DESCRIPTION

Title of the Invention: WIPING SHEET

Technical Field

[0001]

The present invention relates to a wet wiping sheet.

Background Art

[0002]

What is called a wet sheet (cleaning sheet) in the form in which an aqueous solution containing a sanitizer and the like is infiltrated into a nonwoven fabric is convenient, easy to use, and disposable, and thus clean wet sheets are always available. The sheets are therefore used not only at home but also in food factories, kitchens, and medical facilities for environmental improvement.

[0003]

A wet sheet may contain a quaternary ammonium salt such as benzalkonium chloride, benzethonium chloride, and cetylpyridinium chloride for cleansing a surface to be cleansed. The base sheet used for wet sheets typically contains cellulose fibers. Cellulose is negatively charged, and thus a quaternary ammonium salt easily adsorbs to the cellulose fibers. As a result, the concentration of the quaternary ammonium salt contained in a cleaning liquid discharged to a surface to be wiped is lower than the concentration of the quaternary ammonium salt contained in a cleaning liquid before infiltration into a base sheet.

[0004]

To prevent a quaternary ammonium salt from adsorbing to cellulose fibers, Patent Literature 1 discloses combination use of an anionic surfactant represented by R_1-COO-X_1^+ or R_2-O-$(CH_2CH_2O)_n$-CH_2COO-X_2^+ with a quaternary ammonium salt.

Patent Literature 2 discloses combination use of an inorganic salt such as aluminum chloride, calcium chloride, and sodium chloride with a quaternary ammonium salt.

Citation List

Patent Literatures

[0005]

Patent Literature 1: JP 2018-15413 A

Patent Literature 2: JP 2018-15442 A

Summary of Invention

[0006]

The present invention relates to a wiping sheet including a nonwoven fabric containing cellulose fibers and an aqueous cleaning liquid infiltrated into the nonwoven fabric.

In an embodiment, the aqueous cleaning liquid preferably contains a quaternary ammonium salt and a nonionic surfactant.

Description of Embodiments

[0007]

The techniques disclosed in Patent Literatures 1 and 2 can prevent a quaternary ammonium salt from adsorbing to cellulose fibers, but an anionic surfactant or an inorganic salt forms a complex with the cation moiety of a quaternary ammonium salt. The techniques may thus fail to produce sufficient effect (hygiene) on bacteria or viruses. A cleaning liquid containing an inorganic salt leaves wiping streaks on a wiped surface and has insufficient finishing properties.

The present invention therefore relates to a wiping sheet that prevents a quaternary ammonium salt from adsorbing to cellulose fibers without reducing hygiene and provides better hygiene than conventional techniques.

[0008]

The present invention will now be described on the basis of preferred embodiments.

In the present invention, “wiping” includes both meanings of cleaning and cleansing and, for example, includes building cleaning such as floor, wall, ceiling, and pillar cleaning, cleaning of fittings and fixtures, wiping of articles, and cleansing of human bodies and apparatuses for human bodies.

In the following description, an aqueous cleaning liquid may also be called simply a “cleaning liquid”.

[0009]

The present invention relates to a wiping sheet including a nonwoven fabric containing cellulose fibers and an aqueous cleaning liquid infiltrated into the nonwoven fabric. The aqueous cleaning liquid contains a quaternary ammonium salt and a nonionic surfactant.

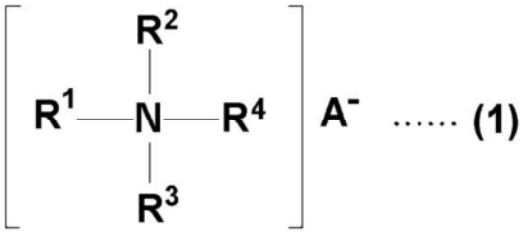
[0010]

As the quaternary ammonium salt, a conventionally used salt having bactericidal and/or antimicrobial activity may be appropriately used. Examples include alkyltrimethylammonium salts, polyoxyethylenealkylmethylammonium salts, alkylbenzyldimethylammonium salts such as benzalkonium chloride, quaternary ammonium salts having a group in which an arylalkyl group is divided by an ether group, a benzyl group, and two methyl groups, and alkylpyridinium salts such as alkyl cetylpyridinium chloride. Examples of the quaternary ammonium salt having a group in which an arylalkyl group is divided by an ether group, a benzyl group, and two methyl groups include benzethonium chloride. Examples of the group in which an arylalkyl group is divided by an ether group include a group in which the alkyl chain of an arylalkyl group is interrupted by an oxygen atom.

[0011]

For example, as the quaternary ammonium salt, a compound represented by General Formula (1) may be used.

[Chemical Formula 1]



[0012]

In the formula, R^1 is a linear or branched alkyl group having 6 or more and 28 or less carbon atoms, a linear or branched alkenyl group having 6 or more and 28 or less carbon atoms, an arylalkyl group having 7 or more and 28 or less carbon atoms, or a group in which the alkyl group, the alkenyl group, or the arylalkyl group is divided by an amido group, an ester group, or an ether group. R^2 is a linear or branched alkyl group having 1 or more and 28 or less carbon atoms, a linear or branched alkenyl group having 1 or more and 28 or less carbon atoms, an arylalkyl group having 7 or more and 28 or less carbon atoms, a group in which the alkyl group, the alkenyl group, or the arylalkyl group is divided by an amido group, an ester group, or an ether group, or an arylalkyl group having 7 or more and 28 or less carbon atoms. R^3 and R^4 are the same or different from each other and are a linear or branched alkyl group having 1 or more and 3 or less carbon atoms. R^2, R^3, and R^4 may together form a pyridine ring. A^- is an anion as the counter ion of the ammonium ion.

[0013]

In General Formula (1), R^1 in a preferred embodiment is preferably a linear or branched alkyl group, a linear or branched alkenyl group, or a group in which an arylalkyl group is divided by an ether group and is more preferably a linear alkyl group from the viewpoint of improving the hygiene performance including microbial removal and virus removal by the wiping sheet. From a similar viewpoint to the above, R^1 preferably has 6 or more and 28 or less carbon atoms and more preferably 8 or more and 18 or less carbon atoms. From a similar viewpoint to the above, R^2 is preferably an arylalkyl group such as a benzyl group, or R^2, R^3, and R^4 preferably together form a pyridine ring. When R^2, R^3, and R^4 do not together form a pyridine ring, R^2 preferably has 1 or more and 28 or less carbon atoms and more preferably 1 or more and 18 or less carbon atoms from a similar viewpoint to the above. R^3 and R^4 have more preferably 1 or more and 18 or less from a similar viewpoint to the above.

A^- is an anion, and examples include a carboxylate ion, a sulfonate ion, and a halogen ion. Of them, a halogen ion is preferred, a chloride ion or a bromide ion is more preferred, and a chloride ion is even more preferred.

[0014]

The quaternary ammonium salt is preferably an alkylbenzyldimethylammonium

salt from the viewpoint of improving the hygiene performance and of easily forming mixed micelle with a nonionic surfactant (specifically polyoxyethylene alkyl ether) and is more preferably benzalkonium chloride.

[0015]

The content of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.005% by mass or more, more preferably 0.01% by mass or more, and even more preferably 0.02% by mass or more from the viewpoint of improving the hygiene performance or of the dissolution stability of the aqueous cleaning liquid. From the viewpoint of safety, the content of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.5% by mass or less, more preferably 0.3% by mass or less, and even more preferably 0.2% by mass or less.

In terms of the range, the content of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.005% by mass or more and 0.5% by mass or less, more preferably 0.01% by mass or more and 0.3% by mass or less, and even more preferably 0.02% by mass or more and 0.2% by mass or less.

In the description, the preferred range of a quaternary ammonium salt is the amount in the aqueous cleaning liquid infiltrated into a nonwoven fabric, but the amount of the quaternary ammonium salt in an aqueous cleaning liquid that is a liquid extracted by squeezing an impregnated nonwoven fabric is also preferably within the above range.

[0016]

The nonionic surfactant contained in the aqueous cleaning liquid is preferably an alkylene oxide adduct nonion such as an ethylene oxide adduct from the viewpoint of efficiently preventing adsorption of a quaternary ammonium salt in a nonwoven fabric containing cellulose fibers and is more preferably a polyoxyalkylene alkyl ether such as a polyoxyethylene alkyl ether.

[0017]

The polyoxyethylene alkyl ether is also called an “alcohol ethoxylate” and is, for example, a nonionic surfactant produced by ethoxylation of an alcohol with ethylene oxide. The inventors of the present invention have found that when a nonwoven fabric containing cellulose fibers such as rayon fibers is impregnated with an aqueous cleaning liquid that

contains a quaternary ammonium salt and a polyoxyethylene alkyl ether, the quaternary ammonium salt in the aqueous cleaning liquid is efficiently prevented from adsorbing to the cellulose fibers. Although why a polyoxyethylene alkyl ether prevents a quaternary ammonium salt from adsorbing to cellulose fibers is unclear, the reason is probably as follows: the polyoxyethylene alkyl ether has a hydrophilic group and a hydrophobic group and thus efficiently forms stable mixed micelle with a quaternary ammonium salt; and this efficiently prevents the cationic moiety of the quaternary ammonium salt from adsorbing to the negatively charged cellulose fiber surface. This effect certainly achieves the hygiene performance by using a quaternary ammonium salt.

The polyoxyethylene alkyl ether is represented by General Formula (2). In General Formula (2), "$H_{2m+1}C_m$" is the hydrophobic group, and "$O(CH_2\text{-}CH_2\text{-}O)_n$" is the hydrophilic group.

[0018]

$$H_{2m+1}C_mO(CH_2CH_2O)_nH \quad (2)$$

In the formula, m is an integer of 1 or more, and n is an integer of 2 or more.

[0019]

The inventors of the present invention have found that when the nonionic surfactant is specifically a polyoxyethylene alkyl ether having an ethylene oxide number of 10 or more, a quaternary ammonium salt can be especially efficiently prevented from adsorbing to cellulose fibers. From this viewpoint, as the nonionic surfactant, the polyoxyethylene alkyl ether preferably has an ethylene oxide number of 15 or more and more preferably 20 or more.

The polyoxyethylene alkyl ether preferably has an ethylene oxide number of 50 or less from the viewpoint of efficiently preventing a quaternary ammonium salt from adsorbing to cellulose fibers and more preferably has an ethylene oxide number of 30 or less.

Accordingly, the polyoxyethylene alkyl ether preferably has an ethylene oxide number of 10 or more and 50 or less, more preferably 15 or more and 50 or less, and even more preferably 20 or more and 30 or less.

The ethylene oxide number is indicated by "n" in General Formula (2).

[0020]

The nonionic surfactant preferably includes two or more polyoxyethylene alkyl ethers having different ethylene oxide numbers. For example, the nonionic surfactant preferably includes a polyoxyethylene alkyl ether having an ethylene oxide number of less than 12 and a polyoxyethylene alkyl ether having an ethylene oxide number of 12 or more. The nonionic surfactant also preferably includes a polyoxyethylene alkyl ether having an ethylene oxide number of 20 or more and a polyoxyethylene alkyl ether having an ethylene oxide number of less than 12.

[0021]

Although using a polyoxyethylene alkyl ether having a small ethylene oxide addition molar number (hereinafter abbreviated as "low EOAE") in combination with a quaternary ammonium salt can improve the hygiene, intensive studies by the inventors of the present invention have revealed that using a low EOAE and a quaternary ammonium salt together with a polyoxyethylene alkyl ether having a large ethylene oxide addition molar number (hereinafter abbreviated as "high EOAE") can improve the effect of the low EOAE to prevent the quaternary ammonium salt from adsorbing to cellulose fibers. The studies have also revealed that combination use of three compounds, the low EOAE, the high EOAE, and the quaternary ammonium salt further improves the hygiene as compared with using only the high EOAE and the quaternary ammonium salt.

[0022]

From the viewpoint of markedly achieving the effect, the polyoxyethylene alkyl ether having an ethylene oxide number of less than 12 more preferably has an ethylene oxide number of not less than 4 and less than 12 and even more preferably 8 or more and 11 or less.

[0023]

As for the alkyl chain length of the polyoxyethylene alkyl ether, the carbon number m is preferably 6 or more and 24 or less and more preferably 9 or more and 18 or less from the viewpoint of excellent balance with the ethylene oxide number and of accordingly easily achieving better adsorption prevention effect. When two or more polyoxyethylene alkyl ethers having different ethylene oxide numbers are contained, the ethers may have the

same carbon number m or different carbon numbers.

[0024]

When the quaternary ammonium salt has a long-chain alkyl group having a carbon number of 8 or more, the rate of the carbon number N of the long-chain alkyl group to the ethylene oxide number n in General Formula (2) of the polyoxyethylene alkyl ether, N/n, is preferably 0.15 or more and 3.0 or less from the viewpoint of more efficiently preventing the quaternary ammonium salt from adsorbing to cellulose fibers and is more preferably 0.20 or more and 1.8 or less. When two or more polyoxyethylene alkyl ethers are used, n is the ethylene oxide number of the polyoxyethylene alkyl ether having the largest ethylene oxide number.

[0025]

From a similar viewpoint to the above, the rate of the carbon number N of the long-chain alkyl group of the quaternary ammonium salt to the carbon number m of the alkyl group of the polyoxyethylene alkyl ether, N/m, is preferably 0.25 or more and 3.5 or less and most preferably 0.75 or more and 1.5 or less. When two or more polyoxyethylene alkyl ethers are used, m is the carbon number of the alkyl chain of the polyoxyethylene alkyl ether having the largest alkyl chain carbon number.

[0026]

From a similar viewpoint to the above, when the ethylene oxide number is 10 or more, the ethylene oxide number n of the polyoxyethylene alkyl ether is preferably not less than the carbon number m of the alkyl group of the polyoxyethylene alkyl ether ($n \geq m$).

[0027]

The content of the nonionic surfactant in the aqueous cleaning liquid is preferably 0.01% by mass or more, more preferably 0.1% by mass or more, and even more preferably 0.2% by mass or more from the viewpoint of easily preventing a quaternary ammonium salt from adsorbing to cellulose fibers in the wiping sheet, of detergency, and of dissolution stability. The content of the nonionic surfactant in the aqueous cleaning liquid is preferably 5.0% by mass or less, more preferably 4.0% by mass or less, and even more preferably 3.0% by mass or less from the viewpoint of finishing properties after cleansing

(preventing sliminess or foaming), of preventing base material damages, and of safety.

In terms of the range, the content of the nonionic surfactant in the aqueous cleaning liquid is preferably 0.01% by mass or more and 5.0% by mass or less, more preferably 0.1% by mass or more and 4.0% by mass or less, and even more preferably 0.2% by mass or more and 3.0% by mass or less.

When two or more nonionic surfactants are used, the content is calculated on the basis of the total amount of all the nonionic surfactants.

[0028]

From the viewpoint of improving the effect of preventing the quaternary ammonium salt from adsorbing to cellulose fibers, of accordingly improving the hygiene performance, and of improving the cleanability, the rate of the content A (% by mass) of the nonionic surfactant to the content B (% by mass) of the quaternary ammonium salt, A/B, in the aqueous cleaning liquid is preferably 1 or more, more preferably 2 or more, and even more preferably 5 or more. The rate is preferably 100 or less, more preferably 60 or less, and even more preferably 40 or less. The rate is preferably 1 or more and 100 or less, more preferably 2 or more and 60 or less, even more preferably 5 or more and 60 or less, and further preferably 5 or more and 40 or less.

[0029]

From a similar viewpoint to the above, the sum of the content A (% by mass) of the nonionic surfactant and the content B (% by mass) of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.01% by mass or more, more preferably 0.1% by mass or more, even more preferably 0.2% by mass or more, and further preferably 0.3% by mass or more. The sum is preferably 12% by mass or less, more preferably 5% by mass or less, even more preferably 4.5% by mass or less, and further preferably 3.5% by mass or less. The sum is preferably 0.01% by mass or more and 12% by mass or less, more preferably 0.1% by mass or more and 5% by mass or less, even more preferably 0.2% by mass or more and 4.5% by mass or less, and further preferably 0.3% by mass or more and 3.5% by mass or less.

[0030]

From the viewpoint of further improving the effect of preventing the quaternary

ammonium salt from adsorbing to cellulose fibers and of improving the cleanability, the amount of the nonionic surfactant, specifically, the amount of the polyoxyethylene alkyl ether is preferably 10 parts by mass or more and more preferably 50 parts by mass or more relative to 100 parts by mass of the surfactants contained in the aqueous cleaning liquid.

[0031]

When the nonionic surfactant includes a polyoxyethylene alkyl ether having an ethylene oxide number of 20 or more and a polyoxyethylene alkyl ether having an ethylene oxide number of less than 12, the mass ratio of the amount E1 of the polyoxyethylene alkyl ether having an ethylene oxide number of 20 or more to the amount E2 of the polyoxyethylene alkyl ether having an ethylene oxide number of less than 12, E1:E2, is preferably 100:10 to 900 and more preferably 100:30 to 300 from the viewpoint of more easily achieving the above marked effect by the two or more polyoxyethylene alkyl ethers.

[0032]

The aqueous cleaning liquid preferably further contains an antimicrobial agent from the viewpoint of further improving the hygiene performance of the wiping sheet. Preferred examples of the antimicrobial agent include an aromatic antimicrobial agent and a glycol compound.

[0033]

The aromatic antimicrobial agent includes both an alcohol antimicrobial agent having an aromatic ring and an antimicrobial agent in which at least one hydrogen atom on an aromatic hydrocarbon nucleus is substituted by a hydroxy group. Examples of the alcohol antimicrobial agent having an aromatic ring include benzyl alcohol, phenoxyethanol, phenethyl alcohol, and 3-phenylpropanol. Examples of the antimicrobial agent in which at least one hydrogen atom on an aromatic hydrocarbon nucleus is substituted by a hydroxy group include parabens (also called “p-hydroxybenzoate esters”), hinokitiol, 5-chloro-2-(2,4-dichlorophenoxy)phenol (common name: triclosan), 4,4'-dichloro-2-hydroxydiphenyl ether (common name: diclosan), o-benzyl-p-chlorophenol (chlorophen), isopropylmethylphenol (3-methyl-4-isopropylphenol, IPMP), parachlorometaxylenol (4-chloro-3,5-dimethylphenol, PCMX), and thymol. Examples of the paraben include methylparaben and ethylparaben.

[0034]

In the present invention, the aromatic antimicrobial agent is preferably used from the viewpoint of especially easily improving the virus removal effect by the wiping sheet. Specifically, phenoxyethanol or a paraben is preferably used, and phenoxyethanol or methylparaben is more preferably used.

[0035]

The glycol compound used as the antimicrobial agent is a compound having no aromatic ring but having two hydroxy groups, and propylene glycol, dipropylene glycol, isoprene glycol, butylene glycol, ethylene glycol, 1,2-pentanediol, 1,2-hexanediol, 1,2-octanediol, and the like are known. Specifically, dipropylene glycol is preferably used from the viewpoint of the safety of a household article that may be used through direct human contact.

[0036]

Hence, in the present invention, dipropylene glycol, phenoxyethanol, or methylparaben is specifically preferably used as the antimicrobial agent.

[0037]

When the aqueous cleaning liquid contains an aromatic antimicrobial agent, the amount of the aromatic antimicrobial agent in the aqueous cleaning liquid is preferably 0.01% by mass or more from the viewpoint of easily allowing the aromatic antimicrobial agent to achieve the above effect, more preferably 0.05% by mass or more, and even more preferably 0.1% by mass or more. In the aqueous cleaning liquid, the amount of the aromatic antimicrobial agent is preferably 1.0% by mass or less from the viewpoint of suppressing base material damages on a surface to be cleansed, more preferably 0.8% by mass or less, and even more preferably 0.5% by mass or less.

In terms of the range, in the aqueous cleaning liquid, the amount of the aromatic antimicrobial agent is preferably 0.01% by mass or more and 1.0% by mass or less, more preferably 0.05% by mass or more and 0.8% by mass or less, and even more preferably 0.1% by mass or more and 0.5% by mass or less.

[0038]

When the aqueous cleaning liquid contains a glycol compound used as the antimicrobial agent, the amount of the glycol compound in the aqueous cleaning liquid is preferably 0.005% by mass or more and 5% by mass or less, more preferably 0.01% by mass or more and 1% by mass or less, and even more preferably 0.05% by mass or more and 0.5% by mass or less from the viewpoint of improving the antimicrobial performance or of the dissolution stability of the cleaning liquid.

[0039]

As long as the effect of the invention is achieved, the aqueous cleaning liquid may contain, in addition to the nonionic surfactant, a cationic surfactant, an anionic surfactant, and/or an amphoteric surfactant as the surfactant. From the viewpoint of preventing the adsorption of the quaternary ammonium salt, of cleanability, and of the dissolution stability of the cleaning liquid, the aqueous cleaning liquid preferably contains only the nonionic surfactant or preferably contains the nonionic surfactant as well as an amphoteric surfactant as the surfactant. Examples of the amphoteric surfactant used in the present invention include at least one selected from lauryldimethylamine oxide, alkyl betaines, and 2-alkyl-N-carboxymethyl-N-hydroxyethyl imidazolinium betaine. When the amphoteric surfactant is contained, the amount of the amphoteric surfactant is preferably 0.01% by mass or more and 0.5% by mass or less in the aqueous cleaning liquid.

[0040]

As long as the effect of the invention is achieved, the aqueous cleaning liquid may further contain an additive in addition to the above components. Examples of the additive include surfactants other than the above-described nonionic surfactants and amphoteric surfactants, bactericidal agents other than the alcohols and quaternary ammonium salts, preservatives, air fresheners, fragrances, deodorants, pH adjusters, sequestering agents, viscosity modifiers, and solvents. These additives may be used singly or in combination. These additives may be used as needed for properties required for the wiping sheet, and when additives are used, each amount may be preferably 0.001% by mass or more and 20% by mass or less in the aqueous cleaning liquid.

[0041]

From the viewpoint of hygiene performance, of safety, or of preventing base

material damages, the aqueous cleaning liquid in the wiping sheet at 25°C preferably has a pH of 4 or more and more preferably 5 or more and preferably has a pH of 10 or less and more preferably 9.5 or less. To make the cleaning liquid have a pH within the above range, for example, a pH adjuster may be added for the adjustment in such an amount that the effect of the invention is achieved.

[0042]

The wiping sheet of the present invention is impregnated with the cleaning liquid mainly containing water. The content of the water contained in the cleaning liquid is preferably 80.0% by mass or more and more preferably 90.0% by mass or more and is preferably 99.8% by mass or less and more preferably 99.0% by mass or less relative to the total mass of the cleaning liquid.

[0043]

Next, the nonwoven fabric containing cellulose fibers will be described.

The cellulose fibers include fibers containing cellulose and fibers derived from cellulose, and the fiber surface is negatively charged. Examples of the cellulose fibers include rayon fibers, cupra fibers, lyocell fibers, acetate fibers, polynosic fibers, pulp fibers, and cotton fibers. As the cellulose fibers, one type of these exemplified fibers may be used, or a plurality of types may be used in combination. Specifically, the nonwoven fabric used in the present invention preferably contains rayon fibers as the cellulose fibers from the viewpoint of the properties retaining a cleaning liquid or of the wetting and spreading uniformity of a cleaning liquid in the whole sheet during storage.

[0044]

The proportion of the cellulose fibers in the nonwoven fabric is preferably 1% by mass or more from the viewpoint of allowing a specific surfactant used in the present invention to achieve excellent effects. From this viewpoint, the proportion of the cellulose fibers in the nonwoven fabric is more preferably 5% by mass or more and even more preferably 10% by mass or more. In contrast, the proportion of the cellulose fibers in the nonwoven fabric has no upper limit and may be, for example, 100% by mass or less.

[0045]

The cellulose fibers preferably have a fineness of 0.5 dtex or more, more preferably 0.75 dtex or more, and even more preferably 1.0 dtex or more from the viewpoint of the properties retaining a cleaning liquid and of the operability during wiping (low cleansing resistance). The upper limit is preferably 3.0 dtex or less, more preferably 2.5 dtex or less, and even more preferably 2.0 dtex or less.

[0046]

The nonwoven fabric may contain additional fibers other than the cellulose fibers. Examples of the additional fibers other than the cellulose fibers include synthetic fibers. The synthetic fibers are preferably formed from a fiber-forming resin as the material from the viewpoint of production efficiency. Examples of such a resin include various thermoplastic resins. Examples of the thermoplastic resin include polyolefin resins such as polyethylene (PE) and polypropylene (PP); polyester resins such as polyethylene terephthalate (PET); polyamide resins; vinyl resins such as polyvinyl chloride and polystyrene; acrylic resins such as polyacrylic acid and polymethyl methacrylate; and fluorine resins such as polyperfluoroethylene. These resins may be used singly or in combination of two or more of them.

[0047]

The synthetic fibers preferably have a fineness of 0.5 dtex or more, more preferably 1 dtex or more, and even more preferably 1.2 dtex or more from the viewpoint of the operability during wiping and of the dirt removal efficiency. The upper limit is preferably 4 dtex or less, more preferably 3.5 dtex or less, and even more preferably 3 dtex or less.

[0048]

When the nonwoven fabric contains synthetic fibers, the amount of the synthetic fibers in the nonwoven fabric is more preferably 95% by mass or less and even more preferably 90% by mass or less from the viewpoint of allowing the cellulose fibers to be contained in an appropriate amount, of the operability during wiping, and of the dirt removal. The proportion of the synthetic fibers in the nonwoven fabric is preferably 10% by mass or more and more preferably 20% by mass or more from the viewpoint of the properties retaining a cleaning liquid and of the operability during wiping.

[0049]

In the nonwoven fabric, fibers including the cellulose fibers and the synthetic fibers are accumulated, entangled, or conjugated to each other to form fiber aggregates. The fibers constituting the nonwoven fabric may be fused to each other or may not be fused. The wiping sheet may include only the nonwoven fabric or may include, in addition to the nonwoven fabric, an additional sheet material or an additional member.

[0050]

The nonwoven fabric constituting the wiping sheet preferably has a basis weight of 30 g/m^2 or more, more preferably 35 g/m^2 or more, and even more preferably 40 g/m^2 or more in the dry state of the nonwoven fabric. The upper limit is preferably 100 g/m^2 or less, more preferably 90 g/m^2 or less, and even more preferably 80 g/m^2 or less. The dry state means that a nonwoven fabric contains water at a content of 3% by mass or less. When the nonwoven fabric in the dry state has such a basis weight, the wiping sheet can be impregnated with a sufficient amount of the aqueous cleaning liquid, accordingly achieves an excellent hygiene performance, can capture much of the dirt removed, and has an excellent strength during wiping.

[0051]

As the nonwoven fabric, a spunlace nonwoven fabric, a meltblown nonwoven fabric, a spunbond nonwoven fabric, an air-through nonwoven fabric, a resin bonded nonwoven fabric, a needle punching nonwoven fabric, or the like may be used. A composite of these nonwoven fabrics may also be used. Of them, a spunlace nonwoven fabric is preferably used from the viewpoint of easy entanglement with fibrous dirt such as hair or cotton dust.

[0052]

The wiping sheet of the present invention including a nonwoven fabric containing cellulose fibers may be, for example, an approximately rectangular sheet having a longitudinal direction and a width direction orthogonal to the longitudinal direction. The wiping sheet may have or may not have projecting-and-depressed portions in a macroscopic pattern having curved lines on at least one face.

[0053]

From the viewpoint of providing a sufficient strength during use of the wiping sheet, the wiping sheet of the present invention may further include a scrim net for supporting the nonwoven fabric. The scrim net is also preferably provided in the center region in the thickness direction of the nonwoven fabric. The scrim net can be integrally tangled with the synthetic fibers constituting the nonwoven fabric and may be in the form of net, lattice, strand, or the like.

[0054]

As the material of the scrim net, a resin may be used. As the resin, for example, a polyolefin resin such as polyethylene and polypropylene; a polyester resin such as polyethylene terephthalate; a polyamide resin such as nylon 6 and nylon 66; an acrylonitrile resin such as polyacrylonitrile; a vinyl resin such as polyvinyl chloride and polystyrene; or a vinylidene resin such as polyvinylidene chloride may be used.

[0055]

From the viewpoint of achieving both the tangling properties between the constituent fibers and the scrim net and the strength of the wiping sheet, the wire diameter (the diameter on a cross section) of the scrim net may be appropriately set depending on the tangling degree of fibers but is preferably 10 μm or more and more preferably 100 μm or more and is preferably 2 000 μm or less and more preferably 1 000 μm or less. The wire diameter of the scrim net may partially vary or may be uniform. When the wire diameter partially varies, the wire diameter of the scrim is the average of varying diameters. The scrim net preferably has a basis weight of 1 g/m^2 or more and more preferably 3 g/m^2 or more and preferably 20 g/m^2 or less and more preferably 10 g/m^2 or less.

[0056]

From the viewpoint of achieving the function removing dirt, the proportion of the aqueous cleaning liquid infiltrated into the nonwoven fabric is preferably 50% by mass or more and more preferably 100% by mass or more and is preferably 800% by mass or less and more preferably 600% by mass or less relative to the mass of the nonwoven fabric.

[0057]

From the viewpoint of the infiltrating performance of the aqueous cleaning liquid into the nonwoven fabric, the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 5 g/m^2 or more and more preferably 10 g/m^2 or more in the dry state of the nonwoven fabric. From the viewpoint of capable of continuously discharging an appropriate amount of the aqueous cleaning liquid during cleansing, the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 60 g/m^2 or less, more preferably 50 g/m^2 or less, and even more preferably 40 g/m^2 or less.

[0058]

From the viewpoint of the infiltrating performance of the aqueous cleaning liquid, the rate of the mass of the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.005 or more, more preferably 0.01 or more, and even more preferably 0.05 or more. From the viewpoint of capable of continuously discharging an appropriate amount of the cleaning liquid during cleansing, the rate of the mass of the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 1.0 or less, more preferably 0.8 or less, and even more preferably 0.5 or less.

[0059]

From the viewpoint of the hygiene performance, the rate of the mass of the quaternary ammonium salt in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.000 01 or more, more preferably 0.000 05 or more, and even more preferably 0.000 1 or more. From the viewpoint of the finishing properties after cleansing, the rate of the mass of the quaternary ammonium salt in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.001 or less, more preferably 0.000 5 or less, and even more preferably 0.000 35 or less.

[0060]

From the viewpoint of the greasy dirt removal effect and of preventing the quaternary ammonium salt from adsorbing to fibers, the rate of the mass of the nonionic surfactant in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.000 05 or more, more

preferably 0.000 1 or more, and even more preferably 0.000 2 or more. From the viewpoint of the hygiene performance and the finishing properties after cleansing, the rate of the mass of the nonionic surfactant in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.04 or less, more preferably 0.02 or less, and even more preferably 0.01 or less.

[0061]

The wiping sheet may be used as the simple wiping sheet or may be attached to a cleaning tool such as a wiper, for building such as floors and walls, fittings such as closets, windowpanes, mirrors, doors, and doorknobs, furniture such as rugs, carpets, and dining tables, a kitchen, a toilet, cleansing of human bodies, sanitary goods, packages, and the like.

[0062]

In particular, in the wiping sheet of the present invention, a nonwoven fabric containing cellulose fibers is impregnated with a cleaning liquid containing a quaternary ammonium salt and a nonionic surfactant, and thus the quaternary ammonium salt is efficiently prevented from adsorbing to the cellulose fibers in the nonwoven fabric. Accordingly, a larger amount of the quaternary ammonium salt is likely to be left in a liquid extracted by squeezing when the wiping sheet of the present invention is used for wiping or on a wiped surface after wiping, and thus the quaternary ammonium salt can efficiently provide the microbial removal, virus removal, antimicrobial, and antiviral effects. This results in excellent hygiene performance.

[0063]

The present invention has been described on the basis of preferred embodiments thereof, but the present invention is not limited to the above embodiments.

[0064]

In consideration of the above embodiments, the present invention will further disclose the following wiping sheets.

<1>

A wiping sheet including a nonwoven fabric containing cellulose fibers and an aqueous cleaning liquid infiltrated into the nonwoven fabric, in which

the aqueous cleaning liquid contains a quaternary ammonium salt and a nonionic surfactant.

<2>

The wiping sheet as set forth in clause <1>, in which A + B is 0.01% by mass or more, preferably 0.1% by mass or more, more preferably 0.2% by mass or more, and even more preferably 0.3% by mass or more and is 12% by mass or less, preferably 5% by mass or less, more preferably 4.5% by mass or less, and even more preferably 3.5% by mass or less where A is the content (% by mass) of the nonionic surfactant contained in the aqueous cleaning liquid, and B is the content (% by mass) of the quaternary ammonium salt.

[0065]

<3>

The wiping sheet as set forth in clause <1> or <2>, in which the rate A/B is preferably 1 or more, more preferably 2 or more, and even more preferably 5 or more and is preferably 100 or less, more preferably 60 or less, and even more preferably 40 or less where A is the content (% by mass) of the nonionic surfactant contained in the aqueous cleaning liquid, and B is the content (% by mass) of the quaternary ammonium salt.

<4>

The wiping sheet as set forth in any one of clauses <1> to <3>, in which the nonionic surfactant is a polyoxyalkylene alkyl ether.

<5>

The wiping sheet as set forth in any one of clauses <1> to <4>, in which the amount of the polyoxyalkylene alkyl ether is preferably 10 parts by mass or more and more preferably 50 parts by mass or more relative to 100 parts by mass of the surfactant contained in the aqueous cleaning liquid.

[0066]

<6>

The wiping sheet as set forth in clause <4> or <5>, in which the polyoxyalkylene alkyl ether has an ethylene oxide number of 20 or more.

<7>

The wiping sheet as set forth in clause <4> or <5>, in which the polyoxyalkylene alkyl ether having an ethylene oxide number of 20 or more and the polyoxyalkylene alkyl ether having an ethylene oxide number of less than 12 are contained.

<8>

The wiping sheet as set forth in clause <7>, in which the mass ratio of the polyoxyalkylene alkyl ether having an ethylene oxide number of 20 or more to the polyoxyalkylene alkyl ether having an ethylene oxide number of less than 12 is preferably 100:10 to 900 and more preferably 100:30 to 300.

[0067]

<9>

The wiping sheet as set forth in any one of clauses <1> to <8>, in which the quaternary ammonium salt is benzalkonium chloride.

<10>

The wiping sheet as set forth in any one of clauses <1> to <9>, in which an aromatic antimicrobial agent is further contained.

<11>

The wiping sheet as set forth in clause <10>, in which in the aqueous cleaning liquid, the amount of the aromatic antimicrobial agent is preferably 0.01% by mass or more, more preferably 0.05% by mass or more, and even more preferably 0.1% by mass or more, and the amount of the aromatic antimicrobial agent is preferably 1.0% by mass or less, more preferably 0.8% by mass or less, and even more preferably 0.5% by mass or less.

[0068]

<12>

The wiping sheet as set forth in clause <10> or <11>, in which the aromatic antimicrobial agent is phenoxyethanol or methylparaben.

<13>

The wiping sheet as set forth in any one of clauses <1> to <12>, in which dipropylene glycol, phenoxyethanol, or methylparaben is further contained.

<14>

The wiping sheet as set forth in any one of clauses <1> to <13>, in which the amount of the cellulose fibers contained in the nonwoven fabric is 1% by mass or more.

[0069]

<15>

The wiping sheet as set forth in any one of clauses <1> to <14>, in which the cellulose fibers are rayon fibers.

<16>

The wiping sheet as set forth in any one of clauses <1> to <15>, in which the amount of the cellulose fibers in the nonwoven fabric is preferably 5% by mass or more and more preferably 10% by mass or more and is 100% by mass or less.

<17>

The wiping sheet as set forth in any one of clauses <1> to <16>, in which the nonwoven fabric preferably has a basis weight of 30 g/m^2 or more, more preferably 35 g/m^2 or more, and even more preferably 40 g/m^2 or more, and the nonwoven fabric preferably has a basis weight of 100 g/m^2 or less, more preferably 90 g/m^2 or less, and even more preferably 80 g/m^2 or less.

[0070]

<18>

The wiping sheet as set forth in any one of clauses <1> to <17>, in which the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric is preferably 5 g/m^2 or more and more preferably 10 g/m^2 or more, and the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric is preferably 60 g/m^2 or less, more preferably 50 g/m^2 or less, and even more preferably 40 g/m^2 or less.

<19>

The wiping sheet as set forth in any one of clauses <1> to <18>, in which the proportion of the aqueous cleaning liquid infiltrated into the nonwoven fabric is preferably 50% by mass or more and more preferably 100% by mass or more relative to the mass of the nonwoven fabric, and the proportion of the aqueous cleaning liquid infiltrated into the nonwoven fabric is preferably 800% by mass or less and more preferably 600% by mass or less relative to the mass of the nonwoven fabric.

<20>

The wiping sheet as set forth in any one of clauses <1> to <19>, in which the content of the nonionic surfactant in the aqueous cleaning liquid is preferably 0.01% by mass or more, more preferably 0.1% by mass or more, and even more preferably 0.2% by mass or more, and the content of the nonionic surfactant in the aqueous cleaning liquid is preferably 5.0% by mass or less, more preferably 4.0% by mass or less, and even more preferably 3.0% by mass or less.

[0071]

<21>

The wiping sheet as set forth in any one of clauses <1> to <20>, in which the content of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.005% by mass or more, more preferably 0.01% by mass or more, and even more preferably 0.02% by mass or more, and the content of the quaternary ammonium salt in the aqueous cleaning liquid is preferably 0.5% by mass or less, more preferably 0.3% by mass or less, and even more preferably 0.2% by mass or less.

<22>

The wiping sheet as set forth in any one of clauses <1> to <21>, in which the rate of the mass of the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.005 or more, more preferably 0.01 or more, and even more preferably 0.05 or more, and the rate of the mass of the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 1.0 or less, more preferably 0.8 or less, and even more preferably 0.5 or less.

[0072]

<23>

The wiping sheet as set forth in any one of clauses <1> to <22>, in which the rate of the mass of the quaternary ammonium salt in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.000 01 or more, more preferably 0.000 05 or more, and even more preferably 0.000 1 or more, and the rate of the mass of the quaternary ammonium salt in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.001 or less, more preferably 0.000 5 or less, and even more preferably 0.000 35 or less.

<24>

The wiping sheet as set forth in any one of clauses <1> to <23>, in which the rate of the mass of the nonionic surfactant in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is preferably 0.000 05 or more, more preferably 0.000 1 or more, and even more preferably 0.000 2 or more, and the rate of the mass of the nonionic surfactant in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven

fabric (g/m^2) is preferably 0.04 or less, more preferably 0.02 or less, and even more preferably 0.01 or less.

Examples

[0073]

The present invention will next be described in further detail with reference to examples. However, the scope of the invention is not limited to the examples.

[0074]

[Example 1 and Comparative Example 1]

As the nonwoven fabric, a spunlace nonwoven fabric was used. A spunlace nonwoven fabric was impregnated with 400% by mass of an aqueous cleaning liquid having the formula shown in Table 1 relative to the mass of the fabric and was folded in four, and the resulting five layers were allowed to stand in a polyethylene bag for a week at 25°C. The layered nonwoven fabric was squeezed with a desktop mangle roller to give a squeezed liquid. The concentration of the quaternary ammonium salt in the squeezed liquid was quantified with a liquid chromatograph (Agilent 1200 manufactured by Agilent). From the concentration C1 of the quaternary ammonium salt in the aqueous cleaning liquid and the concentration C2 of the quaternary ammonium salt in the squeezed liquid, the adsorption rate and the adsorption prevention rate were calculated in accordance with the following formulae, and the adsorption prevention performance was scored. The proportion in a cleaning liquid shown in Table 1 is not the amount of a preparation but is the amount of an active component contained in the preparation.

As the spunlace nonwoven fabric, NW-RH3-55BS (product number) manufactured by Daiwabo was used. The nonwoven fabric had dimensions of 150 mm × 240 mm and a basis weight of 50 g/m^2 and contained rayon fibers at a mixing rate of 80% by mass. PP/PE composite fibers as synthetic fibers were contained at a mixing rate of 20% by mass.

Adsorption rate = C2/C1

Adsorption prevention rate = 1 - {adsorption rate/adsorption rate in Comparative Example 1 (75%)}

Score 4: The adsorption prevention rate is 45% or more

Score 3: The adsorption prevention rate is 35% to 44%

Score 2: The adsorption prevention rate is 20% to 34%

Score 1: The adsorption prevention rate is 0% to 19%

[0075]

[Table 1]

	Ex. 1	Comp. Ex. 1
Nonionic surfactant*1 (% by mass)	1	-
Quaternary ammonium salt*2 (% by mass)	0.1	0.1
Amphoteric surfactant *3 (% by mass)	-	-
Water	Balance	Balance
Adsorption prevention performance evaluation	2	1

*1: EMULGEN 109P (manufactured by Kao Corporation, a polyoxyethylene alkyl ether, n = 9, m = 12)
*2: SANISOL B-50 (manufactured by Kao Corporation, an alkyl benzyl dimethylammonium chloride)
*3: AMPHITOL 20N (manufactured by Kao Corporation, lauryldimethylamine oxide)

[0076]

[Examples 2 to 6]

In Examples 2 to 6, the polyoxyethylene alkyl ether in Example 1 was changed to a polyoxyethylene alkyl ether having an ethylene oxide number of 4 (Example 2), a polyoxyethylene alkyl ether having an ethylene oxide number of 12 (Example 3), a polyoxyethylene alkyl ether having an ethylene oxide number of 19 (Example 4), a polyoxyethylene alkyl ether having an ethylene oxide number of 23 (Example 5), or a polyoxyethylene alkyl ether having an ethylene oxide number of 47 (Example 6). The same procedure as in Example 1 was performed except the above conditions, and the adsorption prevention performance of the quaternary ammonium salt was evaluated. The results are shown in Table 2.

[0077]

[Table 2]

	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
Ethylene oxide number	4	12	19	23	47
Adsorption prevention performance evaluation	2	3	4	4	4

[0078]

[Examples 7 to 18 and Comparative Examples 2 to 5]

As the nonwoven fabric containing cellulose fibers, a nonwoven fabric that had been prepared by water-jet entangling fibers containing synthetic fibers and cellulose fibers

and had a scrim net (made from polypropylene, a wire diameter of about 100 μm, a basis weight of 5 g/m^2) in the center region in the thickness direction was used. The nonwoven fabric contained PET fibers (a fineness of 1.7 dtex), acrylic fibers (a fineness of 1.0 dtex), and rayon fibers (a fineness of 1.7 dtex) at a mass ratio of 70:15:15 as the fiber formulation, had a basis weight of 70 g/m^2 in the dry state, and had dimensions of 285 mm × 205 mm.

The nonwoven fabric was impregnated with 350% by mass of a cleaning liquid to give an intended wet wiping sheet.

[0079]

The cleaning liquid was an aqueous solution containing 0.05% by mass of an amphoteric surfactant (lauryldimethylamine oxide), 2% by mass of alcohol, 1% by mass of a solvent (methyl propylene glycol), 0.01% by mass of a preservative (1,2-benzisothiazolin-3-one), 0.01% by mass of a sequestering agent, and components shown in Table 3 each in an amount shown in Table 3. A pH adjuster was further added such that the liquid had a pH of 9.0. Before infiltration, the pH of the cleaning liquid at 25°C was adjusted by using a pH meter (pH meter F22 manufactured by HORIBA). The cleaning liquid contained water at a content of 90.0% by mass or more.

[0080]

[Microbial removal activity value (extracted liquid)]

A nonwoven fabric was impregnated with a cleaning liquid and was folded in four, and the resulting five layers were allowed to stand in a polyethylene bag for a week at 25°C. The nonwoven fabric was then squeezed with a desktop mangle roller to give a squeezed liquid (extracted liquid). The prepared extracted liquid was subjected to microbial removal test. The test was performed in accordance with the test method for microbial removal activity of synthetic detergents and soaps for residential use as specified by the Fair Trade Council of Detergents and Soaps. In the test, E. coli and S. aureus were used. On a stainless-steel test piece, a test bacterial suspension was applied, and a test sample was applied thereon. The test piece was allowed to stand for 5 minutes and then was put into an inactivator (LP diluted solution) in a vial bottle. Bacteria were then extracted from the vial bottle and were incubated in predetermined conditions, and viable bacteria were counted. The microbial removal activity value was calculated in accordance with the following formula. The results are shown in Table 3. In Table 3, the results in Examples 1 and 5 are also shown. As the control sample, a sterilized aqueous 0.05% w/v

polysorbate 80 solution was used.

[0081]

Calculation method of microbial removal activity value

Microbial removal activity value = X – Y

X: The average of three series of common logarithmic values of the numbers of bacteria after contact with the control sample

Y: The average of three series of common logarithmic values of the numbers of bacteria after contact with a test sample

The performance was scored on the basis of a magnitude of the microbial removal activity value.

Score 4: not less than 3.5

Score 3: not less than 2.5 and less than 3.5

Score 2: not less than 2.0 and less than 2.5

Score 1: not less than 0 and less than 2.0

[0082]

[Antimicrobial activity value]

Each wet wiping sheet in Examples and Comparative Examples was used under a load of 0.64 kN/m^2 to cleanse a 5-cm square stainless-steel plate. The resulting surface-treated stainless-steel plate was subjected to antimicrobial test. The test was performed in accordance with the test method as specified in JIS Z 2801: 2010 (ISO 22196: 2007). In the test, E. coli and S. aureus were used. To the 5-cm square test piece (an antimicrobial treated plate or a plate without treatment), a bacterial suspension was dropped. The test piece was covered with a 4-cm square film and was incubated at a temperature of 35 ± 1°C and a relative humidity of 90% or more for 24 hours. After the incubation, the test bacteria on the test piece were collected by washing, and the number of viable bacteria in 1 cm^2 were counted. The antimicrobial activity value was calculated in accordance with the following formula. The results are shown in Table 3. In Table 3, the results in Examples 1 and 5 are also shown. As the control sample, a sterilized stainless-steel plate without treatment was used.

[0083]

· Calculation method of antimicrobial activity value

Antimicrobial activity value = X' - Y'

X': The average of three series of common logarithmic values of the numbers of bacteria in 1 cm^2 of the control sample after 24 hours

Y': The average of three series of common logarithmic values of the numbers of bacteria in 1 cm^2 of a cleansed sample after 24 hours

The performance was scored on the basis of a magnitude of the antimicrobial activity value.

Score 4: Not less than 3.5

Score 3: Not less than 2.5 and less than 3.5

Score 2: Not less than 2.0 and less than 2.5

Score 1: Not less than 0 and less than 2.0

[0084]

[Virus removal activity value]

Each wet wiping sheet in Examples and Comparative Examples was used under a load of 0.64 kN/m^2 to continuously wipe a 20-tatami mat size (corresponding to 32.4 m^2) of a wood floor (Combit New Advance 101, manufactured by WOOD ONE) as a surface to be wiped at a wiping speed of 1 m/s. The wood floor before wiping had a constant cleanliness by cleaning with a 70% aqueous ethanol solution and by swabbing with Kimtowel (registered trademark). Each wiping sheet in Examples and Comparative Examples after wiping was evaluated in accordance with “Microbial removal performance test of wet wipers” as specified by Japan Clean Paper and Cotton Industry Association.

As the virus species, the influenza A virus was selected. The number of viruses was adjusted at 1.1×10^9 /mL. On a stainless-steel plate, 0.01 mL of a virus-containing liquid was inoculated and was spread with a cell spreader in a 15 mm × 90 mm region. The plate was swabbed with each wiping sheet in Examples and Comparative Examples after the wiping. As the swabbing operation, the wiping sheet under a load of 0.78 kN/m^2 was moved back and forth on the plate five times at intervals of about 2 seconds. After the completion of swabbing operation, the stainless-steel plate was allowed to stand for 5 minutes in an environment at 25°C, and then the swabbed portion was swabbed with a swab that was moved back and forth ten times. The swab had been impregnated with 1.5 mL of a SCDLP liquid culture medium. Next, stirring was performed with a vortex mixer, and a virus suspension was prepared. The above operation was performed without the swabbing operation using a wiping sheet, and the resulting virus suspension was used as

the blank sample.

An EMEM was used to prepare a 10-fold dilution series of the virus suspension, and the viral infectivity in 0.1 mL of the virus suspension was determined by plaque assay. Accordingly, the viral infectivity (PFU/stainless-steel plate) was calculated.

A similar operation was performed with a control sheet, and the average of common logarithms of the determined viral infectivities (PFU/stainless-steel plate) was calculated. As the control sheet, a sheet in which, in place of the cleaning liquid, a physiological saline in which a 0.05% polysorbate 80 was dissolved was infiltrated into Kanakin No. 3 (285 mm × 205 mm) as specified in JIS L0803, Standard adjacent fabrics for staining of color fastness test, at 150% was used. The Kanakin No. 3 had been washed and sterilized by the method as specified by the test method.

The virus removal activity value was calculated in accordance with the following calculation formula. The results are shown in Table 3. In Table 3, the results in Examples 1 and 5 are also shown.

Virus removal activity value = X" - Y"

X": The average of the common logarithm values of viral infectivities (PFU/stainless-steel plate) as the three test results with a control sheet.

Y": The average of the common logarithm values of viral infectivities (PFU/stainless-steel plate) as the three test results with a wiping sheet to be tested.

The virus removal performance was scored on the basis of a magnitude of the virus removal activity value calculated in accordance with the above calculation formula, according to the following criteria.

Score 4: Not less than 3.5

Score 3: Not less than 2.5 and less than 3.5

Score 2: Not less than 2.0 and less than 2.5

Score 1: Less than 2.0

[0085]

[Greasy dirt detergency]

Onto a surface to be cleansed of a wood floor having dimensions of 700 mm × 300 mm, 0.4 g of a colored oleic acid was applied. Wiping was performed by moving a wiping sheet back and forth at most ten times in the longitudinal direction of the floor, and the number of reciprocation times at which the oleic acid was able to be removed was counted. As the wiping conditions, the load was 0.64 kN/m^2, and the speed was 1 m/sec.

The number of reciprocation times needed to remove the greasy dirt was scored. The results are shown in Table 3. In Table 3, the results in Examples 1 and 5 are also shown.

Score 4: Removable within 5 times of reciprocation

Score 3: Removable within 6 to 9 times of reciprocation

Score 2: Some dirt remained after 10 times of reciprocation

Score 1: Most dirt remained after 10 times of reciprocation

[0086]

[Comprehensive evaluation]

As the comprehensive evaluation, the average of scores in all the evaluation items was calculated and was ranked according to the following criteria. A sample having score 1 in any evaluation item was ranked as D regardless of the average.

A^+: The average is 4.0.

A: The average is not less than 3.5 and less than 4.0.

B: The average is not less than 3.0 and less than 3.5.

C: The average is not less than 2.0 and less than 3.0.

D: The average is less than 2.0 or any evaluation item is 1.

[0087]

[Table 3]

		Ex.														Comp. Ex.			
		1	5	7	8	9	10	11	12	13	14	15	16	17	18	2	3	4	5
Nonionic surfactant*1 (% by mass)		0	1	0.25	0.5	0.75	0	0.5	0.5	1	1.5	-	0.1	0.1	0.9	0	0	0	0
Nonionic surfactant *2 (% by mass)		1	0	0.75	0.5	0.25	0.25	0	0.5	1	1.5	0.1	-	0.9	0.1	0	0	0	0
Quaternary ammonium salt*3 (% by mass)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1
Dipropylene glycol		-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	-	-	-	-	0	0	0.1	0.1
Phenoxyethanol		-	-	-	-	-	0.3	0.3	0.3	0.3	0.3	-	-	-	-	0	0	0	0.3
Sum of nonionic surfactants (% by mass)		1	1	1	1	1	0.25	0.5	1	2	3	0.1	0.1	1	1	0	0	0	0
Sum of nonionic surfactants + quaternary ammonium salt (% by mass)		1.1	1.1	1.1	1.1	1.1	0.35	0.6	1.1	2.1	3.1	1.1	1.1	1.1	1.1	0.05	0.1	0.1	0.1
Sum of nonionic surfactants/quaternary ammonium salt		10	10	10	10	10	2.5	5	10	20	30	1	1	10	10	0	0	0	0
Microbial removal activity (extracted liquid)	S. aureus	3	3	4	4	4	3	3	4	4	3	3	3	3	3	3	3	3	3
	E. coli	4	2	4	4	4	4	2	4	4	3	4	2	4	2	3	3	4	4
Antimicrobial activity	S. aureus	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4
	E. coli	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4
Virus removal activity	Influenza A virus	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	2	2	3
Greasy dirt removal activity	Oleic acid	3	4	4	4	4	3	4	4	4	4	2	3	3	4	2	2	2	2
Adsorption prevention performance evaluation		2	4	4	4	4	2	4	4	4	4	2	3	3	4	1	1	1	1
Comprehensive evaluation		3.4	3.6	4.0	4.0	4.0	3.4	3.6	4.0	4.0	3.7	3.3	3.3	3.6	3.6	2.0	2.7	2.9	3.0
		B	A	A+	A+	A+	B	A	A+	A+	A	B	B	A	A	D	C	C	C

*1: EMULGEN 123P (manufactured by Kao Corporation, a polyoxyethylene alkyl ether, n = 23, m = 12)

*2: EMULGEN 109P (manufactured by Kao Corporation, a polyoxyethylene alkyl ether, n = 9, m = 12)

*3: SANISOL B-50 (manufactured by Kao Corporation, an alkyl benzyl dimethylammonium chloride)

[0088]

The results shown in Tables 1 to 3 reveal that a nonionic surfactant such as a polyoxyethylene alkyl ether can prevent a quaternary ammonium salt from adsorbing to cellulose fibers as compared with using a conventional surfactant. The results also reveal that by adding a polyoxyethylene alkyl ether to an aqueous cleaning liquid in a wiping sheet that includes a nonwoven fabric containing cellulose fibers and includes the aqueous cleaning liquid containing a quaternary ammonium salt, the extracted liquid from the wiping sheet has an excellent microbial removal effect, an excellent antimicrobial effect, and an excellent virus removal effect.

Industrial Applicability

[0089]

In the wiping sheet of the present invention, a quaternary ammonium salt is prevented from adsorbing to cellulose fibers without reducing hygiene. Hence, a sufficient amount of the quaternary ammonium salt is fed to a surface to be wiped, and the surface to be wiped becomes highly hygienic.

CLAIMS

1. A wiping sheet comprising:

a nonwoven fabric containing cellulose fibers; and

an aqueous cleaning liquid infiltrated into the nonwoven fabric, wherein

the aqueous cleaning liquid contains a quaternary ammonium salt and a nonionic surfactant.

2. The wiping sheet according to claim 1, wherein A + B is 0.01% by mass or more and 12% by mass or less where A is a content (% by mass) of the nonionic surfactant contained in the aqueous cleaning liquid, and B is a content (% by mass) of the quaternary ammonium salt in the aqueous cleaning liquid.

3. The wiping sheet according to claim 1 or 2, wherein A/B is 1 or more and 100 or less where A is the content (% by mass) of the nonionic surfactant contained in the aqueous cleaning liquid, and B is the content (% by mass) of the quaternary ammonium salt in the aqueous cleaning liquid.

4. The wiping sheet according to any one of claims 1 to 3, wherein the nonionic surfactant is a polyoxyalkylene alkyl ether.

5. The wiping sheet according to claim 4, wherein the polyoxyalkylene alkyl ether is a polyoxyethylene alkyl ether, and

the polyoxyethylene alkyl ether has an ethylene oxide number of 15 or more.

6. The wiping sheet according to claim 4, wherein the polyoxyethylene alkyl ether having an ethylene oxide number of 20 or more and the polyoxyethylene alkyl ether having an ethylene oxide number of less than 12 are contained.

7. The wiping sheet according to any one of claims 1 to 6, wherein the quaternary ammonium salt is benzalkonium chloride.

8. The wiping sheet according to any one of claims 1 to 7, wherein dipropylene glycol, phenoxyethanol, or methylparaben is further contained.

9. The wiping sheet according to any one of claims 1 to 8, wherein a mass of the cellulose fibers in 1 m^2 of the nonwoven fabric is 5 g/m^2 or more and 60 g/m^2 or less.

10. The wiping sheet according to any one of claims 1 to 9, wherein a proportion of the aqueous cleaning liquid infiltrated into the nonwoven fabric is 50% by mass or more and 800% by mass or less relative to a mass of the nonwoven fabric.

11. The wiping sheet according to any one of claims 1 to 10, wherein a rate of a mass of the aqueous cleaning liquid in 1 g of the nonwoven fabric to a mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is 0.005 or more and 1.0 or less.

12. The wiping sheet according to any one of claims 1 to 11, wherein a rate of a mass of the quaternary ammonium salt in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is 0.000 01 or more and 0.001 or less.

13. The wiping sheet according to any one of claims 1 to 12, wherein a rate of a mass of the nonionic surfactant in the aqueous cleaning liquid in 1 g of the nonwoven fabric to the mass of the cellulose fibers in 1 m^2 of the nonwoven fabric (g/m^2) is 0.000 05 or more and 0.04 or less.