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(54) **AQUEOUS COMPOSITION BASED ON POLYOXYMETHYLENE DIALKYL ETHERS (POM) AND THEIR USE FOR THE PRESERVATION AND/OR EMBALMING OF THE HUMAN OR ANIMAL BODY**

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(57) **ABSTRACT**

The invention relates to a composition comprising:

a) a mixture of polyoxymethylene dialkyl ethers (POM) having a restricted specific molecular distribution

b) at least one biocidal agent

c) at least one pro-penetrating agent

d) at least one dye

e) optionally, another additive

and water as diluent.

It also relates to a non-therapeutic method of preserving and/or embalming a dead human or animal body using the composition, such as the use of this composition for anatomopathological purposes.

AQUEOUS COMPOSITION BASED ON POLYOXYMETHYLENE DIALKYL ETHERS (POM) AND THEIR USE FOR THE PRESERVATION AND/OR EMBALMING OF THE HUMAN OR ANIMAL BODY

[0001] The present invention relates to an aqueous composition or formulation for the preservation of the dead human or animal body and/or for the embalming of said body, comprising a component which is a mixture of polyoxymethylene dialkyl ethers of general structure $R—(OCH_2)_n—OR'$ also called POM, having a restricted specific molecular distribution vs n and also comprising a biocide, a pro-penetrating agent, a dye, optionally another additive, and water as a diluent. It also relates to a non-therapeutic method using the composition for the preservation of the dead human or animal body and/or for the embalming of the body.

[0002] EP1938684 A1 already describes the non-therapeutic use of a composition comprising I) polyoxymethylene dialkyl ethers (POM) $R—(OCH_2)_nOR'$ with n from 1 to 8 and identical or different R, R' alkyls of C1-C5 and/or II) dialdehyde acetals, for the preservation and embalming of human or animal cadavers. No use of a specific composition of polyoxymethylene based on a mixture mainly based on dimers (POME and POMM/E), trimers, tetramers and pentamers or dimers (POME and POMM/E), trimers and tetramers in combination with a biocide, is disclosed or taught.

[0003] WO2010/001048 A1 discloses a composition comprising at least one POM with n from 1 to 8 and/or at least one dialdehyde acetal and at least one biocidal agent and, optionally, a pro-penetrating agent for preservation and/or embalming of human or animal bodies. No specific selection of POM is disclosed or taught.

[0004] WO2010/116075 A1 describes a composition comprising at least a POM with n from 2 to 8 and a diol of C2-C6 for non-therapeutic use for the preservation and/or embalming of human or animal bodies. No specific selection of POM composition is disclosed or taught.

[0005] In the formulation (composition) sought according to the invention, the composition of the polyoxymethylene dialkyl ethers must be free from volatile compounds in order to prevent the emanation of volatile products that present a danger to safety, the environment, hygiene and health upon being handled, and it also must be free from heavy compounds which can affect the fluidity of the composition at low temperatures down to <−10° C. when stored and dissolved in water. Also, for the composition to be authorized on the European market, the biocide used must be selected from class TP22 of the regulation on biocidal products (RPB, EU regulation No. 528/2012) which concerns the placing on the market and the use of biocidal products, which are used to protect humans, animals, materials or articles against harmful organisms, such as vermin and bacteria, by the action of the active substances contained in the biocidal product. Class TP22 refers specifically to fluids used for embalming and taxidermy, wherein active substances are used to disinfect and preserve the whole or certain parts of human or animal cadavers. The biocide used must be without any trace of formaldehyde, while the weight ratio of formaldehyde in the specific mixture of POM used must be less than 1000 ppm by weight (i.e. 1000 mg/kg), preferably less than 500 ppm. The desired composition must have body preservation performances at least equivalent to those obtained with formaldehyde but without the disadvantages of formaldehyde toxicity and without the need to keep the bodies cold.

[0006] Biocidal products that are approved or in the process of being approved are identified on the ECHA website (echa.europa.eu/en/information-on-chemicals/biocidal-active-substances). Specifically, the list includes the following products: iodine (CAS: 7553-56-2), bronopol or 2-bromo-2-nitro-1,3-propanediol (CAS 52-51-7), alkyl chloride (C12-C14) dimethyl benzyl ammonium (ADBAC (C12-C14)) (CAS 85409-22-9), alkyl (C12-18) dimethyl benzyl ammonium chloride (ADBAC (C12-18)) (CAS 68391-01-5 polyvinylpyrrolidone-iodine complex (CAS: 25655-41-8), alkyl (C12-C14) dimethyl (ethylbenzyl) ammonium chloride (ADEBAC (C12-C14)) (CAS 85409-23-0), alkyl chloride (C12-C16), and dimethyl benzyl ammonium (ADBAC/BKC (C12-C16)) (CAS 68424-85-1).

[0007] For questions of safety, environment, hygiene and health (i.e. with respect to hazardous volatile compounds and their flammability or explosiveness and with respect to their toxicity) and the fluidity/homogeneity of the low temperature composition, <−10° C., there is a need for a suitable low pouring point adjusted by the removal of heavy POM compounds, and there is also a need for fluid and homogeneous compositions (all components readily soluble in water) at low temperature and without emission of volatile products with, therefore, a) extreme restriction of the level of volatile compounds having a boiling point below 110° C., preferably below 120° C. (measured at atmospheric pressure or 101325 Pa), and b) heavy compounds having a boiling point greater than 130° C., preferably greater than 100° C. under a reduced pressure of 1333 Pa, alternatively greater than 90° C. under a reduced pressure of 100 Pa, preferably greater than 70'C under a reduced pressure of 100 Pa, in the composition of the POM related to these problems.

[0008] In order to overcome the drawbacks of known solutions of the prior art relating to the preservation of the dead human or animal body and/or its embalming, the present invention therefore proposes a formulation free of formaldehyde (for example, a formaldehyde content less than 1000 ppm (mg/kg of POM), preferably less than 500 ppm) based on a specific composition of polyoxymethylene dialkyl ethers (POM) having a restricted specific distribution of n as a function of R and R', the composition comprising in addition to the POM mixture, at least one suitable biocide preferably taken from the TP22 approved biocide class, at least one pro penetrating agent, at least one dye, optionally another additive, and water as a diluent.

[0009] The first object of the invention therefore relates to an aqueous composition comprising the specific mixture of polyoxymethylene dialkyl ethers, a biocide selected from the approved list of biocides without formaldehyde or without formaldehyde liberators (formaldehyde being by definition excluded as a biocide), a pro-penetrating agent, a dye, optionally another additive, and water as a diluent.

[0010] Another object of the present invention is a non-therapeutic method for preserving a dead human or animal body and/or embalming a dead body comprising administering to the body a composition as defined according to the present invention.

[0011] A final object of the present invention relates to the use of the composition as defined according to the invention, for the preservation of the dead human or animal body and/or for the embalming of the dead body.

[0012] Therefore the first object of the invention relates to an aqueous composition which comprises the following components:

[0013] a) a mixture of polyoxymethylene dialkyl ethers (POM) selected from a mixture of compounds of the general formula R—(OCH2)n-OR',

[0014] with R, R' being identical or different and chosen from methyl and/or ethyl for at least 90 mol %, preferably at least 95 mol % of the total R+R', and the rest of R, R' being identical or different alkyls chosen from among those having 3 to 8 carbons and representing less than 10%, preferably less than 5 mol %, of the total R+R', and provided that:

[0015] a1) when R═R'=methyl, the mixture comprises the 3 compounds with n=3 to 5 or both compounds with n=3 to 4 and the weight of the compounds with n=3 to 5 or n=3 to 4, is at least 95%, preferably at least 99% of the total weight of the mixture and

[0016] a2) when R═R'=ethyl, the mixture comprises the 3 compounds with n=2 to 4 or both compounds with n=2 to 3

[0017] and the weight of the compounds (with n=2 to 4 or n=2 to 3) is at least 95%, preferably at least 99% of the total weight of the mixture

[0018] a3) when R=methyl and R'=ethyl, the mixture comprises the 4 compounds with n=2 to 5 or the 3 compounds with n=2 to 4 and the weight of the compounds (with n=2 to 5 or n=2 at 4) represents at least 95%, preferably at least 99% of the total weight of the mixture,

[0019] b) at least one biocidal agent,

[0020] c) at least one pro-penetrating agent,

[0021] d) at least one dye,

[0022] e) optionally, at least one other additive,

[0023] and water as a diluent.

[0024] More particularly, in the composition according to the invention, the proportion by weight of components a)+b)+c)+d)+e) represents from 0.5 to 30%, preferably from 1 to 25% and more preferably from 1 to 20% of the total weight of said aqueous composition.

[0025] Preferably, the component a) represents from 20 to 50%, preferably from 30 to 40% by weight with respect to a)+b)+c)+d)+e) from 0.5 to 15%, of preferably from 0.8 to 8% of the total weight of said aqueous composition.

[0026] According to a first particular option, the component a) is a mixture according to a1) with R═R'=methyl with n=3 to 5 or n=3 to 4.

[0027] According to a second particular option, the component a) is a mixture according to a2) with R═R'=ethyl and with n=2 to 4 or with n=2 to 3.

[0028] According to a particular option of the composition, the mixture is defined according to a3), with R=methyl and R'=ethyl and with n=2 to 5 or n=2 to 4.

[0029] The preparation of the POM mixtures according to the invention is prepared by a process comprising the following steps:

[0030] 1) Reaction: A mixture of POM, most often methylal and/or ethylal, or even POM of the lower and higher ranks of the previous syntheses (i.e. the distillation heads and feet), and a source of preferably anhydrous formaldehyde, such as trioxane, tetraoxane or paraformaldehyde, is put in contact with an acid catalyst. This can be a Bronsted or Lewis acid. The molar ratio between the alkoxy groups (alcohols) of the starting acetals and the CH2O units of the formaldehyde sources is preferably between 2/1 and 2/10. To facilitate the dissolution of paraformaldehyde, the addition of sodium or potassium alcoholate, or sodium or potassium hydroxide, can be necessary. The catalysts that are suitable for this reaction are heterogeneous catalysts that are easy to filter at the end of the reaction. Among the catalysts which can be used, mention can be made, in particular, of acid resins such as acid resins of the Amberlyst^R and Lewatit^R type, Lewis acids of metals such as aluminum, iron, boron, antimony, zinc, tin or titanium, for example BF_3, BF-OEt_2, $TiCl_4$, $NbCl_5$, $SnBr_4$, $SnCl_2$, $SnCl_4$, SbF_5, $(C_6H_5)_3C$+$SbFe_6$-, $SbCl_5$, Et_3O+$SbCl_6$-), $HZSM_5$ zeolite, HY zeolite, H_2SO_4, methanesulfonic acid, paratoluene sulphonic acid, NafionR, etc. The reaction is carried out at low temperature (i.e. at a temperature below 100'C and at a pressure between atmospheric pressure and 6.1 bars or 610000 Pa). The reaction is carried out in batch mode or in continuous mode. In the batch configuration, the catalyst is preferably stirred with the solution, but it can also be put in a wire basket, itself rotated in the reactor. In the continuous mode, the catalyst is preferably placed in a fixed bed. The reaction liquid containing the starting acetals or polyacetals (POM) and the formaldehyde source passes through the catalyst bed from top to bottom or from bottom to top. Preferably the liquid flows through the catalyst bed from bottom to top, and the catalyst grains retain mobility in the catalyst bed.

[0031] 2) Neutralization (optional): The reaction liquid separated from its catalyst is then washed with a sodium hydroxide solution in order to eliminate traces of residual acid. An aqueous solution of sodium hydroxide, or optionally a methanolic solution of sodium hydroxide, sodium or potassium methoxide, a solution of sodium hydroxide in methylal, or anhydrous sodium hydroxide, is used for this purpose. Other bases can be used such as potash, lime, ammonia solution . . . .

[0032] 3) Evaporation: the raw product obtained systematically contains a distribution of POM of all ranks, i.e. ranks n=1 to infinity, however ranks greater than n=8 are difficult to quantify because of the very low levels obtained. In the synthetic raw product, the POMs of the lower ranks represent the bulk of the mass. Evaporation is necessary to remove the lighter POMs from the synthetic mixture. Since they are light POMMs, they can be evaporated at atmospheric pressure, or under reduced pressure at a lower temperature, for example at a temperature below 110° C., preferably below 120° C., at atmospheric pressure, or at an absolute total pressure greater than 27,000 Pa at 70° C., or preferably a total pressure greater than 13500 Pa at a temperature of 50° C. The person skilled in the art can easily select the temperature-pressure pair that corresponds to the molecules that one wishes to evaporate. These light POMs contribute not only to VOC (volatile organic compounds) emissions, but also to solvent odor perceptions, as well as lowering the flash point of the mixture when present in the POM blend. It is therefore necessary to eliminate all or part of it. POMs with lower ranks are, however, good solvents for higher rank POMs. They also solubilize more easily in water. It is therefore necessary to also eliminate the POMs of the higher ranks.

[0033] 4) Distillation: The head mixture obtained previously is then evaporated under partial vacuum, in order to distil the POMs of the next higher ranks and to keep the heaviest distillation. However, it is necessary not to heat the mixture of POMs at a too high temperature that could degrade it. The distillation is thus carried out under partial vacuum. The vacuum level and the distillation temperature are adjusted to distill the targeted chain length POMs.

[0034] 5) Heads and feet recycling: Distillation heads and feet in the previous steps can represent significant fractions, greater than 50% by weight (taking into account the methylal and ethylal that must be recycled) and often above 75% by weight of the reaction mixture. These fractions are not lost. They can be used as raw materials for the synthesis of POMs. However, it is important to know the proportions of compounds present in order to adjust better the amount of formaldehyde source required for the reaction. A quantity of formaldehyde is maintained which is calculated as follows: $Sum(n*POM_n)+m*(CH_2O)_m)/(Sum(POM_n)$ with POM_n moles of POM of rank n, $(CH_2O)_m$ is trioxane when m=3 and $(CH_2O)_m$ represents the number of moles of trioxane, m=4 for tetraoxane or paraformaldehyde when m is greater, so that this quantity remains between 2 and 11, preferably between 2 and 4.

[0035] 6) Analyzes: The product obtained during the syntheses is analyzed by chromatography. The boiling points are also measured to verify that the product is compliant. During this measurement, the product is distilled by varying the vacuum level at constant temperature.

[0036] The biocidal component b) can be chosen from: iodine (CAS #7553-56-2); iodinated polyvinylpyrrolidone (polyvinylpyrrolidone-iodine complex) (CAS #25655-41-8); bronopol or 2-bromo-2-nitro-1,3-propanediol (CAS #52-51-7); (C12-C18) alkyl dimethyl benzyl ammonium chloride (ADBAC (C12-18) (CAS #68391-01-5); (C12-C16) alkyl chloride dimethyl benzyl ammonium chloride (ADBAC/BKC (C12-16)) (CAS 68424-85-1); (C12-C14) alkyl dimethyl benzylammonium chloride (ADBAC (C12-14) (CAS #85409-22-9); alkyl (C12-C14) chloride dimethyl ethyl benzyl ammonium (ADEBAC (C12-14) (CAS #85409-23-0); glutaraldehyde (CAS #111-30-8); ethanol (CAS #64-17-5); peracetic acid (CAS #79-21-0) methyl ethyl ketone peroxide (CAS #1338-23-4), butanedial (CAS #638-37-9), diethyl acetal (CAS #105-57-7), glyoxal (107-22-2), and diethylene glycol (CAS #111-46-6), organic acids such as ascorbic acid (CAS #50-81-7) or citric acid (CAS #77-92-9), phenolics such as vanilic aldehyde (CAS #121-33-5), guaiacol (CAS #90-05-1), eugenol (CAS #97-53-0), phenol (CAS #108-95-2), methyl paraben (CAS #99-76-3), propyl paraben (CAS #94-13-3), 1-hexadecylpyridinium chloride (CAS #123-03-5), a compound of the formula $(C_3H_4O)_n.(C_3H_4O_2)_m$ where n>m such as Chemyde^R from Chemeq CAS # (28349-72-6).

[0037] More preferably, the biocidal component b) is chosen from among: iodine (CAS #7553-56-2); iodinated polyvinylpyrrolidone (polyvinylpyrrolidone-iodine complex) (CAS #25655-41-8); bronopol (CAS #52-51-7); (C12-C18) alkyl dimethyl benzyl ammonium chloride (ADBAC (C12-18) (CAS #68391-01-5); (C12-C16) alkyl chloride dimethyl benzyl ammonium chloride (ADBAC/BKC (C12-16)) (CAS #68424-85-1); (C12-C14) alkyl dimethyl benzyl ammonium chloride (ADBAC (C12-14) (CAS #85409-22-9); alkyl chloride (C12-C14) dimethyl ethyl benzyl ammonium (ADEBAC (C12-14) (CAS #85409-23-0); glutaraldehyde (CAS #111-30-8); a compound of the formula $(C_3H_4O)_n.(C_3H_4O_2)_m$ where n>m such as ChemydeR from Chemeq.

[0038] The pro-penetrating component c) can be chosen from among: propylene glycol (CAS #57-55-6); monoethylene glycol (CAS #107-21-1); glycerol (CAS #56-81-5); propanol-2 (CAS #67-63-0); dimethylsulfoxide (CAS #67-68-5); polyethylene glycol (CAS #25322-68-3); 2-ethoxyethanol (CAS #110-80-5); 2-phenoxyethanol (CAS #122-99-6); tetrahydrofurfuryl alcohol (CAS #97-99-4); a linear or branched C2-C6 monoalcohol; a glycol such as 1,3-propanediol; butanediol-1,4, butanediol-1,3, butanediol-2,3, hexylene glycol; a C8-C22 fatty acid; a cyclodextrin; a surfactant; a C1-C4 alkyl acetate, a mono- or polyester of fatty acid and of glycerol or of propylene glycol, a fatty alcohol ester of lactic acid or of glycolic acid, a fatty acid ester and isopropyl; a C8-C18 fatty alcohol; an azone; an alkyl N,N-dialkylaminoalkanoate; an amide; urea; a urea derivative; a terpene; a terpenoid; methyl or benzyl nicotinate; a sulfoxide; isosorbide.

[0039] Preferably, the pro-penetrating component c) is chosen from among: propylene glycol (CAS #57-55-6); monoethylene glycol (CAS #107-21-1); glycerol (CAS #56-81-5); propanol-2 (CAS #67-63-0); dimethylsulfoxide (CAS #67-68-5).

[0040] Preferably, the composition comprises:

[0041] from 0.5 to 10%, preferably from 0.8 to 8% by weight of component a) relative to the total weight of the aqueous composition

[0042] from 0.1 to 3%, preferably from 0.15 to 2% by weight of component b) relative to the total weight of the aqueous composition

[0043] from 0.5 to 10%, preferably from 0.8 to 8% by weight of component c) relative to the total weight of the aqueous composition

[0044] from 0.1 to 8%, preferably from 0.2 to 5% by weight of component d) relative to the total weight of the aqueous composition.

[0045] The at least one other additive can be selected from: fragrances such as flower extracts such as rose (rose oil), lilac, or synthetic fragrances (aromatic esters with rather fresh notes like eucalyptus), borax (EC Number 215-540-4), potassium nitrate (CAS #7757-79-1), boric acid (CAS #10043-35-3); sodium citrate (CAS #68-04-2); sodium hexametaphosphate (CAS #10124-56-8); sodium acetate (CAS 127-09-3); hydrochloric acid (CAS #7647-01-0); bis(tributyltin) oxide (CAS #56-35-9); sodium phosphate dibasic (CAS 7558-79-4); sodium phosphate monobasic (CAS #7558-80-7); ethylenediaminetetraacetic acid (EDTA) (CAS #60-00-4); sodium alkylsulfonate (CAS #85711-69-9); potassium carbonate (CAS #584-08-7); trichloroacetaldehyde (CAS #302-17-0).

[0046] The second object of the invention relates to a non-therapeutic method for preserving a human or animal body and/or embalming a dead body, the method comprising the administration to said body of a composition as defined above according to the invention.

[0047] According to a particular option of the method of the invention, the composition is injected intra-arterially into the body.

[0048] According to another particular option of the method of the invention, the composition is infused into the body.

[0049] According to a third particular option of the method of the invention, the composition is applied topically to the body.

[0050] A last object covered by the present invention relates to the use of the composition as defined according to the invention, for the preservation of the dead human or animal body, and/or for the embalming of the dead body, or the use for anatomopathology purposes. According to a particular option, the use relates to the preservation of organs, tissues or cells of a living or dead human or animal organism/body, by immersion of said organs, tissues or cells in (or infusion with) the composition as defined above according to the invention, for anatomopathology purposes. "Anatomopathology" in the context of the invention is the medical specialty which relates to the examination of the organs, tissues or cells of a living or dead human or animal organism/body, in order to identify and analyze abnormalities related to a disease. More particularly the invention is covering a method of preservation of organs, tissues or cells of a living or dead, human or animal organism/body, comprising the step of immersion of said organs, tissues or cells in the composition of the present invention. More specifically said preservation is for anatomopathology purposes.

[0051] More particularly according to this use, the composition is used for the preservation and/or for the embalming of the body according to one of the following methods:

[0052] injecting said composition intra-arterially into the body

[0053] infusion of said composition into the body

[0054] topical application of said composition on the body.

[0055] The following examples are presented to illustrate the invention and its performances and do not limit the scope of its coverage which is defined by the claims below.

EXAMPLES

1) Raw Materials Used

[0056] All raw materials used in synthesis and application are presented in the summary table 1 below.

[0057] Raw materials used in synthesis and application formulation

TABLE 1

Raw material	Name or chemical nature	Technical function according to the invention
Synthesis		
Methylal	$CH_3—OCH_2—OCH_3$	Raw material
Ethylal	$CH_3CH_2OCH_2OCH_2CH_3$	Raw material
Paraformaldehyde	$(CH_2O)_n$	Raw material
Trioxane	$(CH_2O)_3$	Raw material
Amberlyst^R resin	A15 (from Dow/Röhm & Haas)	Catalyst
Application formulation		
POMs	$R—(OCH_2)_n—OR'$	Component a) see synthesis examples
(ADBAC/BKC (C12-16) CAS# 68424-85-1	Alkyl chloride (C12-16) dimethyl benzyl Ammonium	Biocide b)
(ADBAC (C12-14)) CAS#85409-22-9	Alkyl chloride (C12-14) dimethyl benzyl ammonium	Biocide b)
(ADBAC (C12-18)) CAS# 68391-01-5	Alkyl chloride (C12-18) dimethyl benzyl ammonium	Biocide b)
(ADEBAC (C12-14)) CAS# 85409-23-0	Alkyl chloride (C12-14) dimethyl ethyl benzyl ammonium	Biocide b)
Propylene glycol	$CH_2(OH)—CH(OH)—CH_3$	Propenetrating agent c)
Borax		Additive e)
Glycerin	$CH_2(OH)CH(OH)CH_2(OH)$	Propenetrating agent c)
Potassium nitrate	KNO_3	Additive e)
Dye	Eosin	Dye d)
Perfume	Rose essence	Additive e)

Preparation of POMM (R═R': Methyl) and POME (R═R'=Ethyl

Synthesis Example 1

Preparation of $POMM_{2-8}$ ($R—(CH_2O)_n—OR'$ with n=2 to 8 and R═R'=Methyl)

[0058] 100 g of methylal—also called dimethoxymethane—(1.32 mol) and 30 g of trioxane (1 mol) are loaded into a 500 ml double-jacketed Schott reactor equipped with mechanical stirring, a condenser, and a temperature probe. 5 g of Amberlyst^R A15 resin, previously washed with methanol and dried under vacuum, are added. The mixture is heated to 50° C. and allowed to react for 1 hour. The reaction mixture is filtered and then washed with 10 g of 15% aqueous sodium hydroxide solution. The methylal is removed by evaporation under reduced pressure (90° C., 650 mbar (65,000 Pa absolute) measured at the evaporator) on a rotary evaporator. 55 g are obtained from a cut $POMM_{2-8}$ ($CH_3—(CH_2O)_n—OCH_3$ where n is 2 to 8.

[0059] The mass distribution of the product obtained is determined by GC analysis as shown in Table 2. The analysis is performed on an Agilent 5890 chromatograph equipped with an Agilent sample changer, a split injector and an FID detector. An OV1701 column (14% cyanopropylmethylmethylpolysiloxane), 30 m in length, 0.25 mm in diameter, with a film thickness of 0.25 μm is used. The split is 46 mL/min, 1 μL is injected, the column pressure is 5 psi (34474 Pa relative), the oven temperature is programmed to 50° C. for 5 minutes, then a ramp of 10° C./min up to 250° C., then maintained for 15 minutes. The temperature of the injector is 200'C, that of the detector 270° C. A satisfactory separation of the products is thus obtained.

Synthesis Example 2

Preparation of $POMM_{3-8}$ with n=3 to 8 and R═R'=Methyl

[0060] 100 g of methylal (also called dimethoxymethane $CH_3—OCH_2—OCH_3$) (1.32 mol) and 30 g of trioxane (1 mol) were loaded into a 500 ml jacketed Schott reactor equipped with mechanical stirring, a condenser, and a temperature probe). 5 g of Amberlyst^R A15 resin, previously washed with methanol and dried under vacuum, are added. The mixture is heated to 50° C. and allowed to react for 1

hour. The reaction mixture is filtered and then washed with 10 g of 15% aqueous sodium hydroxide solution. The methylal is removed by evaporation under reduced pressure (90° C., 600 mBar (60,000 Pa) measured at the evaporator) on a rotary evaporator, then the POMM2 and the residual water are then removed by vacuum distillation. (Oldershaw type column with 10 trays) operating at a pressure of 200 mBar (20,000 Pa) at 90° C. 32 g of a cut $POMM_{3-8}$ (CH_3—$(CH_2O)_n$—OCH_3 where n is 3 to 8) are obtained.

[0061] The mass distribution of the product obtained is determined by GPC analysis as shown in Table 2.

Synthesis Example 3

Preparation of $POMM_{3-4}$ with n=3 to 4 and R═R'=Methyl

[0062] On the product of Synthesis Example 2, the distillation cut is collected between 60° C. under 65 mbar (6500 Pa) and 90° C. under 10 mbar (1000 Pa) corresponding to $POMM_{3-4}$ where n is 3-4.

Synthesis Example 4

Preparation of $POMM_{3-5}$ with n=3 to 5 and R═R'=Methyl

[0063] On the product of Synthesis Example 2, the distillation cut is collected between 60° C. under 65 mbar (6500 Pa) (measured at the column) and 86° C. under 1 mbar (100 Pa) corresponding to $POMM_{3-5}$.

Synthesis Example 5

Preparation of $POME_{2-8}$ with n=2 to 8 and R═R'=Ethyl

[0064] The procedure is identical to that of Synthesis Example 2 using 137 g of ethylal-diethoxymethane (CH_3CH_2—OCH_2—OCH_2CH_3)-(1.32 mol), 30 g of trioxane (1 mol), and 7 g of Amberlyst^R resin A15. After reaction, the catalyst is filtered, the product is neutralized with sodium hydroxide to remove all traces of acid, then the light fractions are evaporated under a partial vacuum of 65 mbar (6500 Pa) at 60° C.

[0065] A C_2H_5—$(CH_2O)_n$—C_2H_5 mixture is obtained with n from 2 to 8 (R═R'=ethyl). The mass distribution of the product obtained is determined by GPC analysis as shown in Table 2.

Synthesis Example 6

Preparation of $POME_{2-4}$, with n=2 to 4 and R═R'=Ethyl

[0066] On the product of Synthesis Example 5, the distillation cut is collected up to 79° C. under 1 mbar (100 Pa) corresponding to $POME_{3-4}$.

Synthesis Example 7

Preparation of $POME_{2-3}$, with n=2 to 3 and R═R'=Ethyl

[0067] On the product of Synthesis Example 5, the distillation cut is collected at 79° C. under 13 mbar (1300 Pa) corresponding to $POME_{2-3}$.

Synthesis Example 8

Preparation of a Mixture of Compounds $POMM_{3-5}$ (n=3 to 5 and R═R'=Methyl)+$POMM/E_{2-4}$ (n=2 to 4 and R═R'=Ethyl)+$POMM/E_{2-5}$ (n=2 to 5 and R=Methyl and R'=Ethyl) from a Methylal/Ethylal Reaction Mixture=75/25 in Moles

[0068] In a 1 L double-jacketed Schott reactor equipped with a mechanical stirrer, a condenser and a temperature probe, 271 g of methylal (3.57 mol), 122 g of ethylal (1.17 mol) and 107 g of trioxane (3.57 mol CH_2O). 25 g of Amberlyst^R A15 resin, previously washed with methanol and dried under vacuum, are added. The mixture is heated to 50° C. and allowed to react for 1 hour. The reaction mixture is filtered and then washed with 100 g of an aqueous solution of sodium hydroxide at 15% by weight. The product is rectified by evaporation under reduced pressure on a rotary evaporator at 60° C. under 100 mbar (10,000 Pa).

[0069] 180 g of a mixture of compounds of formula: CH_3—$(CH_2O)_n$—OCH_3 (n=3 to 8 or $POMM_{3-8}$ (n=3 to 8 and R═R'=methyl) of formula C_2H_5—$(CH_2O)_n$—C_2H_5 or $POME_{2-8}$ (n=2 to 8 and R═R'=ethyl) and of formula CH_3—$(CH_2O)_n$—OC_2H_5 $POMM/E_{2-8}$ (n=2 to 8 and R=methyl and R'=ethyl), are obtained.

[0070] The product is then vacuum distilled using a scraped film evaporator under a vacuum of 1 mbar (100 Pa) at 90° C. 167 g of a mixture consisting essentially of compounds of formula: CH_3—$(CH_2O)_n$—OCH_3 (n=3 to 5 or $POMM_{3-5}$ (n=3 to 5 and R═R'=methyl), of formula C_2H_5—$(CH_2O)_n$—C_2H_5 or $POME_{2-8}$ (n=2 to 4 and R═R'=ethyl) and of formula CH—$(CH_2O)_n$—OC_2H_5 $POMM/E_{2-5}$ (n=2 to 5 and R=methyl and R'=ethyl).

[0071] The statistical distribution of the masses of the mixture obtained is determined by GC analysis as shown in Table 4. Table 4 groups the compositions and molecular distributions as a function of n (determined by GPC) for all the POM products prepared in the synthesis examples 1 to 7 described above.

Synthesis Example 9

Preparation of $POMM_{3-4}$ with n=3 to 4 and R═R'=Methyl, by Recycling Distillation Heads and Feet of Synthesis Examples 2 and 3

[0072] In a 1 L double-jacketed Schott reactor equipped with a mechanical stirrer, a condenser and a temperature probe, 100 g of methylal (also called dimethoxymethane—CH_3—OCH_2—OCH_3) (1.32 mol) and 30 g of trioxane (1 mol CH_2O). The heads of the evaporation of Example 2, i.e. methylal and POMM2, are added after removing the water contained therein by drying over magnesium sulphate. The foot of the distillation of Example 3 is also added.

[0073] 10 g of Amberlyst A15 resin, previously washed with methanol and dried under vacuum, are added. The mixture is heated to 50° C. and allowed to react for 1 hour. The reaction mixture is filtered and then washed with 10 g of 15% aqueous sodium hydroxide solution. The methylal is removed by evaporation under reduced pressure (90° C., 650 mBar (65,000 Pa) measured at the evaporator) on a rotary evaporator, then the $POMM_2$ and the residual water are then removed by vacuum distillation. (Oldershaw type column with 10 trays) operating at a pressure of 200 mBar (20,000 Pa) at 90° C. 60 g of a cut $POMM_{3-8}$ (CH_3—OCH_2—OCH_3), where n is 3 to 8, are obtained.

[0074] On the product obtained, the distillation cut is collected between 60° C. under 65 mbar (6500 Pa) and 90° C. under 10 mbar (1000 Pa) corresponding to $POMM_{3-4}$, where n is 3-4.

POMM Characteristics of Synthesis Examples 1 to 4 and 9

[0075]

TABLE 2

Synthesis examples	POMM composition	n = 2%	n = 3%	n = 4%	n = 5%	n = 3-5 (n = 3-4) %	n < 3%	n > 5%
Synthesis example 1	$POMM_{2-8}$	48%	33%	12%	4%	49 (45)	48	3%
Synthesis example 2	$POMM_{3-8}$		47%	29%	14%	90 (76)	0	10%
Synthesis example 3	$POMM_{3-4}$	—	62%	37%	1%	100 (99)	0	0
Synthesis example 4	$POMM_{3-5}$		55%	32%	13%	100	0	0
Synthesis example 9	$POMM_{3-4}$	—	60%	38%	2%	100 (98)	0	0

The % s reported are percent areas of the chromatography peaks comparable to % by weight.

POME Characteristics of Synthesis Examples 5 to 7

[0076]

TABLE 3

Synthesis examples	POMM composition POME	n = 2%	n = 3%	n = 4%	n = 5%	n = 2-4 (n = 2-3)	n < 2%	n > 5%
Synthesis example 5	$POME_{2-8}$	48	30	13	6	91 (78)	0	3
Synthesis example 6	$POME_{2-4}$	56	30	13	1	100 (86)	0	0
Synthesis example 7	$POME_{2-3}$	61	38	1		100 (99)	0	0

The % s reported are percent areas of the chromatography peaks comparable to % by weight.

POMM/POME and POMM/E Blend Characteristics of Synthesis Example 8

[0077]

TABLE 4

Synthesis examples	POMM, POME and POMM/E composition	n = 2%	n = 3%	n = 4%	n = 5%	Relative distribution in the respective POMM, POME and POMM/E families
Synthesis example 8	$POMM_{3-5}$	0	22	11	5	n = 3 à 5: 100% rel n = 3 à 4: 86.8% rel
	$POME_{2-4}$	4	2	1	0.3	n = 2 à 4: 95.9% rel, n > 4: 4.1% n = 2 à 3: 82.2% rel
	$POMM/E_{2-5}$	27	15	7	2.5	n = 2 à 5: 100% rel n = 2 à 4: 95.2% rel

The % s reported are percent areas of the chromatography peaks comparable to % by weight.

Application Examples of Embalming/Preservation Compositions

[0078] The application examples were made following the application guide "Transitional Guidance on the Biocidal Products Regulation. Transitional Guidance on Efficacy Assessment for Product; Type 22 Embalming Products, of August 2014", Published by ECHA.

Application Example 1 (Comparative Outside the Invention)

[0079] 900 g of $POMM_{2-8}$ of Synthesis Example 1 and 100 g of 1,2-propanediol (propylene glycol) are mixed.

[0080] 200 ml of the mixture diluted in 4.3 liters of water are injected with an electric pump, into the femoral artery of

the mortal remains of a woman of 50 kg, then 500 ml of the mixture is injected into a cavity. The total volume drained during arterial injection is 3 liters. The diffusion of the product in the organism is excellent. During the operation, a slight solvent odor is noted by the operators. The skin appears hydrated and supple. After 4 days at room temperature, body preservation is good, and the suppleness and hydration of the skin are maintained.

[0081] After 10 days at room temperature, the preservation of the body is good, but it is observed that the skin is dry and rigid, especially in the nose. The product does not meet expectations.

Application Example 2 (Comparative Outside the Invention)

[0082] 300 ml of POMM-$_{2-8}$ as produced according to the Synthesis Example 1 diluted in 7.2 liters of water are injected with an electric pump into the femoral artery of the mortal remains of a man of 80 kg, then 500 ml of POMM-$_{2-8}$ are injected into a cavity. The total volume drained during arterial injection is 6 liters.

[0083] After 5 days at room temperature, body preservation is good. After 15 days at room temperature, there is a strong degradation of the body accompanied by unpleasant odors. The product does not meet expectations.

Application Example 3 (According to the Invention)

[0084] A mixture of a formulation containing POMM$_{3-5}$ (4.8% by weight) of Synthesis Example 4, propane-1,2-diol (1.2% by weight), biocide, alkyl chloride (C12-16) dimethyl benzyl ammonium (ADBAC/BKC (C12-16)-CAS #68424-85-1 (1.5% wt) glycerin (3.7% by weight), a red-resin dye (2% by weight) and water to complete, are prepared.

[0085] A first solution of 1.5 liters of the formulation is prepared in 6 liters of water.

[0086] 5 liters of the aqueous solution are injected with an electric pump into the femoral artery of a mortal remains of a man of 83 kg, then again 2.5 liters of the solution. Then 500 ml of the formulation (containing the 4.8% by weight POMM) is injected into a cavity. The total volume drained during arterial injection is 6 liters.

[0087] After 4 days at room temperature, body preservation is good; no swelling is observed. After 10 days at room temperature, body preservation is good, no odor is detected. After 15 days at room temperature, a dissection is performed by the doctors, the muscles were well colored, no odor. The doctor did not notice any difference with a dead body just deceased. Sampling by doctors of the liver, which was found to be of good quality. The other organs were well preserved. The suppleness of the body gives the appearance of a body not "embalmed" and recent, appreciated for the practical work of surgery.

Conditions of Application Examples 1 to 3

[0088]

TABLE 5a

Application example	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrig-erated body	Whole body	Injection/ C = Carotid: F = Femoral: A = Axillary	Arterial fluid	Cavity treatment	Drainage
1 HI	F	50	nr	nr	nr	nr	F/electrical	4.4% by weight POMM in 4.3 L	0.5 L	3 L
2 HI	H	80	Average	Average	Yes	yes	nr	4% by weight POMM2-8 in 7.2 L	0.5 L	6 L
3	H	83	Average	Average	24 hr	yes	C-D + F-D/ electrical	7.5 L @ 20% Vol	0.5 L	6 L

nr = not reported;
HI = outside invention;
H: Man;
F: Woman;
F-D: right femoral;
F-G: left femoral;
C-D: right carotid,
C-G: left carotid;/electric: electric pump./manual: manual pump

Results of Application Examples 1 to 3

[0089]

TABLE 5b

Application example		Observation at treatment Before	Observation at treatment After	Observation at 2 days	Observation at 5 days	Observation at 15 days
1 - outside invention	Odor	Good	Odor of solvent	Good	Good	Bad
	Coloring	Good	Good	Good	Good	Bad
	Skin suppleness	Good	Good	Good	Good	Acceptable

TABLE 5b-continued

Application example		Observation at treatment Before	After	Observation at 2 days	Observation at 5 days	Observation at 15 days
2 - outside invention	Odor	Acceptable	Good - Odor of solvent	Good	Good	Bad
	Coloring	Acceptable	Good	Acceptable	Acceptable	Bad
	Skin suppleness	Good	Good	Good	Good	Acceptable
3	Odor	Good	Good	Good	Good	Good
	Coloring	Good	Good	Good	Good	Good
	Skin suppleness	Good	Good	Good	Good	Good

Application Example 4 (Comparative, Outside the Invention)

[0090] Preparation of a mixture of a formulation containing $POMM_{3-8}$ (9.0% by weight) of Synthesis Example 2, propane-diol-1.2 (1.2% by weight), biocide alkyl chloride (C12-14) dimethyl benzyl ammonium CAS #85409-22-9 (1.5% by weight), borax $Na_2B_4O_7$ (0.4% wt), red dye (2% by weight) and water to complete. It is found that the product of the water-$POMM_{3-8}$ mixture is not clear. When the final mixture is exposed to cold (+1° C.) flakes form which settle in the bottom of the flask. The product is therefore not stable and therefore not in line with expectations.

[0091] A first solution of 1.8 liters of the formulation is prepared in 7.2 liters of water.

[0092] 9 kg of the aqueous solution is injected with a manual pump into the right and left carotid of the mortal remains of a man weighing 60 kg. 500 ml of the pure formulation are then injected in a cavity. The total volume drained during arterial injection is 5 liters.

Conditions of the Application Example 4

[0093]

TABLE 6a

Application example	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage
4	H/40	60	Average	Low	24 hr	yes	C – D + G/manual	9 L (at 20% vol)	0.5 L pure.	5 L

[0094] Preservation after 15 days is not good. There are significant odors (see Table 6b).

Results of Application Example 4

[0095]

TABLE 6b

		Observation at treatment before	after	Observation at 2 days	Observation at 5 days	Observation at 15 days
4	Odor	Good	Good	Good	Good	Bad
	Coloring	Good	Good	Good	Good	Acceptable
	Skin suppleness	Good	Good	Good	Good	Good

Application Example 5 (According to the Invention)

[0096] Preparation of a mixture of a formulation containing $POMM_{3-4}$ (4.8% by weight) of Synthesis Example 3, propanediol-1.2 (1.2% by weight), alkyl chloride (C12-18) dimethyl benzyl ammonium (ADBAC (C12-18)) CAS #68391-01-5 (1.5% by weight), potassium nitrate (0.3% by weight) red dye (2% by weight) and water to complete.

[0097] A first solution of 1.5 liters of the formulation is prepared in 7.5 liters of water.

[0098] 6 liters of the aqueous solution are injected with a manual pump into the right carotide of the mortal remains of a woman of 75 kg, then again 3 liters of the solution. 500 ml of the pure formulation are then injected in a cavity. The total volume drained during arterial injection was not reported.

Conditions of Application Example 5

[0099]

TABLE 7a

Application example appli	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage
5	F/90	75	Average	Average	24 hr	yes	C – D/manual	9 L (at 17% vol)	0.5 L	nr

[0100] Preservation after 15 days is excellent (see Table 7b).

Results of Application Example 5

[0101]

TABLE 7b

Application Example		Observation at treatment Before	Observation at treatment After	Observation at 2 days	Observation at 5 days	Observation at 15 days
5	Odor	Acceptable	Good	Good	Good	Good
	Coloring	Acceptable	Good	Acceptable	Acceptable	Acceptable
	Skin suppleness	Good	Good	Good	Good	Good

Application Example 6 (Comparative Outside the Invention)

[0102] Preparation of a mixture of a formulation containing $POME_{2-8}$ (6% by weight) of Synthesis Example 5, propanediol-1.2 (1.2% by weight), alkyl chloride (C12-14) dimethyl ethyl benzyl ammonium (ADEBAC (C12-14)) CAS #85409-23-0 (1.5% by weight), perfume (0.1% by weight), glycerin (3% by weight), a red dye (2% by weight) and water to complete. When the product is exposed to cold (+1° C.), a haze is formed, and a material in suspension settles towards the bottom of the flask. The product is therefore not stable and is not in line with expectations.

[0103] A first solution of 1.6 liters of the formulation is prepared in 6.4 liters of water.

[0104] 6 liters of the aqueous solution are injected with an electric pump into the right and left carotid of the mortal remains of a man of 120 kg, then again 2 liters of the solution. Then 1000 ml of the pure formulation is injected in a cavity. The total volume drained during arterial injection is 6 liters.

Conditions of Application Example 6

[0105]

TABLE 8a

Application example	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage
6	H	120	strong	average	yes	yes	C – D + G/electric	8 L (@ 20% vol)	1 L	6 L

[0106] Preservation after 15 days is not acceptable. Color and body flexibility are severely degraded (see Table 8b).

Results of Application Example 6

[0107]

TABLE 8b

Application example		Observation at treatment before	Observation at treatment after	Observation at 2 days	Observation at 5 days	Observation at 15 days
6	Odor	Good	Good	Good	Good	Acceptable
	Coloring	Acceptable	Good	Good	Acceptable	Bad
	Skin suppleness	Good	Good	Good	Acceptable	Bad

Application Example 7 (According to the Invention)

[0108] Preparation of a mixture of a formulation containing $POME_{2-4}$ (4.8% by weight) of Synthesis Example 6, propanediol-1.2 (1.2% by weight), alkyl chloride (C12-C16) dimethyl benzyl ammonium (ADBAC/BKC (C12-16)) CAS #68424-85-1 (1.5% by weight), borax (0.5% by weight), red dye (2% by weight) and water to complete.

[0109] A first solution of 1.5 liters of the formulation is prepared in 4.5 liters of water.

[0110] 4 liters of the aqueous solution are injected with a manual pump into the right carotid artery and into the right femoral artery of the mortal remains of a 95 kg woman, then again 2 liters of the solution. 500 ml of the pure formulation are then injected in a cavity. The total volume drained during arterial injection is not reported.

Conditions of the Application Example 7

[0111]

TABLE 9a

Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage	
7	F/90	95	Strong	Significant	48 hr	yes	C − D + F − D/manual	6 L (@ 17% vol)	0.5 L	nr

[0112] Preservation after 15 days is good (see Table 9b).

Results of Application Example 7

[0113]

TABLE 9b

Application example	Characteristic	Observation at treatment before	Observation at treatment after	Observation at 2 days	Observation at 5 days	Observation at 15 days
7	Odor	Good	Good	Good	Good	Good
	Coloring	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	Skin suppleness	Good	Good	Good	Acceptable	Acceptable

Application Example 8 (According to the Invention)

[0114] A mixture of a formulation containing POME2-3 (4.8% by weight) of Synthesis Example 7, propane-1,2-diol (1.2% by weight), alkyl chloride (C_{12}-C_{16}) dimethyl benzyl ammonium (ADBAC/BKC (C12-16)) CAS #68424-85-1 (1.5% by weight), borax (0.5% by weight), red dye (2% by weight) and water to complete.

[0115] A first solution of 1.5 liters of the formulation is prepared in 7.5 liters of water.

[0116] 6 liters of the aqueous solution are injected with a manual pump to the right carotid artery and into the right femoral artery of the mortal remains of a man of 95 kg, then again 3 liters of the solution. Then, 500 ml of the pure formulation are injected in a cavity. The total volume drained during arterial injection has not been reported.

Conditions of Application Example 8

[0117]

TABLE 10a

Application example appli	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage
8	H	95	Strong	Average	yes	yes	C − D + F − D/manual	9 L (@ 17% vol)	0.5 L	nr

[0118] Preservation of the body after 15 days is good (see table 10b).

Results of Application Example 8

[0119]

TABLE 10b

Application		Observation at treatment		Observation	Observation	Observation
Example	Characteristic	before	after	at 2 days	at 5 days	at 15 days
8	Odor	Good	Good	Good	Good	Good
	Coloring	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	Skin suppleness	Good	Acceptable	Acceptable	Acceptable	Acceptable

Application Example 9 (According to the Invention)

[0120] Preparation of a mixture of a formulation containing a mixture of $POMM_{3-5}$, $POME_{2-4}$ and $POMM/E_{2-5}$ (4.8% by weight) of Synthesis Example 8, propane-1,2-diol (1.2% by weight), alkyl chloride (C12-C16) dimethyl benzyl ammonium (ADBAC/BKC (C_{12-16})) CAS #68424-85-1 (1.5% by weight), borax (0.5% by weight), a red dye (2% by weight) and water to complete.

[0121] A first solution of 1.5 liters of the formulation is prepared in 7.5 liters of water.

[0122] 6 liters of the aqueous solution are injected into the right and left carotid artery of the mortal remains of a man, then again 3 liters of the solution. 500 ml of the pure formulation are then injected in a cavity. The total volume drained during arterial injection is 7 liters.

Conditions of Application Example 9

[0123]

TABLE 11a

Application example appli	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral;	Arterial fluid	Cavity treatment	Drainage
9	H	90	Average	Average	yes	yes	C − D + G/nd	9 L (@17% vol)	0.5 L	7 L

[0124] After 15 days, body preservation is good (see Table 11 b).

Results of Application Example 9

[0125]

TABLE 11b

Application		Observation at treatment		Observation	Observation	Observation
Example	Characteristic	Before	after	at 2 days	at 5 days	at 15 days
9	Odor	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	Coloring	Bad	Good	Good	Acceptable	Acceptable
	Skin suppleness	Acceptable	Good	Good	Good	Good

Application Example 10 (According to the Invention)

[0126] Preparation of mixture of a formulation containing POMM3-4 (4.8% by weight) of Synthesis Example 9, propanediol-1.2 (1.2% by weight) of the alkyl chloride (C_{12}-C_{16}) dimethyl benzyl ammonium (ADBAC/BKC (C_{12}-C_{16})) CAS #68424-85-1 (1.5% by weight), borax (0.5% by weight), red dye (2% by weight) and water to complete.

[0127] A first solution of 1.5 liters of the formulation is prepared in 7.5 liters of water.

[0128] 6 liters of the aqueous solution are injected with a manual pump into the right and left carotid artery of the mortal remains of a man of 80 kg, then again 3 liters of the solution. 500 ml of the pure formulation are then injected in a cavity. The total volume drained during arterial injection is 6 liters.

Conditions of the Application Example 10

[0129]

TABLE 12a

Application example appli	Sex/Age (years)	Estimated weight (Kg)	Corpulence	Adiposity level	Refrigerated body	Whole body	Injection/C = Carotid; F = Femoral; A = Axillary	Arterial fluid	Cavity treatment	Drainage
10	H/90	80	Average	Average	24 hr	yes	C – D + G/manual	9L (@ 17% vol)	0.5 L	6 L

[0130] After 15 days, the body preservation is good (see Table 12b).

Results of Application Example 10

[0131]

TABLE 12b

Application		Observation at treatment		Observation	Observation	Observation
example	Characteristic	before	after	at 2 days	at 5 days	at 15 days
10	Odor	Acceptable	Good	Good	Good	Good
	Coloring	Acceptable	Good	Acceptable	Acceptable	Acceptable
	Skin suppleness	Good	Good	Good	Acceptable	Acceptable

1. Aqueous composition wherein it comprises the following components:

a) a mixture of polyoxymethylene dialkyl ethers (POM) selected from a mixture of compounds of the general formula $R—(OCH_2)_n—OR'$,

with R,R' being identical or different and chosen from methyl and/or ethyl for at least 90%, preferably at least 95 mol %, of the total R+R' and the rest of R,R' being identical or different alkyls chosen from among those having 3 to 8 carbons and representing less than 10%, preferably less than 5 mol % of the total R+R', and provided that:

a1) when R=R'=methyl, the mixture comprises the 3 compounds with n=3 to 5 or both compounds with n=3 to 4, and the weight of the compounds (with n=3 to 5 or n=3 to 4) represents at least 95%, preferably at least 99% of the total weight of the mixture and

a2) when R=R'=ethyl, the mixture comprises the 3 compounds with n=2 to 4 or both compounds with n=2 to 3

and the weight of the compounds (with n=2 to 4 or n=2 to 3) is at least 95%, preferably at least 99% of the total weight of the mixture

a3) when R=methyl and R'=ethyl, the mixture comprises the 4 compounds with n=2 to 5 or the 3 compounds with n=2 to 4 and the weight of the compounds (with n=2 to 5 or n=2 to 4) represents at least 95%, preferably at least 99% of the total weight of the mixture,

b) at least one biocidal agent

(c) at least one pro-penetrating agent

d) at least one dye,

e) optionally, at least one other additive

and water as diluent.

2. Composition according to claim **1**, wherein the proportion by weight of components a)+b)+c)+d)+e) represents

from 0.5 to 30%, preferably from 1 to 25% and more. preferably from 1 to 20%, of the total weight of the aqueous composition.

3. Composition according to claim **1**, wherein the component a) represents from 20 to 50%, preferably from 30 to 40% by weight with respect to a)+b)+c)+d)+e), and from 0.5 to 15%, preferably from 0.8 to 8%, of the total weight of the aqueous composition.

4. Composition according to claim **1**, wherein the component a) is a mixture according to a1) with R=R'=methyl with n=3 to 5 or n=3 to 4.

5. Composition according to claim **1**, wherein the component a) is the mixture according to a2) with R=R=ethyl and with n=2 to 4 or with n=2 to 3.

6. Composition according to claim **1**, wherein the mixture is according to a3), with R=methyl and R'=ethyl and with n=2 to 5 or n=2 to 4.

7. Composition according to claim **1**, wherein the biocidal component b) is selected from: iodine, polyvinylpyrrolidone iodine (polyvinylpyrrolidone-iodine complex), bronopol or 2-bromo-2-nitro-1,3 propylene glycol, alkyl chloride (C12-C18) dimethylbenzylammonium (ADBAC C12-18), alkyl chloride (C12-C16) dimethylbenzylammonium (ADBAC/BKC C12-16), alkyl chloride (C12-C14) dimethylbenzylammonium (ADBAC C12-14); alkyl chloride (C12-C14) dimethyl ethyl benzyl ammonium (ADEBAC C12-14), glutaraldehyde; ethanol, peracetic acid, methyl ethyl ketone peroxide, butanedial, diethylacetal, glyoxal, diethylene glycol, organic acids such as ascorbic acid or citric acid, phenolics such as vanilic aldehyde, guaiacol, eugenol, phenol, methylparaben, propylparaben 1-hexadecylpyridinium chloride, a compound of the formula $(C_3H_4O)n.(C_3H_4O_2)m$ where n>m.

8. Composition according to claim **1**, wherein the biocidal component b) is chosen from: iodine, polyvinylpyrrolidone iodine (polyvinylpyrrolidone-iodine complex), bronopol, alkyl chloride (C12-C18) dimethylbenzylammonium (ADBAC C12-18), alkyl chloride (C12-C16) dimethyl benzyl ammonium (ADBAC/BKC C12-16), alkyl chloride (C12-C14) dimethyl benzyl ammonium chloride (ADBAC C12-14), alkyl chloride (C12-C14) dimethyl ethyl benzyl ammonium (ADEBAC C12-14), glutaraldehyde, a compound of formula $(C_3H_4O)n.(CH_4O_2)m$ where n>m.

9. Composition according to claim **1**, wherein the propenetrating component c) is chosen from: propylene glycol, monoethylene glycol, glycerol, propanol-2, dimethyl sulfoxide, polyethylene glycol, 2-ethoxyethanol, 2 phenoxyethanol, tetrahydrofurfuryl alcohol, linear or branched C_2-C_6 monoalcohol; a glycol such as 1,3-propanediol, 1,4-butanediol, 1,3-butanediol, 2,3-butanediol, hexylene glycol; a C_8-C_{22} fatty acid; a cyclodextrin; a surfactant; C_1-C_4 alkyl acetate; a mono- or polyester of fatty acid and glycerol or propylene glycol; a fatty alcohol ester of lactic acid or glycolic acid; an ester of fatty acid and isopropyl; a C_8-$C1_8$ fatty alcohol; an azone; an alkyl N,N-dialkylaminoalkanoate; an amide, urea; a urea derivative; a terpene; a terpenoid; methyl or benzyl nicotinate; a sulfoxide; isosorbide.

10. Composition according to claim **1**, wherein the propenetrating component c) is selected from propylene glycol, monoethylene glycol, glycerol, propanol-2, dimethylsulfoxide.

11. Composition according to claim **1**, wherein it comprises:

- 0.5 to 10%, preferably 0.8 to 8% by weight of component a) relative to the total weight of the aqueous composition,
- from 0.1 to 3%, preferably from 0.15 to 2% by weight of component b) relative to the total weight of the aqueous composition
- from 0.5 to 10%, preferably from 0.8 to 8% by weight of component c) relative to the total weight of the aqueous composition
- from 0.1 to 8%, preferably from 0.2 to 5% by weight of component d) relative to the total weight of the aqueous composition.

12. Composition according to claim **1**, wherein it comprises in addition to at least one other additive selected from: perfume as flower extracts such as rose (rose oil), lilac, or perfumes synthetic (aromatic esters with rather fresh notes like eucalyptus), borax, potassium nitrate, boric acid, sodium citrate, sodium hexametaphosphate, sodium acetate, hydrochloric acid, bis(tributyltin) oxide, sodium phosphate dibasic, sodium phosphate monobasic, ethylenediamine tetracetic acid (EDTA), sodium alkylsulfonate, potassium carbonate, trichloroacetaldehyde.

13. Non-therapeutic method for preserving a human or animal body and/or embalming a dead body, the method comprising administering to the body a composition according to any claim **1**.

14. Method according to claim **13**, wherein the composition is injected intra-arterially into the body.

15. Method according to claim **13**, wherein the composition is infused into the body.

16. Method according to claim **13**, wherein the composition is applied topically on the body.

17. A method of preservation of organs, tissues or cells of a living or dead, human or animal organism/body, comprising the step of immersion of said organs, tissues or cells in the composition of claim **1**.

18. The method of claim **17**, wherein said preservation is for anatomopathology purposes.

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