% by mass or more, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material. The content of the trimer acid salt in the unsaturated fatty acid salt is preferably 90% by mass or less, more preferably 85% by mass or less, and particularly preferably 80% by mass or less, from the viewpoint of the initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0049] The copolymer may include a reactive emulsifier other than the unsaturated fatty acid salt as a monomer unit. The reactive emulsifier other than the unsaturated fatty acid salt has an emulsifying property. The reactive emulsifier other than the unsaturated fatty acid salt has at least one unsaturated bond in its molecule, and is incorporated into the copolymer by radical polymerization with an unsaturated bond.

[0050] The unsaturated bond is not particularly limited, but is preferably an ethylenically unsaturated bond such as an ethylenically unsaturated double bond (carbon-carbon double bond, C=C) and an ethylenically unsaturated triple bond

(carbon-carbon triple bond), and is more preferably an ethylenically unsaturated double bond. The unsaturated bond may be included in multiple in the molecule.

[0051] The ethylenically unsaturated double bond is an unsaturated bond included in a functional group such as an alkenyl group, a (meth)allyloxyalkyl group, or a (meth)acryloyl group, for example. Note that (meth)allyl means allyl or methallyl, and (meth)acryloyl means acryloyl or methacryloyl.

[0052] Examples of the alkenyl group include a vinyl group, a (meth)allyl group, a 1-propenyl group, a 2-methyl-1-propenyl group, and an isopropenyl group.

[0053] The reactive emulsifier other than the unsaturated fatty acid salt is not particularly limited, and examples thereof include a sulfate ester salt of a polyoxyalkylene phenyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule, a sulfosuccinate ester salt of a polyoxyethylene alkyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule (ester sodium salt, ester ammonium salt, and the like), a sulfate ester salt of a polyoxyethylene alkyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule (ester sodium salt, ester ammonium salt, and the like), a sulfosuccinate ester salt of a

polyoxyethylene alkyl phenyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule (ester sodium salt, ester ammonium salt, and the like), a sulfate ester salt of a polyoxyalkylene ether
5 which has at least one functional group including an ethylenically unsaturated double bond in its molecule (ester sodium salt, ester ammonium salt, and the like), a sulfate ester salt of a polyoxyalkylene alkyl phenyl ether which has at least one functional group including an ethylenically
10 unsaturated double bond in its molecule (ester sodium salt, ester ammonium salt, and the like), and an acidic phosphoric acid (meth)acrylic acid ester-based dispersant which has at least one functional group including an ethylenically unsaturated double bond in the molecule. Note that the
15 reactive emulsifier other than the unsaturated fatty acid salt may be used alone, and two or more kinds thereof may be used in combination.

[0054] It is preferable that the reactive emulsifier other than the unsaturated fatty acid salt have an ethylenically
20 unsaturated double bond in the vicinity of the molecular terminal. The phrase "the vicinity of the molecular terminal" refers to a carbon-carbon bond moiety formed by a terminal carbon atom and second and third carbon atoms counted from the terminal carbon atom (first) in a molecular chain composed of
25 bonded carbon atoms. It is preferable that the reactive

emulsifier other than the unsaturated fatty acid salt have an ethylenically unsaturated double bond between the terminal carbon atom (first carbon atom) and the carbon atom (second carbon atom) bonded to the terminal carbon atom. It is

5 preferable that the reactive emulsifier other than the unsaturated fatty acid salt have an ethylenically unsaturated double bond between the second and the third carbon atoms counted from the terminal carbon atom.

[0055] The reactive emulsifier other than the unsaturated
10 fatty acid salt is preferably a sulfate ester salt of a polyoxyalkylene phenyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule, more preferably a sulfate ester ammonium salt of a polyoxyalkylene phenyl ether which has at least one
15 functional group including an ethylenically unsaturated double bond in its molecule, and more preferably a sulfate ester ammonium salt of a polyoxyethylene phenyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule.

20 [0056] The sulfate ester salt of a polyoxyalkylene phenyl ether which has at least one functional group including an ethylenically unsaturated double bond in its molecule is preferably a polyoxyethylene styrenated propenyl phenyl ether sulfate ammonium salt, a polyoxyethylene styrenated propenyl
25 phenyl ether sulfate sodium salt, a polyoxyethylene propenyl

phenyl ether sulfate ammonium salt, or a polyoxyethylene propenyl phenyl ether sulfate sodium salt. It is more preferably a polyoxyethylene styrenated propenyl phenyl ether sulfate ammonium salt, and a polyoxyethylene styrenated propenyl phenyl ether sulfate sodium salt.

[0057] Examples of the reactive emulsifier other than the unsaturated fatty acid salt include acid anhydride modified products of rosin glycidyl ester acrylate (Japanese Patent Application Laid-Open No. Hei. 4-256429), dispersants described in Japanese Patent Application Laid-Open No. Sho. 63-23725, dispersants described in Japanese Patent Application Laid-Open No. Sho. 63-240931, and dispersants described in Japanese Patent Application Laid-Open No. Sho. 62-104802.

[0058] The reactive emulsifier can also be procured as commercially available products. Examples of such commercially available products include KAYAMER PM-1 (manufactured by Nippon Kayaku Co., Ltd.), KAYAMER PM-2 (manufactured by Nippon Kayaku Co., Ltd.), KAYAMER PM-21 (manufactured by Nippon Kayaku Co., Ltd.), SE-10N (manufactured by ADEKA Corporation), NE-10 (manufactured by ADEKA Corporation), NE-20 (manufactured by ADEKA Corporation), NE-30 (manufactured by ADEKA Corporation), New Frontier A229E (manufactured by DKS Co., Ltd.), New Frontier N-117E (manufactured by DKS Co., Ltd.), New Frontier N250Z (manufactured by DKS Co., Ltd.), AQUALON RN-20 (manufactured by DKS Co., Ltd.), AQUALON RN-2025

(manufactured by DKS Co., Ltd.), AQUALON BC-1025 (manufactured by DKS Co., Ltd.), AQUALON AR-1025 (manufactured by DKS Co., Ltd.), AQUALON HS-10 (manufactured by DKS Co., Ltd.), AQUALON KH-1025 (manufactured by DKS Co., Ltd.), EMINOL JS-2

5 (manufactured by Sanyo Chemical Industries, Ltd.), LATEMUL K-180 (manufactured by Kao Corporation), and LATEMUL PD-104 (manufactured by Kao Corporation). The reactive emulsifier is preferably AQUALON AR-1025 (manufactured by DKS Co., Ltd.).

[0059] In the emulsifier component of the copolymer, the
10 content of the monomer unit derived from the reactive emulsifier other than the unsaturated fatty acid salt is preferably 0 to 70% by mass, more preferably 0 to 50% by mass, and particularly preferably 0 to 30% by mass, because of the improvement in the initial water resistance of the coating
15 film formed from the resin composition for an aqueous coating material. Note that "0% by mass" means that no monomer unit derived from the reactive emulsifier other than the unsaturated fatty acid salt is included in the copolymer.

[0060] When the copolymer includes the reactive
20 emulsifiers that include the unsaturated fatty acid salt and a compound other than the unsaturated fatty acid salt as monomer units, the content of the monomer unit derived from all the reactive emulsifiers in the copolymer is preferably 0.5% by mass or more from the viewpoint of the stability of the
25 emulsion particles in the aqueous coating material. When the

copolymer includes the reactive emulsifiers that include the unsaturated fatty acid salt and the compound other than the unsaturated fatty acid salt as monomer units, the content of the monomer unit is preferably 4% by mass or less, more preferably 2% by mass or less, and more preferably 1% by mass or less, from the viewpoint of the initial water resistance of the coating film formed from the resin composition for an aqueous coating material.

[0061] When the copolymer includes the reactive

emulsifiers that include the unsaturated fatty acid salt and a compound other than the unsaturated fatty acid salt as monomer units, the ratio (total amount of compound other than unsaturated fatty acid salt / unsaturated fatty acid salt) of the total amount of the compound other than the unsaturated fatty acid salt to the total amount of the unsaturated fatty acid salt in the reactive emulsifier is preferably 0.2 or more. The ratio (total amount of compound other than unsaturated fatty acid salt / unsaturated fatty acid salt) of the total amount of the compound other than the unsaturated fatty acid salt to the total amount of the unsaturated fatty acid salt in the reactive emulsifier is preferably 3 or less, more preferably 2 or less, more preferably 1.5 or less, and more preferably 0.5 or less. The ratio of the total amount of the compound other than the unsaturated fatty acid salt to the total amount of the unsaturated fatty acid salt being 0.2 or

more improves the stability of the emulsion particles in the aqueous coating material, which is preferable. The ratio of the total amount of the compound other than the unsaturated fatty acid salt to the total amount of the unsaturated fatty acid salt being 3 or less improves the initial gloss and the initial water resistance of the coating film formed from the resin composition for an aqueous coating material, which is preferable.

[0062] The copolymer may include a fatty acid-modified monomer unit. The fatty acid-modified monomer is a compound obtained by reacting a drying oil fatty acid and/or a semi-drying oil fatty acid with an epoxy group-containing polymerizable unsaturated monomer by a known method. In place of the drying oil fatty acid and the semi-drying oil fatty acid, or in combination with the drying oil fatty acid and/or the semi-drying oil fatty acid, an unsaturated fatty acid (not-polymerized unsaturated fatty acid) may be used. The unsaturated fatty acid may be used alone, and two or more kinds thereof may be used in combination.

[0063] The content of the fatty acid-modified monomer unit in the copolymer is preferably 1% by mass or more, more preferably 2% by mass or more, and particularly preferably 3% by mass or more, because of the improvement in the initial water resistance of the coating film formed from the resin composition for an aqueous coating material. The content of

the fatty acid-modified monomer unit in the copolymer is preferably 10% by mass or less, more preferably 8% by mass or less, and particularly preferably 6% by mass or less, from the viewpoint of the stability of the emulsion particles in the aqueous coating material.

[0064] The drying oil fatty acid and the semi-drying oil fatty acid are fatty acids which have a polymerizable unsaturated group of an oxidation curable type. Examples of the drying oil fatty acid and the semi-drying oil fatty acid include a fish oil fatty acid, a dehydrated castor oil fatty acid, a safflower oil fatty acid, a linseed oil fatty acid, a soybean oil fatty acid, a sesame oil fatty acid, a poppy oil fatty acid, a perilla oil fatty acid, a hemp seed oil fatty acid, a grape kernel oil fatty acid, a corn oil fatty acid, a tall oil fatty acid, a sunflower oil fatty acid, a cottonseed oil fatty acid, a walnut oil fatty acid, and a rubber seed oil fatty acid, among which a tall oil fatty acid is preferable.

[0065] The drying oil fatty acid and/or the semi-drying oil fatty acid may be used, as necessary, in combination with, for example, a non-drying oil fatty acid such as a coconut oil fatty acid, a hydrogenated coconut oil fatty acid, and a palm oil fatty acid; caproic acid, capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, and the like.

[0066] Examples of the epoxy group-containing polymerizable unsaturated monomer include glycidyl

(meth)acrylate, β -methylglycidyl (meth)acrylate, 3,4-epoxycyclohexylmethyl (meth)acrylate, 3,4-epoxycyclohexylpropyl (meth)acrylate, and allylglycidyl ether. Among these, glycidyl (meth)acrylate is preferable, and
5 glycidyl methacrylate is more preferable.

[0067] The salts of the unsaturated fatty acid salts are not particularly limited, and examples thereof include an alkali metal salt such as sodium, potassium, and lithium; an alkaline earth metal salt such as calcium and barium; an
10 organic amine salt such as an alkanolamine such as monoethanolamine, diethanolamine, and triethanolamine, and triethylamine; and an ammonium salt. Among these, an alkali metal salt and an alkaline earth metal salt are preferable, an alkali metal salt is more preferable, sodium and potassium
15 salts are more preferable, and a potassium salt is particularly preferable.

[0068] The glass transition temperature T_g of the copolymer constituting the resin composition for an aqueous coating material is preferably -4°C or higher, more preferably
20 1°C or higher, and particularly preferably 6°C or higher, because of the improvement in the initial water resistance and the gloss retention property of the coating film formed from the resin composition for an aqueous coating material. The glass transition temperature T_g of the copolymer constituting
25 the resin composition for an aqueous coating material is

preferably 40°C or lower, more preferably 35°C or lower, more preferably 25°C or lower, more preferably 23°C or lower, and particularly preferably 19°C or lower, because of the improvement in the initial gloss of the coating film formed from the resin composition for an aqueous coating material.

[0069] The glass transition temperature (T_g) of the copolymer refers to a temperature measured using a differential scanning calorimetry (DSC) device according to JIS K7121-1987.

[0070] The method for producing the copolymer constituting the resin composition for an aqueous coating material is not particularly limited, and examples thereof include (1) a production method in which the copolymer is produced by emulsion polymerization of a monomer composition including the styrene-based monomer, the acrylic monomer, and the unsaturated fatty acid salt, which serves as the reactive emulsifier, in an aqueous medium in the presence of a general-purpose radical polymerization initiator, and (2) a production method in which the copolymer is produced by radical polymerization of a monomer composition including the styrene-based monomer, the acrylic monomer, and the unsaturated fatty acid salt in an organic solvent (e.g., xylene, toluene, methyl isobutyl ketone, and the like) in the presence of a general-purpose radical polymerization initiator. From the viewpoint of the remaining amount of solvent, the production method (1)

is preferable. When the copolymer is produced by the above production method (2), the obtained copolymer may be isolated, and the isolated copolymer may be dispersed in an aqueous medium using a disperser which has a high energy shearing ability, as necessary. Examples of the radical polymerization initiator include an azo-based compound, a peroxide-based compound, sulfides, sulfines, and a diazo compound.

[0071] An aqueous coating material can be produced by dispersing the resin composition for an aqueous coating material in an aqueous medium. In the aqueous coating material, the content (content of solid content) of the copolymer constituting the resin composition for an aqueous coating material is preferably 10 to 90% by mass, more preferably 15 to 80% by mass, and particularly preferably 20 to 60% by mass.

[0072] Then, since the copolymer constituting the resin composition for an aqueous coating material includes the unsaturated fatty acid salt, which is the reactive emulsifier, as a monomer unit thereof, it is possible to satisfactorily emulsify and disperse the copolymer in an aqueous medium to form a substantially homogeneous aqueous coating material. In addition, dispersing the resin composition for an aqueous coating material in an aqueous medium can be performed without using an emulsifier, however if used, the use amount of the emulsifier can be reduced.

[0073] The aqueous coating material may include, as necessary, general-purpose additives such as a non-reactive emulsifier, a pigment, a film forming aid, a defoaming agent, a thickener, an antiseptic, an antifungal agent, a pH adjusting agent, and a metal dryer, for example.

[0074] Examples of the non-reactive emulsifier include an anionic emulsifier, a cationic emulsifier, and a nonionic emulsifier. Among these, an anionic emulsifier is preferable. The non-reactive emulsifier may be used alone, and two or more kinds thereof may be used in combination.

[0075] Examples of the anionic emulsifier include sodium lauryl sulfate, ammonium lauryl sulfate, sodium dodecylbenzene sulfonate, sodium polyoxyethylene alkyl ether sulfate, sodium polyoxyethylene alkyl phenyl ether sulfate, ammonium polyoxyethylene alkyl phenyl ether sulfate, sodium polyoxyethylene alkyl sulfosuccinate, polyoxyalkylene polycyclic phenyl ether sulfate ester salts (e.g., polyoxyethylene polycyclic phenyl ether sulfate ester sodium, polyoxyethylene polycyclic phenyl ether sulfate ester ammonium salt, and the like). The anionic emulsifier is preferably a polyoxyalkylene polycyclic phenyl ether sulfate ester salt, preferably a polyoxyethylene polycyclic phenyl ether sulfate ester salt, and more preferably polyoxyethylene

polycyclic phenyl ether sulfate ester ammonium.

[0076] Examples of the cationic emulsifier include an alkyltrimethylammonium chloride.

[0077] Examples of the nonionic emulsifier include a
5 polyoxyethylene alkyl ether, a polyoxyethylene alkyl phenyl ether, a polyoxyethylene fatty acid ester, and a polyoxyethylene polyoxypropylene block polymer. These may be used alone, and two or more kinds thereof may be used in combination.

10 [0078] The content of the non-reactive emulsifier in the aqueous coating material is preferably 0 to 5 parts by mass, more preferably 0 to 3 parts by mass, and more preferably 0 to 2 parts by mass, relative to 100 parts by mass of the copolymer. Note that "0 parts by mass" means that no non-
15 reactive emulsifier is included in the aqueous coating material.

[0079] In order to coat the surface of an object to be coated (e.g., a building material such as an exterior material used for constructing a building) with the obtained aqueous
20 coating material, the aqueous coating material is applied onto a surface of an object to be coated to form an applied layer, and the aqueous medium in the applied layer is then evaporated and removed, which will lead to solidification of the applied film to form a coating film. This coating film can coat the
25 surface of the object to be coated.

[0080] Herein, as described above, the copolymer constituting the resin composition for an aqueous coating material includes the unsaturated fatty acid salt unit, which is a reactive emulsifier, as a monomer unit in its molecule.

5 The unsaturated fatty acid salt with unsaturated bonds in the molecule is bonded and incorporated in the copolymer by a copolymerization reaction. In addition to this, it has an aliphatic group, so it is possible to prevent elution of the coating film component when the coating film formed from the
10 resin composition for an aqueous coating material is exposed to water. Therefore, in the coating film formed from the aqueous coating material, the unsaturated fatty acid salt unit constituting the copolymer is not released from the copolymer and never bleeds out on the surface of the coating film.

15 [0081] In addition, in preparing an aqueous coating material by dispersing the resin composition for an aqueous coating material in an aqueous medium, as described above, it is possible to eliminate the use of an emulsifier or to reduce the amount of an emulsifier to be used.

20 [0082] Accordingly, the amount of the free emulsifier in the coating film formed from the aqueous coating material is extremely reduced, and voids caused by bleed-out of the emulsifier, which forms on the surface of the coating film when exposed to water during or after the formation of the
25 coating film, are reduced or suppressed.

[0083] Therefore, penetration of moisture into the interior of the coating film through voids on the surface of the coating film is reduced or suppressed, and the coating film has excellent initial water resistance. In addition, the leveling property is improved at the time of coating film formation by the unsaturated fatty acid salt unit in the copolymer, and the coating film also excels in the initial gloss.

[Examples]

[0084] [Synthesis of fatty acid-modified monomer]

The compounds shown below were fed into a reaction vessel, and were reacted with stirring in the reaction vessel at 160°C. Thus, a tall oil fatty acid and glycidyl methacrylate were subjected to an addition reaction for about 90 minutes to obtain a fatty acid-modified monomer. After completion of the reaction, 0.08 parts by mass of hydroquinone was fed into the reaction vessel. The tall oil fatty acid included 2% by mass of palmitic acid and 2% by mass of stearic acid as saturated fatty acids, and 46% by mass of oleic acid and 41% by mass of linoleic acid as unsaturated fatty acids. Note that the addition reaction between the epoxy group of glycidyl methacrylate and the carboxy group of the tall oil fatty acid was monitored by measuring the amount of the remaining acid component.

Tall oil fatty acid: 260.00 parts by mass

Glycidyl methacrylate: 136.00 parts by mass

p-Methoxyphenol: 0.70 parts by mass

Tetrabutylphosphonium bromide: 0.40 parts by mass

Triphenylphosphine: 0.40 parts by mass

5 [0085] [Emulsifier]

(Synthesis 1 of unsaturated fatty acid salt)

First, 344.92 parts by mass of distilled water and 44.73 parts by mass of 48% by mass of an aqueous potassium hydroxide solution were fed into a reaction vessel and maintained at 95°C for about 1 hour with stirring. Next, 110.35 parts by mass of an unsaturated fatty acid shown below was fed into the reaction vessel and reacted for 3 hours at 95°C with stirring to obtain a potassium salt (reactive emulsifier) of the unsaturated fatty acid which had a solid concentration of 25% by mass. In Table 1, each potassium salt of the obtained unsaturated fatty acids was represented by adding "K salt" to the end of the trade name of the reactive emulsifier that serves as a raw material. In the following, "potassium salt" is shown as "K salt".

20 Unsaturated fatty acid 1: trade name "HARIDIMER 200 (DA-200)" manufactured by Harima Chemical Co., Ltd.

Unsaturated fatty acid 2: trade name "TSUNODYME 395" manufactured by TSUNO FOOD INDUSTRIAL CO., LTD.

25 Unsaturated fatty acid 3 : trade name "TSUNODYME 228" manufactured by TSUNO FOOD INDUSTRIAL CO., LTD.

[0086] (Synthesis 2 of unsaturated fatty acid salt)

The addition reaction of the unsaturated fatty acid in a tall oil fatty acid with maleic anhydride gave an adduct. This adduct was subjected to the same treatment as that according to the method of Synthesis 1 of unsaturated fatty acid salt to obtain a potassium salt of the unsaturated fatty acid with a solid content of 25% by mass (BK-73B K salt, potassium salt of oleic acid) (reactive emulsifier).

[0087] The tall oil fatty acid included 2% by mass of palmitic acid and 2% by mass of stearic acid as saturated fatty acids, and 46% by mass of oleic acid and 41% by mass of linoleic acid as unsaturated fatty acids.

[0088] (Synthesis 3 of unsaturated fatty acid salt)

A reactant obtained by reacting an unsaturated fatty acid (trade name "HARIDIMER 200 (DA-200)" manufactured by Harima Chemical Co., Ltd.) with N,N-dimethylaminoethanol was subjected to the same treatment as that according to the method of Synthesis 1 of unsaturated fatty acid salt to obtain a potassium salt of the unsaturated fatty acid with a solid content of 25% by mass (DA-200Mabs salt) (reactive emulsifier).

[0089] (Synthesis 4 of unsaturated fatty acid salt)

First, 471.91 parts by mass of distilled water and 47.38 parts by mass of 48% by mass of an aqueous potassium hydroxide solution were fed into a reaction vessel and maintained at 95°C

for about 1 hour with stirring. Next, 110.08 parts by mass of a tall oil fatty acid (trade name "HARTALL FA-1" manufactured by Harima Chemical Co., Ltd.) was fed into the reaction vessel and reacted for 3 hours at 95°C with stirring to obtain a potassium salt of the tall oil fatty acid with a solid concentration of 19.4% by mass (FA-1 K salt) (reactive emulsifier). The potassium salt of the tall oil fatty acid included a potassium salt of oleic acid and a potassium salt of linoleic acid.

[0090] The tall oil fatty acid included 2% by mass of palmitic acid and 2% by mass of stearic acid as saturated fatty acids, and 46% by mass of oleic acid and 41% by mass of linoleic acid as unsaturated fatty acids.

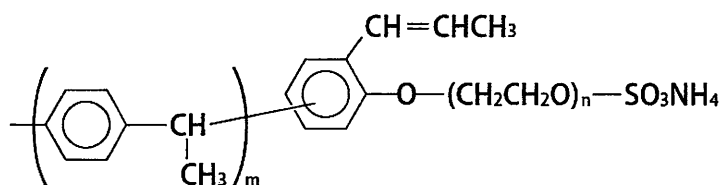
[0091] (Synthesis 1 of saturated fatty acid salt)

First, 676.89 parts by mass of distilled water and 46.83 parts by mass of 48% by mass of an aqueous potassium hydroxide solution were fed into a reaction vessel and maintained at 95°C for about 1 hour with stirring. Next, 109.67 parts by mass of stearic acid, which is a saturated fatty acid, was fed into the reaction vessel and reacted for 3 hours at 95°C with stirring to obtain a potassium salt of stearic acid with a solid concentration of 15% by mass (Stearic Acid K salt) (non-reactive emulsifier).

[0092] (Other emulsifiers)

· trade name "AQUALON AR-1025" manufactured by DKS Co., Ltd.

(reactive emulsifier, polyoxyethylene styrenated propenyl phenyl ether sulfate ammonium salt)



[0093]

5 Polyoxyethylene polycyclic phenyl ether sulfate ester salt
trade name "NEWCOL 707-SF" manufactured by NIPPON
NYUKAZAI CO., LTD. (non-reactive emulsifier)



f: Polycyclic phenyl group, X: Na or NH₄

10 [0094]

trade name "HITENOL LA-12" manufactured by DKS Co., Ltd.
(non-reactive emulsifier)

Polyoxyethylene lauryl ether sulfate ester ammonium

[0095] As to the above-described emulsifiers, the contents

15 of the monomer acid potassium salt (monomer acid K salt), the
dimer acid potassium salt (dimer acid K salt) and the trimer
acid potassium salt (trimer acid K salt), and the iodine
values thereof (solid) are shown in Table 1.

[0096] [Monomer composition]

20 Monomer compositions 1 to 16 each including styrene,
methyl methacrylate, isobutyl methacrylate, 2-ethylhexyl
acrylate, n-butyl acrylate, cyclohexyl methacrylate, fatty
acid-modified monomer, diacetone acrylamide, and methacrylic

acid in respective predetermined amounts shown in Table 2 were prepared.

[0097] [Examples 1 to 25, Comparative Examples 1 to 7]

(Production of resin composition for aqueous coating
5 material)

An emulsifier which had the composition (% by mass) shown in each of Tables 3 to 5 was prepared. An amount of half of the predetermined fed amount of the emulsifier shown in Tables 3 to 5 and 91.5 parts by mass of distilled water were fed to a
10 reaction vessel. Nitrogen gas was fed into the reaction vessel to substitute the inside air with the nitrogen gas while stirring the content in the reaction vessel, and water including the emulsifier in the reaction vessel was heated to 90°C and maintained.

15 [0098] Next, to a mixture of 100 parts by mass of the monomer composition shown in Tables 3 to 5 and the remaining half of the above-mentioned emulsifier, 55.2 parts by mass of distilled water and 0.74 parts by mass of ammonium persulfate were added. The mixture was emulsified by stirring at a high
20 speed using a high speed disperser to prepare a monomer emulsion.

[0099] The monomer emulsion was dripped into the reaction vessel over a period of 3 hours. A radical polymerization reaction was performed by maintaining the reaction solution in
25 the reaction vessel at 90°C for 2 hours to synthesize a

copolymer. After that, the reaction solution in the reaction vessel was cooled to 40°C or lower, and then adjusted with 28% by mass of aqueous ammonia so that the pH of the reaction solution became 9, to obtain a resin composition for an aqueous coating material with a solid content (copolymer) concentration of 40% by mass.

[0100] Note that the content (% by mass) and the fed amount (parts by mass) of the emulsifier shown in Tables 3 to 5 indicate the amount of solid content.

10 [0101] (Production of aqueous coating material)

First, 8.55 parts by mass of water, 17.09 parts by mass of a pigment (titanium oxide), 0.70 parts by mass of a pigment dispersant (trade name "DISPERBYK-190" manufactured by Byk Chemie Co., Ltd.), and 0.09 parts by mass of a defoaming agent (trade name "SN DEFOAMER 777" manufactured by San Nopco Co., Ltd.) were uniformly mixed to prepare a coating raw material liquid.

[0102] Next, 26.43 parts by mass of the above-mentioned coating raw material liquid, 1.81 parts by mass of an emulsifier (trade name "NEWCOL 707-SF" manufactured by NIPPON NYUKAZAI CO., LTD.), 27.00 parts by mass (solid content) of a resin composition for an aqueous coating material, 40.50 parts by mass of water, 2.20 parts by mass of a film forming aid (butyl diglycol), 0.10 parts by mass of a defoaming agent (trade name "SN DEFOAMER 777" manufactured by San Nopco Co.,

Ltd.), 0.40 parts by mass of a thickener (trade name "PRIMAL RM-12W" manufactured by Dow Chemical Japan Co., Ltd.), 1.46 parts by mass of a metal dryer (trade name "DICNATE3111TL" manufactured by DIC Corporation), and 0.10 parts by mass of an
5 adjuvant (adipic acid dihydrazide) were uniformly mixed to prepare an aqueous coating. Note that the amount of the resin composition for an aqueous coating material is a solid content.

[0103] Regarding the obtained aqueous coating material,
10 the initial gloss and the gloss retention property as an evaluation criterion of the initial water resistance were measured as described below, and the results are shown in Tables 3 to 5. Note that the aqueous coating material of Comparative Example 4 could not be evaluated because it had
15 been gelled.

[0104] (Initial gloss)

The aqueous coating material was applied to a stainless steel plate (length: 150 mm × width: 70 mm × thickness: 0.8 mm) (manufactured by Taiyu Kizai Co., Ltd.) by using a film
20 applicator (trade name "AP100" manufactured by Taiyu Kizai Co., Ltd.). Thus, an applied layer is formed.

[0105] The applied layer on the stainless steel sheet was dried in a room at 23°C and 50% relative humidity for 16 hours to evaporate and remove moisture included in the applied layer
25 to form a coating film. The 20° specular reflectance (20°G) of

the resulting coating film was measured. The measured values were converted to specular gloss according to JIS Z8741. The obtained specular gloss was regarded as "initial specular gloss" and used as evaluation criterion of the initial gloss.

5 [0106] (Initial water resistance)

The coating film was formed in the same manner as that for the initial gloss, and the initial specular gloss of the coating film was measured as described above.

[0107] A polyvinyl chloride pipe with an inner diameter of
10 43 mm was prepared, and a silicone grease was applied to the entire end surface of the first opening of the pipe. The pipe was brought into intimate contact with the coating film. Note that the entire applied surface of the silicone grease of the pipe was made to be in intimate contact with the coating film.

15 [0108] After 15 g of distilled water was fed into the pipe, the second opening of the pipe was closed with a synthetic resin film so that the distilled water in the pipe was not allowed to evaporate in order to prepare a test body. The test body was allowed to stand for 24 hours in a room at
20 23°C and 50% relative humidity.

[0109] Next, after removing the distilled water in the pipe, the pipe was removed from the coating film, and the moisture on the coating film was sufficiently wiped off. The coating film was then left to stand for 1 hour in a room at
25 23°C and 50% relative humidity.

[0110] The specular gloss of the coating film after the water resistance test (specular gloss after the water resistance test) was measured in the same manner as that for the initial specular gloss. The gloss retention rate was
5 calculated on the basis of the following formula. The higher the gloss retention rate, the better the initial water resistance.

Gloss retention rate (%) = $100 \times \frac{\text{Specular gloss after water resistance test}}{\text{Initial specular gloss}}$

10 [0111]

[Table 1]

	DA-200 K Salt	TSUNODYME 395 K Salt	TSUNODYME 228 K Salt	BK-73B K Salt	DA-200 Mabs Salt	FA-1 K Salt	AQUALON AR-1025	NEWCOL 707-SF	HITENOL LA-12	Stearic Acid K Salt
Monomer Acid K Salt (% by mass)	5	3	5	—	5	—	—	—	—	—
Dimer Acid K Salt (% by mass)	78	94	81	—	78	—	—	—	—	—
Trimer Acid K Salt (% by mass)	17	3	14	—	17	—	—	—	—	—
Iodine Value (Solid)	61.2	81.4	80.6	99.92	63.6	115.10	Not Measured	0	0	0
Nonvolatile Content (% by mass)	25	25	25	25	25	19.4	25	30	95	15

[0112]

[Table 2]

Monomer Composition No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Styrene	30.0	0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	5.0	50.0	30.0	30.0	30.0	30.0	30.0
Methyl Methacrylate	0	47.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isobutyl Methacrylate	32.5	0	16.0	20.0	24.0	29.0	35.0	38.5	42.0	61.5	9.3	35.8	45.0	47.5	50.0	32.5
2-Ethylhexyl Acrylate	14.5	0	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
n-Butyl Acrylate	17.5	40.0	34.0	30.0	26.0	21.0	15.0	11.5	8.0	13.5	20.7	19.2	5.0	2.5	0	16.0
Cyclohexyl Methacrylate	0	12.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fatty Acid-Modified Monomer	5.0	0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0	5.0	5.0	5.0	5.0
Diacetone Acrylamide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5
Methacrylic Acid	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

[0113]

[Table 3]

		Example													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Emulsion Polymerization	Emulsifier	DA-200 K Salt	100	70	50	30	0	70	0	0	50	0	0	0	50
		Unsaturated Fatty Acid Salt (% by mass)	0	0	0	0	0	0	0	0	0	100	0	0	0
		TSUNODYME 395 K Salt	0	0	0	0	0	0	0	0	0	0	100	0	0
		TSUNODYME 228 K Salt	0	0	0	0	0	0	0	0	0	0	100	0	0
		BK-73B K Salt	0	0	0	0	0	0	0	0	0	0	0	100	0
		DA-200Mabs Salt	0	0	0	0	100	0	0	0	0	0	0	0	0
	AQUALON AR-1025 (% by mass) NEWCOL 707-SF (% by mass) HITENOL LA-12 (% by mass) Stearic Acid K Salt (% by mass) Fed Amount (parts by mass)	FA-1 K Salt	0	0	0	0	0	100	50	0	50	0	0	0	0
			0	30	50	70	0	0	0	50	0	0	0	0	50
			0	0	0	0	0	30	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0
Copolymer	Monomer Composition No.		2	2	2	2	2	2	2	1.5	2	2	2	2	2
			1	1	1	1	1	1	1	1	1	1	1	1	4
		Glass Transition Temperature (°C)	16	15	16	16	16	15	15	16	15	16	16	15	1
		Initial Specular Gloss	68	68	61	61	64	66	72	62	64	62	64	69	66
		Specular Gloss after Water Resistance Test	50	52	42	37	38	45	45	40	44	42	43	47	39
Coating Film		Gloss Retention Rate (%)	72	75	69	61	60	68	62	65	66	68	67	68	60

[0114]

[Table 4]

		Example												
		15	16	17	18	19	20	21	22	23	24	25		
Emulsion Polymerization	Unsaturated Fatty Acid Salt (% by mass)	DA-200 K Salt	50	50	50	50	50	50	100	50	50	50	50	
		TSUNODYME 395 K Salt	0	0	0	0	0	0	0	0	0	0	0	
		TSUNODYME 228 K Salt	0	0	0	0	0	0	0	0	0	0	0	
		BK-73B K Salt	0	0	0	0	0	0	0	0	0	0	0	
		DA-200Mabs Salt	0	0	0	0	0	0	0	0	0	0	0	
		FA-1 K Salt	0	0	0	0	0	0	0	0	0	0	0	
	Emulsifier	AQUALON AR-1025 (% by mass)	50	50	50	50	50	50	0	50	50	50	50	
		NEWCOL 707-SF (% by mass)	0	0	0	0	0	0	0	0	0	0	0	
		HITENOL LA-12 (% by mass)	0	0	0	0	0	0	0	0	0	0	0	
		Stearic Acid K Salt (% by mass)	0	0	0	0	0	0	0	0	0	0	0	
Monomer Composition No.	Fed Amount (parts by mass)	2	2	2	2	2	2	2	2	2	2	2		
	Glass Transition Temperature (°C)	5	6	7	8	10	11	12	9	13	14	16		
Copolymer														
Coating Film	Initial Specular Gloss	64	63	61	60	62	64	66	58	56	55	60		
	Specular Gloss after Water Resistance Test	40	41	44	46	37	44	40	47	47	46	45		
	Gloss Retention Rate (%)	63	65	72	77	60	69	61	81	84	84	75		

[0115]

[Table 5]

		Comparative Example						
		1	2	3	4	5	6	7
Emulsion Polymerization	Emulsifier	DA-200 K Salt	0	0	0	100	50	50
		TSUNODYME 395 K Salt	0	0	0	0	0	0
		TSUNODYME 228 K Salt	0	0	0	0	0	0
		BK-73B K Salt	0	0	0	0	0	0
		DA-200Mabs Salt	0	0	0	0	0	0
		FA-1 K Salt	0	0	0	0	0	0
	Unsaturated Fatty Acid Salt (% by mass)	AQUALON AR-1025 (% by mass)	100	0	0	0	50	50
		NEWCOL 707-SF (% by mass)	0	100	0	0	0	0
		HITENOL LA-12 (% by mass)	0	0	100	0	0	0
		Stearic Acid K Salt (% by mass)	0	0	0	100	0	0
Copolymer	Fed Amount (parts by mass)		2	2	2	2	2	2
	Monomer Composition No.		1	1	1	1	2	15
	Glass Transition Temperature (°C)		17	16	17	—	24	42
	Initial Specular Gloss		62	65	56	—	50	68
	Specular Gloss after Water Resistance Test		35	29	13	—	9	37
Coating Film	Gloss Retention Rate (%)		56	44	24	—	17	85

Industrial Applicability

[0116] The aqueous coating material formed from the resin

5 composition for an aqueous coating material of the present invention can form a coating film, which has excellent initial gloss and initial water resistance, on a surface of an object

to be coated such as a building material, whereby the surface of the object to be coated can be coated.

[0117] (Cross-reference to related application)

The present application claims the priority under
5 Japanese Patent Application No. 2019-51959, filed March 19, 2019, the disclosure of which is incorporated herein in its entirety by reference.

CLAIMS

1. A resin composition for an aqueous coating material comprising a copolymer that includes a styrene-based monomer unit, an acrylic monomer unit, and an unsaturated fatty acid salt unit, and has a glass transition temperature of -4 to 40°C.
2. The resin composition for an aqueous coating material according to claim 1, wherein an unsaturated fatty acid salt includes a polymerized fatty acid salt and/or an oleic acid salt.
3. The resin composition for an aqueous coating material according to claim 2, wherein the polymerized fatty acid salt includes a dimer acid salt.
4. The resin composition for an aqueous coating material according to any one of claims 1 to 3, wherein an unsaturated fatty acid salt includes a potassium salt.
5. The resin composition for an aqueous coating material according to any one of claims 1 to 4, wherein the copolymer is an emulsion polymerization product of a monomer composition including a styrene-based monomer, an acrylic monomer, and an unsaturated fatty acid salt serving as a reactive emulsifier.
6. The resin composition for an aqueous coating material according to claim 5, wherein the monomer composition is an emulsion polymerization product of a monomer composition including a styrene-based monomer, an acrylic monomer, and a reactive emulsifier that includes an unsaturated fatty acid

salt and a compound other than the unsaturated fatty acid salt.

7. A coating film being a solidified product of an applied layer of the resin composition for an aqueous coating material according to any one of claims 1 to 6 on an object to be

5 coated.