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(54) KIT FOR COLOURING DISINFECTED REGIONS OF A SURFACE

(57) The invention relates to a kit for the coloring of disinfected areas of a surface, the kit comprising
a) at least one swab of surgical gauze and
b) liquid disinfectant,
wherein the swab is dry and is dyed with colorant, and the liquid disinfectant, when brought in contact with the at least one dry swab, dissolves the colorant at least partially, to result in a swab impregnated with colored disinfectant.

According to the invention, kits can be put together such that customary swabs from surgical gauze can be dyed. The colorant is then dissolved from the swab using the disinfectant, so as to result in a colored disinfectant. The colored disinfectant can be used to indicate disinfected areas.

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Description

[0001] The invention relates to a kit for colouring disinfected regions of a surface, comprising a) at least one dry and coloured swab made of absorbent gauze, and b) liquid disinfectant. The invention further relates to the kit for use in a method for disinfecting skin or mucous membrane. The invention relates, moreover, to a dry and coloured swab made of absorbent gauze and to the corresponding use of a liquid disinfectant.

[0002] The normal procedure in pre-operative disinfection of skin or mucous membrane is as follows:

- The disinfectant is put into a kidney bowl or other container.
- Sterile swabs are already in the container or are placed subsequently into the solution, and the swabs are fully impregnated with the solution.
- The impregnated swabs are taken from the solution with dressing forceps or another device, and the site for disinfection is treated.

[0003] With certain applications of antiseptic disinfectants, a coloured identification of the treated surface (such as skin or mucous membrane) is desirable, as for example prior to a surgical intervention, such as an operation for example.

[0004] In the case of the DuraPrep® product from 3M, a solution containing 74 wt% isopropanol and an iodine-acrylate copolymer complex is delivered from an applicator. The complex is coloured and releases iodine. Increasingly, however, products containing iodine are criticized by users on account of the in some cases adverse properties of the active ingredient.

[0005] There are also skin antiseptics on the market that are coloured with additional dye, where the active ingredients are, for example, nonionic (e.g. the coloured product Kodan® Tinktur forte from Schülke & Mayr GmbH, with 45 wt% 2-propanol, 10 wt% 1-propanol, 0.2 wt% 2-biphenylol, H_2O_2, and the dyes E104, E110 and E151).

[0006] DE 41 37 548 A1 discloses active antimicrobial ingredient combinations based on acridine dyes (which have an inherent antimicrobial effect), optionally in combination with other active antimicrobial ingredients. Acridine dyes are associated with carcinogenic properties, and it is inappropriate, accordingly, to use these dyes in disinfectant preparations for application on human skin.

[0007] DE 199 01 526 A1 discloses an antiseptic particularly for the control of HIV and HBV, this antiseptic comprising defined amounts of 1-propanol, 2-propanol and ethanol. The optional presence of dyes is additionally envisaged.

[0008] DE 10 2007 030 416 A1 describes alcoholic antiseptics which contain 50 or more wt% of alcohol having 1 to 3 carbon atoms, dye and optionally further active antimicrobial ingredients. Alongside a broad multiplicity of dyes, a broad multiplicity of the optional antimicrobial additives is disclosed.

[0009] WO 2007/062306 A2 describes methods for coating surfaces. Here, a composition which comprises antimicrobial agent is cured on the surface by means of heat, and the composition may include a dye. The surface is typically an inanimate surface (the surface of a medical device, for example).

[0010] US 5,244,666 A describes surgical and wound disinfectants which contain quaternary ammonium compound and dye.

[0011] WO2009/058144 A1 discloses an antiseptic solution which comprises a micellar complex and an active cationic antiseptic ingredient, the complex being composed of cationic auxiliary and anionic dye. Examples of cationic auxiliaries are quaternary ammonium compounds. The solution is applied using an applicator. WO02/082907 A1 as well describes complexes of antiseptics with dyes: described by way of example therein are compositions with chlorhexidine, which to be effective must be employed at a comparatively high concentration.

[0012] WO97/46622 A2 describes the use of natural or nature-identical synthetic dyes for the marking or colouring of materials, and mentions the marking of operation sites by means of dye-containing disinfecting solution or using marker pens.

[0013] WO02/091832 A1 describes two-component disinfecting systems where the first component comprises chlorite and the second component comprises acid and optionally oxidizable dye. The use of two-component disinfectants is costly and inconvenient, and in the hospital sector the use of agents which release chlorine is also fundamentally inappropriate.

[0014] WO2006/077616 A1 addresses a system for visualizing contaminated regions, using a film with controlled release of coloured substances.

[0015] WO2007/100654 A2 discloses a method for monitoring microorganisms, in which a surface is coated with a removable composition that forms an antimicrobial film.

[0016] WO2008/032212 A2 is concerned with coloured or colourable, foamable liquid compositions for topical application, where the colouring of the composition differs from that of the foam produced from it.

[0017] WO2009/138890 A2 describes a wipe made of fibrous material, with beads being included in the fibrous material, the beads enclosing an active ingredient. When the beads are moistened, they rupture and release the active ingredient.

[0018] Established on the US market for skin antiseptic is chlorhexidine digluconate (hereinafter "chlorhexidine") in

combination with 70% 2-propanol (e.g. the product ChloraPrep®). The concentration of the cationic active ingredient chlorhexidine in ChloraPrep® is 2 wt%.

[0019] The ChloraPrep® product is applied by means of an applicator. There is an uncoloured version and a coloured version. In the case of the commercial embodiment of the applicator for applications where coloured identification of the disinfected region is desired (cf. *inter alia* WO2007/130981 A2 and WO2004/083905 A2), a glass ampoule with the chlorhexidine-containing disinfectant is located in a plastic tube. Located in the front region of the tube, on the inside, is a felt which is coloured with the dye Yellow Orange S (E 110). Following this, sealed onto the end of the plastic tube, is a foam material which extends beyond the periphery of the plastic tube. For use, the glass ampoule is destroyed by exertion of pressure on the plastic tube laterally. The disinfectant then flows through the coloured felt, which delivers the dye to the disinfectant and also retains glass fragments. The coloured disinfectant then impregnates the foam material and is delivered from it again in order to disinfect skin or mucous membrane, and to provide disinfected regions with coloured identification, before and during an operation.

[0020] Because applicators of this kind have to be disposed of after use, they are disadvantageous to use on environmental grounds. Furthermore, a comparatively large amount of disinfectant remains in the plastic tube and in the foam material and is therefore not used. Accordingly, an applicator of this kind is unsuitable for those disinfectants which include a lower concentration of active antiseptic ingredient than ChloraPrep®. With the applicator described, moreover, it is not possible to influence the concentration of the dye and hence the intensity of the colouring of the disinfectant emerging from the applicator, depending on the natural colour of the patient's skin and on the lighting within the operating theatre. Lastly, for measures to be implemented aseptically, the applicators, which are comparatively large, must be sterile and hence packaged in a fully sterile manner prior to application, and consequently there is also a lot of packaging waste.

[0021] According to WO2014/043354 A1 (US2014/0081222 A1) an antiseptic based on chlorhexidine or octenidine is applied with the aid of a hydrophilic, solid (polyurethane) foam. According to WO2014/043199 A1 (US2014/0081221 A1), the solid (polyurethane) foam is hydrophobic. The antiseptic may be coloured, or may become coloured by dye included within the foam. The use of polyurethane foams, however, is not in line with the routine procedure for skin disinfection.

[0022] The problem addressed by the present invention was therefore that of providing a system with which disinfected regions can be colouringly identified in a simple way. The system ought to be applicable to a large number of different active ingredients, and active ingredients used in different concentrations, in disinfectants, and for a multiplicity of different dyes. The system, moreover, ought not automatically to lead to excessive waste (including packaging waste).

[0023] It has now surprisingly emerged that this problem is solved by a kit for colouring disinfected regions of a surface, that comprises:

a) at least one swab made from absorbent gauze, and
b) liquid disinfectant,

where

- the at least one swab is dry and coloured with dye, and
- the liquid disinfectant, when contacted with the at least one dry swab, is able to leach the dye at least partly from the swab, to give a swab impregnated with coloured disinfectant.

[0024] Part of the basis of the invention is the finding that kits can be compiled in such a way that commercial swabs made of absorbent gauze can be coloured and that the dye then leaches when the disinfectant is used, to give a coloured disinfectant. The coloured disinfectant is then applied in a usual way, with the impregnated swab, to the area that is to be disinfected. The swab hence serves both as a carrier for the dye and as a carrier for the subsequent application of the (coloured) disinfectant for disinfecting. By using swabs with lesser or greater colouring, the desired intensity of the colouring of the disinfectant is achieved in a simple way. In accordance with the invention, moreover, there is no need to modify the routine disinfectant procedure using swabs made of absorbent gauze.

Coloured swab

[0025] The kit comprises a) at least one swab made of absorbent gauze. The absorbent gauze is preferably in accordance with EN 14079:2003, i.e. the absorbent gauze is designed in a manner defined in EN 14079:2003.

Swab material

[0026] The absorbent gauze is therefore preferably made from woven fabric, in contrast to the coloured material of

the Chlora-Prep® applicators (which is made from felt: an unordered fibre material which is difficult to separate, i.e. a nonwoven textile).

[0027] It is preferred, moreover, for the woven fabric of the absorbent gauze to comprise cotton, and hence for the absorbent gauze to be designed in the manner defined specifically in EN 14079:2003 as per 3.1. Especially preferred is an embodiment in which the woven fabric consists essentially of cotton, and preferably consists of cotton.

[0028] In accordance with the invention it is further preferred for the dye to be adsorbed on the fibres of the swab. The dye is therefore in particular not contained in beads (cf. WO2009/138890 A2).

[0029] Typical swab sizes are pea-sized, hazelnut-sized, walnut-sized, plum-sized, egg-sized, extra-sized or fist-sized.

[0030] Typical packaging units vary in size and contain 4, 5, 10, 20, 100, 250, 500 or even 1000 swabs per packaging unit.

[0031] Since the coloured swabs must generally be available in sterilized form, the skilled person should ensure by appropriate selection that the dyes employed permit sterilization. This means that the nature of the coloured swabs (i.e. the swab material and the dye) must be such that they are not altered or destroyed by typical sterilizing techniques. Examples of sterilizing techniques are sterilization with gamma radiation, electron beams or ethylene oxide.

[0032] It is therefore preferred for the at least one swab a) to be packaged separated, with the swab preferably having been sterilized with the packaging, and the packaging also ensuring the sterility.

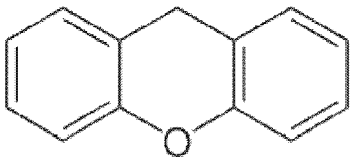
[0033] With particular preference the dry swab contains no active antimicrobial ingredient.

Dye of the swab

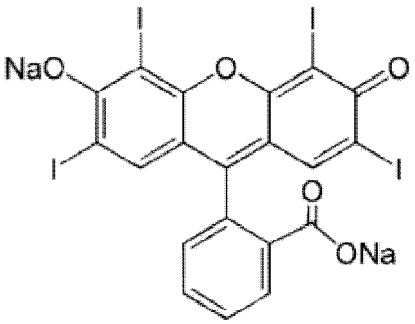
[0034] The dye of the swab is preferably selected from a1) xanthene dyes, a2) azo dyes, a3) polyterpene compounds, a4) triarylmethane dyes, a5) quinophthalone dyes and mixtures thereof, where the dye is preferably selected from a1) xanthene dyes, a2) azo dyes, a3) polyterpene compounds and mixtures thereof.

i. Xanthene dyes

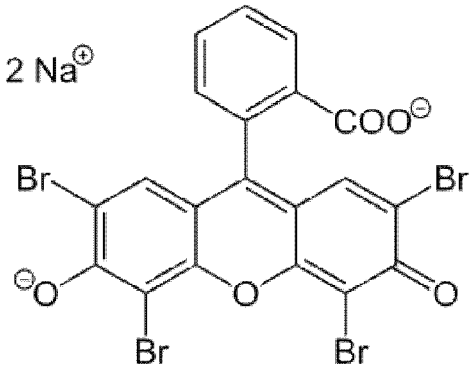
[0035] Xanthene is a tricyclic ether. The xanthene dyes, for example the rhodamines, fluorescein and also eosin B and eosin Y, have the xanthene parent structure:



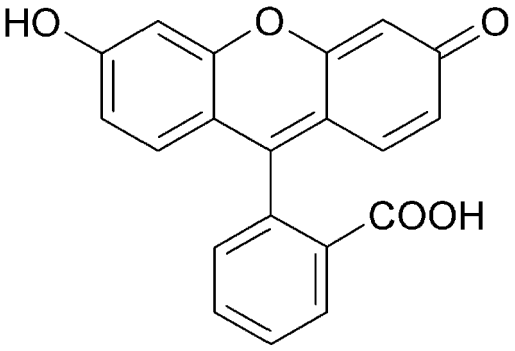
Xanthene



Erythrosine



Eosin Y



Fluorescein

[0036] Uranine is the sodium salt of fluorescein. D&C RED 27 is 2',4',5',7'-tetrabromo-4,5,6,7-tetrachlorofluorescein

(2',4',5',7'-tetrabromo-4,5,6,7-tetrachloro-3',6'-dihydroxy-spiro[isobenzofuran-1(3H),9'-[9H]xanthen]-3-one). D&C Orange 5 is 4',5'-dibromofluorescein (4,5-dibromo-3,6-dihydroxy-spiro[isobenzofuran-1(3H),9-[9H]xanthen]-3-one).

[0037] The xanthene dye is preferably selected from erythrosine, eosin, uranine, D&C Orange 5, D&C Red 27 and phloxine B; very preferably, component b) is erythrosine.

ii. Azo dyes

[0038] The azo dye is preferably a monoazo dye, and the monoazo dye is preferably selected from D&C Orange 4, Fastyellow and D&C Red 33; more particularly component b) is D&C Orange 4.

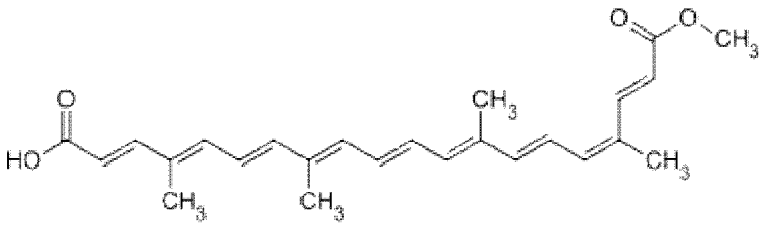
iii. Polyterpene compounds

[0039] The polyterpene compound is preferably an isoprenoid, more particularly a carotenoid, and the carotenoid in turn is preferably selected from carotene dyes and xanthophyll dyes.

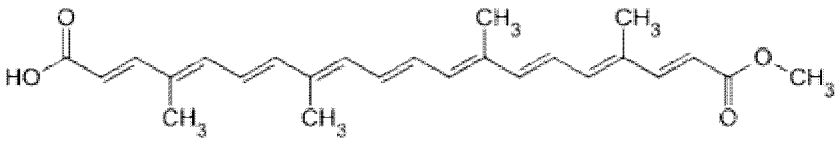
[0040] Carotenes are pure hydrocarbons; xanthophylls are hydrocarbons oxidized with oxygen. Frequently occurring primary carotenoids are β-carotene, a representative of the carotenes, and also lutein, violaxanthin and neoxanthin as representatives of the xanthophylls.

[0041] The xanthophyll dye is selected for example from lutein and the annatto dyes cis- or trans-bixin and cis- or transnorbixin, with component b) being more particularly lutein (4-[18-(4-hydroxy-2,6,6-trimethylcyclohex-2-enyl)-3,7,12,16-tetramethyloctadeca-1,3,5,7,9,11,13,15,17-nonaenyl]3,5,5-trimethyl-cyclohex-3-enol, E161b).

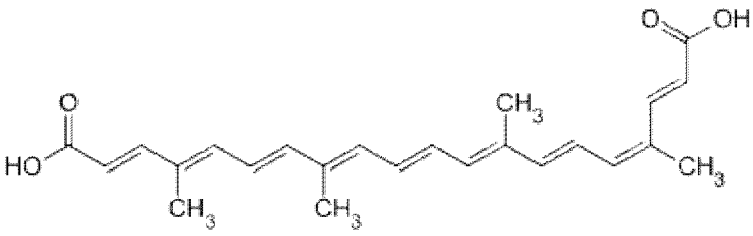
[0042] Norbixin (a xanthophyll) is a natural dye which is obtained by extraction from the seeds of the roucou or achiote plant annatto (Bixa orellana). Norbixin can be obtained by removing the outer layer of the prepared seeds of the annatto tree (Bixa orellana) by grinding down of the seeds in cold water and subsequent extraction through solvents such as acetone, methanol or hexane, for example. The solution resulting from this process is acidified bixin (this being the methyl ester of the acid norbixin), which is then filtered and dried, with the precipitate being ground. The precipitate contains primarily cis- and trans-bixin, with the principal dye being cis-bixin. With alkaline lye, norbixin can be obtained as the corresponding salt, where again it is cis-norbixin which is the principal dye.



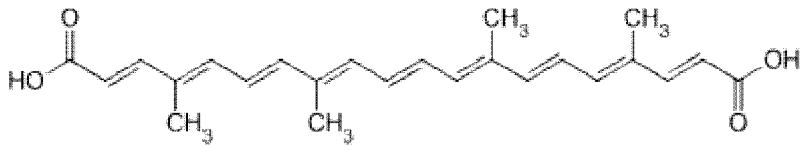
cis-bixin



trans-bixin



cis-norbixin

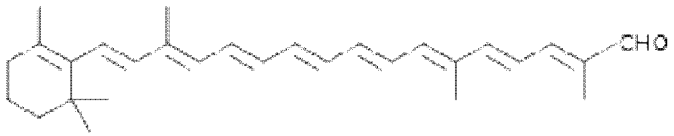


trans-norbixin

[0043] If the dye is E160b (annatto, bixin, norbixin), it is preferably stabilized (for example with propylene glycol and Polysorbat 80, Annatto® AS).

[0044] The carotene dye is selected for example from beta-carotene and 8'-apo-beta-caroten-8'-al.

[0045] 8'-Apo-β-caroten-8'-al is a carotenoid. It occurs naturally, for example, in oranges, vegetables and liver, but is nowadays principally synthesized. In the EU it is approved as a food additive, with the number E 160e.



8'-apo-β-caroten-8'-al

[0046] With particular preference the carotene dye is an annatto dye.

iv. Triarylmethane dyes

[0047] When the dye is a triarylmethane dye, it is preferably selected from Patent Blue V, Fast Green FCF, Bromocresol Green, Brillant Blue G and Bromothymol Blue.

v. Quinophthalone dyes

[0048] A preferred quinophthalone dye is Quinoline Yellow.

[0049] With particular preference the dye is selected from i) annatto dyes, ii) a mixture of D&C Orange 4 with erythrosin and iii) a mixture of annatto dyes with D&C Orange 4 and erythrosin.

[0050] The dye is applied to the absorbent gauze swab in a conventional way, as for example from an aqueous solution. For this purpose the swab is impregnated with the aqueous dye solution and dried, and then is optionally treated with the selected sterilization method. The skilled person is aware of a multiplicity of dyes which are compatible with absorbent gauze made from cotton, for example. The skilled person is also able without problems, and where appropriate with minimal experimental effort, to identify those dyes which are compatible with a particular sterilization method.

[0051] It is preferred, moreover (though not mandatory) for the at least one swab to have an X-ray contrast thread. X-ray contrast threads of this kind are known and serve for subsequent identification of swabs which have mistakenly remained inside a closed operation wound, and which can then be removed. It is preferred for the at least one X-ray contrast thread to be coloured and for the colour of the X-ray contrast thread to differ from the colour of the swab, thereby facilitating the identification of the swab during the operation as well. One exemplary X-ray contrast agent which is preferred and is present in the X-ray contrast thread is barium sulphate.

[0052] The carrier material of the X-ray contrast thread may differ from the material of the absorbent gauze (preferably cotton), and a typical material for the X-ray contrast thread is a synthetic polymer such as polypropylene or polyester.

[0053] The dry swab preferably contains no active antimicrobial ingredient; in other words, the swab consists wholly of cotton, optionally with the added X-ray contrast thread.

Disinfectant

[0054] As well as a) swab the kit further and necessarily comprises b) liquid disinfectant. The skilled person is aware of suitable disinfectants.

[0055] The disinfectant comprises preferably b1) one or more alcohols selected from aliphatic and aromatic alcohols and mixtures thereof. Typical and preferred as component b1) are one or more aliphatic alcohols.

[0056] The aliphatic alcohol is preferably a C_2 to C_6 alkyl alcohol, such as, for example, ethanol, propanol, butanol and mixtures thereof, more particularly ethanol and propanol and mixtures thereof. The concentration of the aliphatic alcohol in the disinfectant is typically at least 5 wt%, preferably at least 30 wt%, more preferably at least 40 wt%, more

particularly 50 to 90 wt%. In the case of n-propanol, even the low concentrations from 10 wt% up are very effective (more particularly between 30 and 50 wt%). In the case of the sole use of an aliphatic alcohol, the use of isopropanol is preferred over the use of n-propanol, and the use of isopropanol is preferred over the use of ethanol. The disinfectant frequently comprises mixtures of aliphatic alcohols as b1).

Ethanol

[0057] If ethanol is used as aliphatic alcohol, a preferred amount in the disinfectant of the invention is at least 30 wt%, preferably at least 40 wt%, more particularly at least 60 wt%, as for example at least 80 wt%. When a specific aim is to control aerobic sporulating bacteria such as *Bacillus* spp., then the amount of ethanol in the disinfectant is preferably not more than 90 wt%, more preferably not more than 80 wt%, with an amount of ethanol of 60 wt% being the most preferred.

Isopropanol (2-propanol)

[0058] When using isopropanol as aliphatic alcohol, the preferred amount in the disinfectant is at least 10 wt%, more preferably at least 30 wt%.

n-Propanol (1-propanol)

[0059] If n-propanol is used as aliphatic alcohol in the disinfectant, then the concentration is preferably at least 4 wt%, more preferably at least 10 wt%, more particularly at least 20 wt%.

Mixtures of ethanol and isopropanol

[0060] In a further embodiment, the disinfectant comprises a mixture of ethanol and isopropanol as aliphatic alcohol. Preferred concentrations of ethanol are 60 to 85 wt%, more preferably 65 to 80 wt%, more particularly 70 to 80 wt%. Preferred concentrations of isopropanol are 1 to 15 wt%, such as 2 to 12 wt%.

Mixtures of isopropanol and n-propanol

[0061] In a further preferred embodiment, the disinfectant comprises a mixture of isopropanol and n-propanol as aliphatic alcohol. The concentration of isopropanol is preferably 5 to 55 wt%, more preferably 15 to 50 wt%, more particularly 25 to 50 wt%, such as 28 to 48 wt%. Preferably the amount of n-propanol is 5 to 50 wt%, preferably 10 to 45 wt%, more particularly 20 to 35 wt%.

Mixtures of ethanol and n-propanol

[0062] In a further preferred embodiment, mixtures of ethanol and n-propanol are used as component b1) in the disinfectant. A preferred concentration of ethanol in the disinfectant is 10 to 50 wt%, more preferably 20 to 30 wt%, such as, for example, about 25 wt%. A preferred concentration of n-propanol is 30 to 50 wt%, preferably 35 to 45 wt%.

Mixtures of ethanol with n-propanol and isopropanol

[0063] Mixtures of ethanol with isopropanol and n-propanol as component b1) are especially preferred. A preferred concentration of ethanol is 10 to 30 wt%, such as about 20 wt%. A preferred amount of isopropanol is 20 to 40 wt%, such as about 30 wt%. Preferably the amount of n-propanol is 15 to 35 wt%, such as about 25 wt%.

[0064] In all embodiments of the invention a preferred aliphatic alcohol is propanol, i.e. n-propanol, isopropanol and mixtures thereof.

[0065] Alternatively to the one or more aliphatic alcohols (or additionally) it is possible for one or more aromatic alcohols to be present as component b1) in the disinfectant of the invention.

Aromatic alcohol

[0066] The aromatic alcohol (or the optionally two or more aromatic alcohols) preferably comprises (i) aryloxyalkanol (i.e. glycol monoaryl ether) or (ii) arylalkanol.

[0067] Preferred aryloxyalkanols (i) are selected from phenoxyethanol and phenoxypropanol, preferably phenoxyethanol.

[0068] Preferred arylalkanols (ii) are selected from 3-phenylpropan-1-ol, phenethyl alcohol, veratryl alcohol, benzyl alcohol or 2-methyl-1-phenyl-2-propanol, preferably 3-phenylpropan-1-ol, phenethyl alcohol, veratryl alcohol or 2-methyl-1-phenyl-2-propanol, more particularly phenethyl alcohol.

[0069] In all embodiments of the invention it is preferred for the aromatic alcohol to be selected from benzyl alcohol, phenoxyethanol and phenethyl alcohol; more particularly preferred as component b) are phenethyl alcohol or phenoxyethanol.

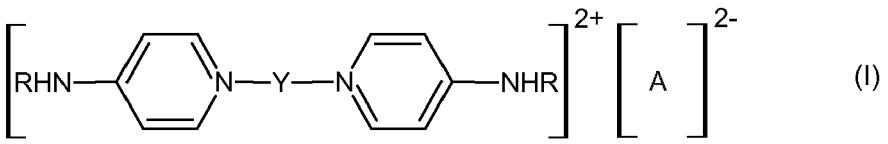
[0070] In one embodiment of the invention, the aromatic alcohol is not benzyl alcohol, since in certain circumstances an odour may develop over time as a result of formation of benzaldehyde (since benzyl alcohol is sensitive to oxidation). In one embodiment of the invention, therefore, the composition of the invention is free from benzyl alcohol. In an alternative embodiment, if benzyl alcohol is present, there is (are) additionally one (or more) different aromatic alcohol(s), i.e. aromatic alcohol(s) different from benzyl alcohol.

[0071] In one preferred embodiment the disinfectant comprises b2) at least one active antiseptic ingredient selected from peroxide compounds, quaternary ammonium salts, phenolic compounds, hexetidine and mixtures thereof.

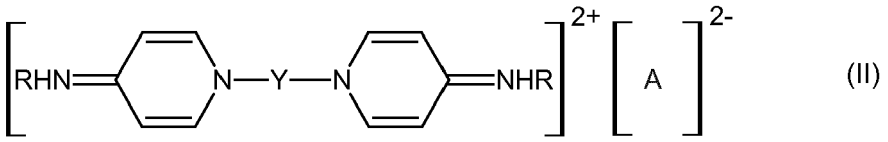
[0072] The peroxide compound is preferably hydrogen peroxide.

[0073] The quaternary ammonium salt is preferably selected from benzalkonium chloride, bispyridiniumalkanes (preferably octenidine dihydrochloride, hereinafter "octenidine"), chlorhexidine and polyhexamethylenebiguanide (hereinafter "polyhexanide").

[0074] The term "bispyridiniumalkane" here encompasses the bis [4-(substituted amino)-1-pyridinium]alkanes that are disclosed in DE 27 08 331 C2, of the general formulae (I) or (II)



(I)



(II)

in which

Y is an alkylene group having 4 to 18 carbon atoms,

R is an alkyl group having 6 to 18 carbon atoms or a cycloalkyl group having 5 to 7 carbon atoms or the phenyl radical, which is substituted by a halogen atom, and

A is an anion or a plurality of anions.

[0075] The definition above of A applies strictly speaking to monovalent and divalent anions, but A can of course also be a multivalent anion, e.g. phosphate or orthosilicate. The term "bispyridiniumalkane" further encompasses the various prototropes of the compounds of the formula (I), as is disclosed in DE 196 47 692 A1, for example.

[0076] In all embodiments of the invention, however, it is preferred for the bispyridiniumalkane to be octenidine dihydrochloride (R = n-octyl, Y = n-decenyl; A = 2 × Cl, "octenidine"). With particular preference, therefore, the active ingredient b1) is octenidine.

[0077] Other cationic surfactants as well, such as quaternary ammonium salts, are a suitable active antiseptic ingredient. In principle it is possible in accordance with the invention to use all suitable quaternary ammonium compounds. The quaternary ammonium compound is preferably a dialkyldimethylammonium salt.

[0078] Quaternary ammonium salts used in accordance with the invention are represented for example by the formula $[R^1R^2R^3\ (CH_3)\ N]^+\ [X]^-$, where R^1 to R^3 may be identical or different and are selected from C_1 to C_{30} alkyl, aralkyl, alkenyl and mixed groups, which may have one or more atoms selected from 0, S, N and P, where R^1 to R^3 for example are C_8 to C_{18} alkyl, benzyl or methyl, preferably C_9 to C_{18} alkyl, benzyl or methyl, such as C_{16} alkyl, benzyl or methyl. X is an anion (of an organic or inorganic acid). Both anion and cation of the quaternary ammonium salt here may be multivalent ions, resulting in a stoichiometry $[A^{(n+)}]_m[K^{(m+)}]_n$.

[0079] Suitable quaternary ammonium salts in accordance with the invention are all quaternary ammonium salts known in the prior art and of the formula above, of the kind that are disclosed, for example, in WO 00/63337 A, hereby referenced. Preference, however, is given to using dialkyldimethylammonium salts, as for example dialkyldimethylammonium chlorides, whose alkyl chains are selected independently of one another from C_8 to C_{18} alkyl, preferably C_9 to C_{18} alkyl, such as C_{16} alkyl. In the case of the dialkyldimethylammonium salts, one of the methyl groups may be an alkoxylated, for example ethoxylated, hydromethyl group.

[0080] Quaternary ammonium salts used preferably in accordance with the invention are compounds of the formulae $[R^1N(CH_3)3]^+[X]^-$, $[R^1R^2N(CH_3)^2]^+[X]^-$ and $[R^1R^2R^3(CH^3)N]^+[X]^-$, where R^1 to R^3 are selected independently of one another from C_8 to C_{18} alkyl and $-(CH_2-CHR^4O)_n-R^5$, where n is a number from 1 to 20, preferably 1 to 5, and R^4 and R^5, which may be identical or different, are H and/or C_1 to C_4 alkyl, preferably H.

[0081] Exemplary anions and classes of anions of the stated quaternary ammonium salts are hydroxide, sulphate, hydrogen sulphate, methosulphate, ethosulphate, lauryl sulphate, lauryl ether sulphate, cellulose sulphate, sulfamate, halide (fluoride, chloride, bromide, iodide), nitrite, nitrate, carbonate, hydrogencarbonate, phosphate, alkyl phosphate, metaphosphate, polyphosphate, thiocyanate (rhodanide), carboxylic salt such as benzoate, lactate, acetate, propionate, citrate, succinate, glutarate, adipate, toluenesulfonate (tosylate) and salicylate. Particularly preferred anions are chloride and propionate.

[0082] Employed with particular preference as surfactants are the quaternary ammonium salts mecetroniumetilsulfat (hexadecyl(ethyl)dimethylammonium ethylsulphate) and benzalkonium chloride.

[0083] Preferred amounts of component b2) in the disinfectant are 0.005 to 1.0 wt%, preferably 0.01 to 0.5 wt%, more preferably 0.03 to 0.3 wt%, even more preferably 0.04 to 0.2 wt%, such as 0.05 to 0.15 wt%, for example about 0.1 wt%, based in each case on the total weight of the disinfectant, especially so when component b2) comprises one or more quaternary ammonium salts; especially preferred as active antiseptic ingredient b2) is octenidine.

[0084] The phenolic compound is preferably o-phenylphenol.

[0085] The disinfectant b) preferably contains no added dye, and more preferably the disinfectant has no inherent colour.

[0086] It is especially preferred if

a) the dye of the swab is selected from i) annatto dyes, ii) a mixture of D&C Orange 4 with erythrosine, and iii) a mixture of annatto dyes with D&C Orange 4 and erythrosine, and
b) the disinfectant comprises b1) one or more aliphatic alcohols and b2) octenidine.

[0087] Besides the optional components b1) and b2) (with aliphatic alcohols being preferred as component b1)), the disinfectant of the invention, in one preferred embodiment, comprises one or more of the following optional components b3):

- one or more further surfactants,
- one or more solvents and/or
- one or more further active ingredients and/or auxiliaries.

Surfactant

[0088] Present as an optional constituent in the disinfectant of the invention are anionic, amphoteric and/or nonionic surfactants, preferably amphoteric or nonionic surfactants. Particularly if they are present in a comparatively small amount, these surfactants may have a supporting effect for the activity of the active antiseptic ingredient. If they are present at higher use concentrations in the disinfectant, then these surfactants may have an antimicrobial activity or may contribute substantially to such activity.

[0089] Nonionic surfactant used may comprise all suitable nonionic surfactants, with (i) (fatty) alcohol ethoxylates, (ii) sorbitan esters, (iii) alkylglycosides (more particularly alkylpolyglucosides), (iv) amine oxides and (v) ethylene oxide/propylene oxide block copolymers being preferred.

[0090] The (i) alcohol polyalkoxylates include fatty alcohol alkoxylates, e.g. isodecyl ethoxylates with different fractions of ethylene oxide, isotridecyl ethoxylates, polyethylene glycol ethers of stearyl alcohol, of lauryl alcohol and of cetyl alcohol and of oleyl alcohol. The alcohols here may have been alkoxylated with ethylene oxide, propylene oxide or any desired mixtures of ethylene oxide and propylene oxide. Alcohol polyalkoxylates are known by names including the designations Lutensol®, Marlipal®, Marlox®, Brij® and Plurafac®. Particularly preferred as nonionic surfactant are lauryl alcohol ethoxylates.

[0091] Additionally used as nonionic surfactants (ii) are sorbitan esters, which are mostly present as oleates, stearates, laurates and palmitates and which are referred to as polysorbates (e.g. Tween®).

[0092] Furthermore, the nonionic surfactant may be an (iii) alkylglycoside, such as an alkylglucoside (i.e. an alkylglycoside of glucose), more preferably a C_8 to C_{20} alkylpolyglucose, more particularly a C_8 to C_{16} alkylpolyglucose of a fatty alcohol, with preference being given to a laurylpolyglucose, a decylpolyglucose or a mixture thereof. The C chain length is 8 to 16 atoms in the case of the cocoylpolyglucose, 12 to 16 C atoms in the case of the laurylpolyglucose, and likewise 8 to 16 C atoms in the case of the decylpolyglucose.

[0093] A typical amount of alkylglycoside is 0.03 to 10 wt%, preferably 0.06 to 5 wt%, more particularly 0.1 to 2 wt%.

[0094] As (iv) amine oxide it is possible in accordance with the invention to use in principle all suitable amine oxides. The amine oxides, which are N-oxides of tertiary amines, include aliphatic amine oxides, cyclic amine oxides (such as N-alkylmorpholine oxide) and aromatic amine oxides (such as pyridine N-oxides). In one preferred embodiment the amine oxide possesses the general formula

$$R^1R^2R^3N\text{-}O,$$

in which R^1 is methyl, ethyl or 2-hydroxyethyl, R^2 is methyl, ethyl or 2-hydroxyethyl, R^1 and R^2 together may be morpholine, R^3 is alkyl having 8 to 18 carbon atoms or $R^4CONH(CH_2)_n$, where R^4 is alkyl having 8 to 18 carbon atoms and n is in the range from 1 to 10, preferably 1 to 5, more preferably 2 to 4, and more particularly 3, and 2-hydroxyethyl may be condensed with 1 to 2000 ethylene oxide, ethylene oxide/propylene oxide or propylene oxide units.

[0095] Exemplary amine oxides are cocamidopropylamine oxide, N-cocomorpholine oxide, decyldimethylamine oxide, dimethylcetylamine oxide, dimethylcocamine oxide, dimethyl-hydrogenated tallow-amine oxide, dimethyllaurylamine oxide, dimethylmyristylamine oxide, (2-hydroxyethyl)cocamine oxide and oleamine oxide; see also "International Cosmetic Ingredient Dictionary and Handbook", 10th edition 2004, Volume 3, pages 2268-2275 (Surfactants-Cleansing Agents).

[0096] In one preferred embodiment the amine oxide is cocamidopropylamine oxide, i.e. R^4CO represents the acyl radical derived from the fatty acids from coconut oil, n = 3, and R^1 and R^2 are methyl. This product is sold as Rewominox B 204 by Evonik, Federal Republic of Germany.

[0097] A typical amount of amine oxide is 0.03 to 10 wt%, preferably 0.06 to 5 wt%, more particularly 0.1 to 2 wt%.

[0098] Likewise suitable as surfactant are amphoteric surfactants, examples being betaines. Suitable betaines are described in EP 560 114 A2. Particularly preferred is cocamidopropyl betaine. A typical amount of betaine is 0.03 to 10 wt%, preferably 0.06 to 5 wt%, more particularly 0.1 to 2 wt%.

Solvents

[0099] Furthermore, the disinfectant optionally comprises solvents. Preferred solvents are glycols and water and also mixtures thereof. A preferred solvent is water.

Further active ingredients and/or auxiliaries

[0100] Examples of active ingredients and/or auxiliaries which may optionally be present in disinfectants of the invention are skincare additives, refatting agents, perfumes, fragrances, thickeners, pH regulators and humectants. These include:

- polyols which act as skincare additives, refatting agents and humectants, such as glycerol, propylene glycol, erythritol, 1,2,6-hexanetriol, inositol, lactitol, maltitol, mannitol, methylpropanediol, phytantriol, polyglycerols, sorbitol and xylitol, with glycerol and propylene glycol being particularly preferred,
- glycerol esters, preferably glycerol cocoate, isopropyl myristate, isopropyl palmitate, and triglycerides, which act as refatting agents,
- cellulose derivates as thickeners,
- pH regulators such as sodium gluconate, lactic acid and the salts thereof (such as sodium lactate), citric acid and the salts thereof, and/or
- allantoin and dexpanthenol, which may act as skincare additives.

[0101] Present for example as optional active ingredients and/or auxiliaries are preferably the following constituents:

- polyol, such as glycerol, in an amount of 0.5 to 10 wt%, preferably 1 to 5 wt%, more preferably 1.5 to 3 wt%, such as 2 to 2.8 wt%, and/or
- glycerol monoalkyl ethers, such as 1-(2-ethylhexyl) glycerol ether in an amount of 0.01 to 5 wt%, preferably 0.02 to 2 wt%, more particularly 0.03 to 0.5 wt%, such as 0.04 to 0.06 wt%.

[0102] The disinfectant of the invention is liquid. It is preferably an aqueous, an aqueous-alcoholic or an alcoholic solution. The disinfectant wets the swab immediately on contact and dissolves the dye that is present in the swab, this dissolution being at least partial and preferably substantially complete.

[0103] Ultimately it is preferred for the disinfectant used in accordance with the invention not to contain any added dye.

[0104] Exemplary formulations for disinfectants 1 to 4 used in accordance with the invention are listed below (amounts in wt%):

	Component b1)	Component b2)
1	- 10 to 65%, preferably 20 to 55%, such as about 45% of isopropanol, and - 10 to 50%, preferably 20 to 40%, such as about 30% of n-propanol	0.02 to 0.5%, preferably 0.05 to 0.2%, such as about 0.1% of octenidine
2	- 10 to 65%, preferably 20 to 55%, such as about 45% of isopropanol, and - 3 to 20%, preferably 5 to 15%, such as about 10% of n-propanol	0.05 to 1%, preferably 0.1 to 0.5%, such as about 0.2% of o-phenylphenol, and 0.01 to 1%, preferably 0.05 to 0.25%, such as about 0.10% of hydrogen peroxide
3	40 to 85%, preferably 50 to 75%, such as about 63% of isopropanol	0.005 to 1.0 wt%, preferably 0.01 to 0.5 wt%, more preferably 0.03 to 0.3 wt%, more preferably still 0.04 to 0.2 wt%, such as 0.05 to 0.15 wt% of benzalkonium chloride
4	- 50 to 85%, preferably 65 to 80%, such as about 74.1% of ethanol - 3 to 20%, preferably 5 to 55%, such as about 10% of isopropanol	

Kit

[0105] The kit of the invention comprises a) swab and b) disinfectant. These constituents a) and b) need not necessarily be present together in packaged form. The disinfectant b) may therefore be present separately from constituent a), i.e. a) and b) may also be present in physically separate form.

[0106] It is possible, for example, for the invention to be realized by coloured swabs a) being present in packaged form, preferably at least two coloured swabs, more preferably at least three coloured swabs, more particularly at least five coloured swabs, as for example at least ten coloured swabs, at least 20 coloured swabs or at least 50 coloured swabs, which are packaged jointly (and preferably are sterile-packaged jointly), and additionally the use of the swabs together with a disinfectant is recommended or described in an in-pack leaflet, a usage recommendation or the like, without, therefore, disinfectant being present physically combined with the swab or swabs.

Application

[0107] The invention further relates to the kit for use in a method for disinfecting skin or mucous membrane, more particularly in humans. The method is preferably a pre-operative measure and/or a measure prior to puncture or injection, with the disinfection preferably being followed by a surgical intervention and/or by puncture or injection.

[0108] The usual procedure with the kit of the invention (in the case of pre-operative disinfection of skin or mucous membrane in hospitals, or in vessel puncture or injections) is therefore as follows:

- The disinfectant is put into a kidney bowl or other container.
- Coloured swabs are already in the container or are placed subsequently into the disinfectant, and the coloured swabs are fully impregnated with disinfectant.
- The swabs impregnated with coloured disinfectant are taken from the coloured disinfectant with dressing forceps or another device, and the site for disinfection is treated with the coloured disinfectant.

[0109] There is no fundamental change here to the skin or mucous membrane disinfection procedure with which the user (for example doctor or theatre nurse) is familiar, and so it can be assumed that the users will accept the kits of the invention and the technique described.

[0110] Solely through contact between the coloured swab and the disinfectant, therefore, dye is dissolved from the absorbent gauze, without any need for mechanical extraction of the dye from the absorbent gauze (mechanical action is necessary, for example, for the beads of WO2009/138890 A2 with enclosed active ingredients, since the beads have to be broken open). The dye therefore detaches from the fibres of the absorbent gauze when the swab is immersed (optionally a number of times) into the disinfectant.

[0111] For use with a patient, the impregnated sterile swabs are removed from the solution using dressing forceps, a clamp or another device and placed onto the area of skin/mucous membrane that is to be disinfected; subsequently, disinfection is carried out with the impregnated swabs, with the coloured disinfectant drawn up into the impregnated

swab being applied to the skin/mucous membrane regions that are to be disinfected. It may be necessary to repeat the procedure a number of times (each time with a fresh swab). The exposure time is governed by the specification of the disinfectant manufacturer for skin/mucous membrane disinfection. The required number of swabs and quantity of liquid is guided by the size of the area to be disinfected.

[0112] In accordance with the invention, the skin/mucous membrane area to be disinfected is coloured as a result of the colouring of the swabs and consequently of the skin/mucous membrane disinfectant. After use, the swabs and the excess disinfectant solution are discarded.

[0113] Furthermore, the invention relates to a dry swab made of absorbent gauze, which is coloured with dye, with the dye, when the swab is contacted with liquid disinfectant, being at least partly leached from the swab.

[0114] The invention further relates to a liquid disinfectant for use in a method for disinfecting skin or mucous membrane, where the method includes the colouring of disinfected regions of the skin or mucous membrane with a dye and where this dye is at least partly leached from a swab made of absorbent gauze.

[0115] Through use of different-coloured swabs, moreover, the possibility exists of colouring the skin/mucous membrane, or the areas of a patient's body that are to be disinfected, individually, according to requirement, prior to operation or to other medical measures such as vessel punctures, for example. Accordingly, safety is increased significantly for the patient and the doctor or medical personnel, by the visualization of where the skin/mucous membrane has been disinfected and/or whether there are parts of the body not sufficiently wetted with skin/mucous membrane disinfectant.

[0116] The intensity of the colouring of the disinfectant can be controlled through the amount of coloured swabs used.

[0117] The problem of the possibly inadequate long-term stability of relevant dyes in skin/mucous membrane disinfectants (as a result of interaction between dye and active antiseptic ingredient) is avoided, since the dye comes into contact only very briefly (during preparation and use) with the skin/mucous membrane disinfectant.

Claims

1. Kit for colouring disinfected regions of a surface, comprising:

   a) at least one swab made from absorbent gauze, and
   b) liquid disinfectant,
   where

   - the at least one swab is dry and coloured with dye, and
   - the liquid disinfectant, when contacted with the at least one dry swab, is able to leach the dye at least partly from the swab, to give a swab impregnated with coloured disinfectant.

2. Kit according to Claim 1, **characterized in that** the absorbent gauze is made from woven fabric, the woven fabric consisting preferably of cotton.

3. Kit according to Claim 1 or 2, **characterized in that** the dye is adsorbed on the fibres of the swab.

4. Kit according to any of the preceding claims, **characterized in that** the at least one swab a) is packaged separately, the swab having been sterilized preferably with the packaging, and the packaging also ensuring the sterility.

5. Kit according to any of the preceding claims, **characterized in that** the dye of the swab is selected from a1) xanthene dyes, a2) azo dyes, a3) polyterpene compounds, a4) triarylmethane dyes, a5) quinophthalone dyes and mixtures thereof,
   and where **preferably** the dye of the swab is selected from a1) xanthene dyes, a2) azo dyes, a3) polyterpene compounds and mixtures thereof,
   and where **more preferably** the dye is selected from i) annatto dyes, ii) a mixture of D&C Orange 4 with erythrosine and iii) a mixture of annatto dyes with D&C Orange 4 and erythrosine.

6. Kit according to any of the preceding claims, **characterized in that** the at least one swab additionally has an X-ray contrast thread,
   where **preferably** the X-ray contrast thread is coloured and the colour of the X-ray contrast thread differs from the colour of the swab.

7. Kit according to any of the preceding claims, **characterized in that** the swab is pea-sized, hazelnut-sized, walnut-sized, plum-sized, egg-sized, extra-sized or fist-sized,

where **preferably** the dry swab contains no active antimicrobial ingredient.

8. Kit according to any of the preceding claims, **characterized in that** the disinfectant b1) comprises one or more alcohols selected from aliphatic and aromatic alcohols and mixtures thereof,
where **preferably** the disinfectant comprises as component b1) one or more aliphatic alcohols.

9. Kit according to any of the preceding claims, **characterized in that** the disinfectant comprises b2) at least one active antiseptic ingredient selected from peroxide compounds, quaternary ammonium salts, phenolic compounds, hexetidine and mixtures thereof,
where **preferably**

a) the peroxide compound is hydrogen peroxide,
b) the quaternary ammonium salt is selected from benzalkonium chloride, bispyridiniumalkane (more particularly octenidine), chlorhexidine and polyhexanide,
c) the phenolic compound is o-phenylphenol.

10. Kit according to any of Claims 5 to 9, **characterized in that**

a) the dye of the swab is selected from i) annatto dyes, ii) a mixture of D&C Orange 4 with erythrosine, and iii) a mixture of annatto dyes with D&C Orange 4 and erythrosine,
b) the disinfectant comprises b1) one or more aliphatic alcohols and b2) octenidine.

11. Kit according to any of the preceding claims, **characterized in that** the disinfectant contains no added dye.

12. Kit according to any of the preceding claims for use in a method for disinfecting skin or mucous membrane, more particularly in humans.

13. Kit for use according to Claim 12, **characterized in that** the method is a pre-operative measure and/or a measure prior to puncture or injection,
where **preferably** the disinfection is followed by a surgical intervention and/or by puncture or injection.

14. Dry swab made from absorbent gauze, which is coloured with dye, the dye, when the swab is contacted with liquid disinfectant, being at least partly leached with the disinfectant from the swab.

15. Liquid disinfectant for use in a method for disinfecting skin or mucous membrane, the method including the colouring of disinfected regions of skin or mucous membrane with a dye, and the dye here being at least partly leached with the disinfectant from a swab made of absorbent gauze.

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 4321

DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 October 2015	Tiercet, Marc

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 16 4321

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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