Claims

1. Microcapsules whose capsule walls comprise a resin which is obtainable by reacting
   a) at least one compound selected from the group of
      a1) amines and
      a2) aromatic or heteroaromatic compounds which are unsubstituted or substituted by one or more substituents from group C_1-C_{20} alkyl, OH, OR, COOH, SH, SR, NHCOR, OCOR, halogen and aromatic, where R represents a C_1-C_{10} alkyl group,

   with
   b) at least one aldehydic component which has at least two C atoms per molecule, in the presence
   c) of at least one copolymer which comprises units of 2-acrylamido-2-methylpropanesulfonic acid or its salts (AMPS) and/or 2-acrylamido-2-methylpropanephosphonic acid or its salts (AMPP) and units of one or more (meth)acrylates,

   the use of formaldehyde being excluded.

2. The microcapsules as claimed in claim 1, wherein one or more amines having at least two amine groups per molecule are selected as component a).

3. The microcapsules as claimed in claim 1 or 2, wherein one or more compounds from the group of ureas, melamines, and benzoguanamines are selected as component a).

4. The microcapsules as claimed in claim 1, wherein one or more aromatic or heteroaromatic alcohols and/or one or more aromatic or heteroaromatic carboxylic acids are selected as component a).

5. The microcapsules as claimed in claim 1 or 4, wherein an aromatic alcohol or ether thereof or derivative thereof is selected as component a).

6. The microcapsules as claimed in either of claims 4 and 5, wherein the at least one aromatic alcohol has at least two aromatically attached free hydroxyl groups per molecule.

7. The microcapsules as claimed in any of claims 4 to 6, wherein the at least one aromatic alcohol is selected from the phenols having two or more hydroxyl groups, preferably from pyrocatechol, resorcinol, hydroquinone, and 1,4-naphthohydroquinone, phloroglucinol, pyrogallol, and hydroxyhydroquinone, more preferably resorcinol and phloroglucinol.

8. The microcapsules as claimed in any of claims 4 to 7, wherein the alcohols are present in the form of their salts, ethers or esters and the carboxylic acids are present in the form of their salts or esters.

9. A microcapsule wherein component a) comprises a mixture of a1) one or more amines, defined as in any of claims 1 to 3, and a2) one or more aromatic or heteroaromatic compounds, defined as in any of claims 1 and 4 to 8.

10. The microcapsules as claimed in any of the preceding claims, wherein the aldehydic component

b) is selected from the aliphatic and aromatic aldehydes.

11. The microcapsules as claimed in any of the preceding claims, wherein the aldehydic component is selected from valeraldehyde, caproaldehyde, caprylaldehyde, decanal, succinaldehyde, cyclohexanecarbaldehyde, cyclopentanecarbaldehyde, 2-methyl-1-propanal, 2-methylpropionaldehyde, acetaldehyde, acrolein, aldosterone, antimycin A, 8'-apo-β-caroten-8'-al, benzaldehyde, butanal, chloral, citral, citronellal, crotonaldehyde, dimethylaminobenzaldehyde, folic acid, fosmidomycin, furfural, glutaraldehyde, glyceraldehyde, glycolaldehyde, glyoxal, glyoxylic acid, heptanal, 2-hydroxybenzaldehyde, 3-hydroxybutanal, hydroxymethylfurfural, 4-hydroxynonenal, isobutanal, isobutyraldehyde, methacrolein, 2-methylundecanal, mucochloric acid, N-methylformamide, 2-nitrobenzaldehyde, nonanal, octanal, oleocanthal, orlistat, pentanal, phenylethanal, phycocyanin, piperonal, propanal, propenal, protocatechualdehyde, retinal, salicylaldehyde, secologanin, streptomycin, strophanthidin, tylosin, vanillin, and cinnamaldehyde.

12. The microcapsules as claimed in any of the preceding claims, wherein the at least one aldehydic component has at least two free aldehyde groups per molecule.

13. The microcapsules as claimed in any of the preceding claims, wherein the aldehydic component is selected from glutaraldehyde and/or succinaldehyde.

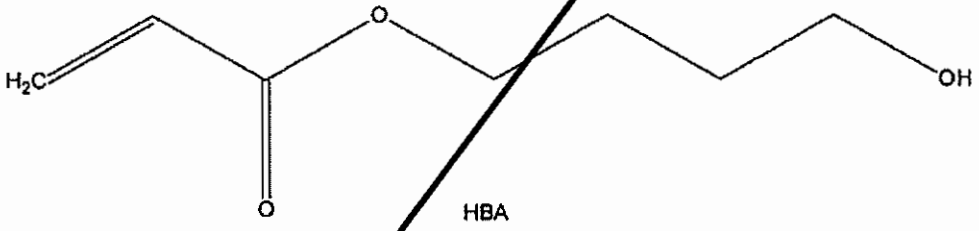
AMENDED SHEET

14. The microcapsules as claimed in any of the preceding claims, wherein the copolymer is a bipolymer or a terpolymer.

15. The microcapsules as claimed in any of the preceding claims, wherein the copolymer c) is constructed from units of AMPS or AMPP, preferably AMPS, and one or more (meth)acrylates.

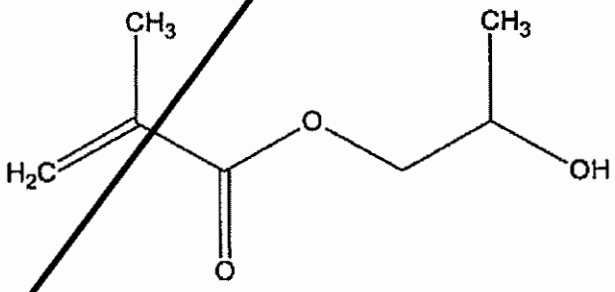
16. The microcapsules as claimed in claim 1 or 15, wherein the (meth)acrylates in copolymer c) are selected from the group of

a) 4-hydroxybutyl acrylate



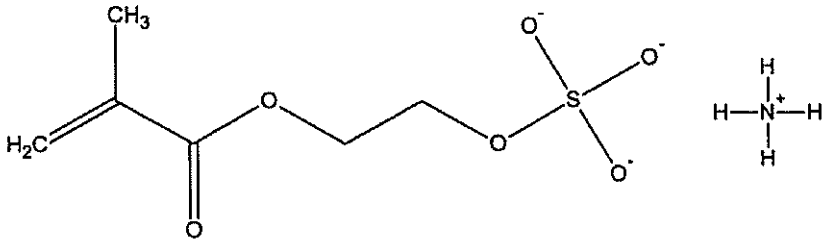
HBA

b) 2-hydroxypropyl methacrylate

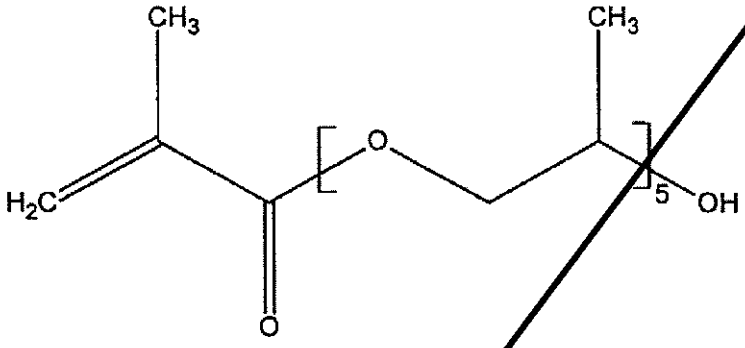


HPMA

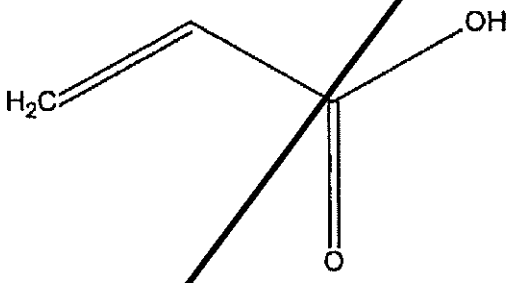
c) ammonium sulfatoethyl methacrylate



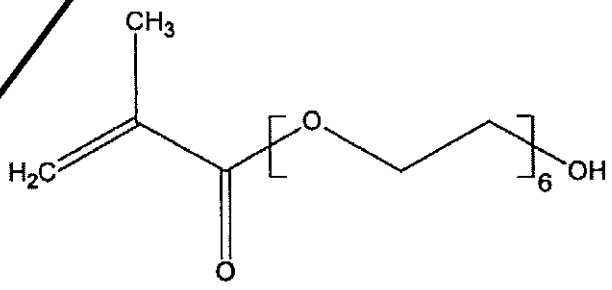
d) pentapropylene glycol methacrylate



e) acrylic acid

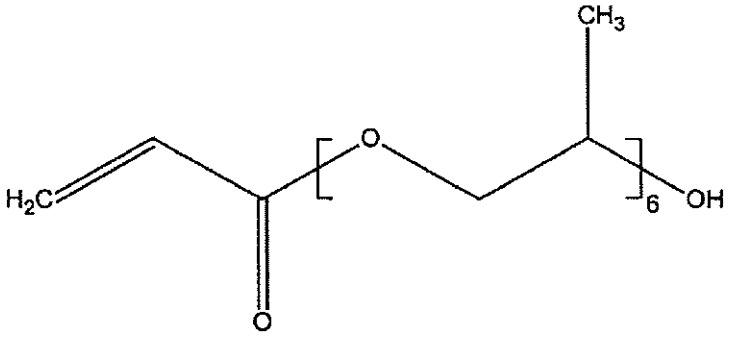


f) hexaethylene glycol methacrylate



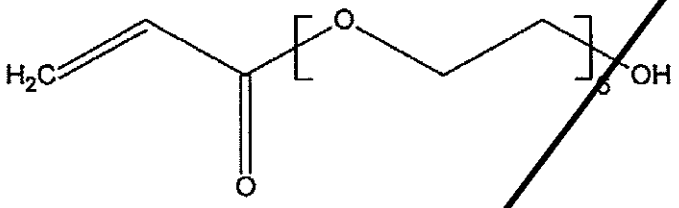
g) hexapropylene glycol acrylate

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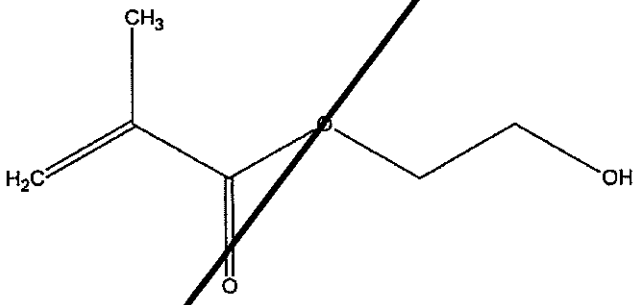
PPA 6

h) hexaethylene glycol acrylate



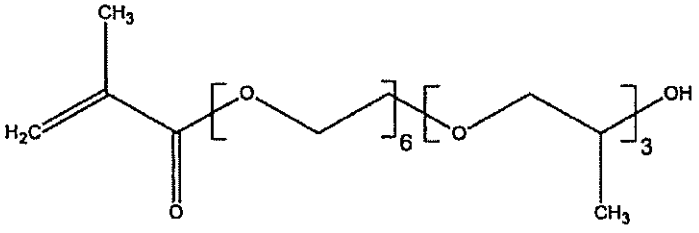
PEA 6

i) hydroxyethyl methacrylate



HEMA

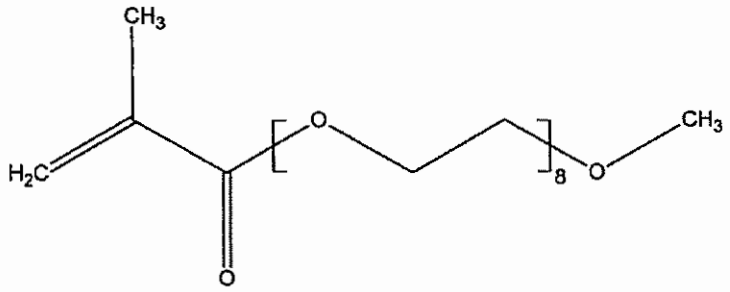
j) polyalkylene glycol methacrylate (CAS No. 589-75-9)



Bisomer PEM63PHD

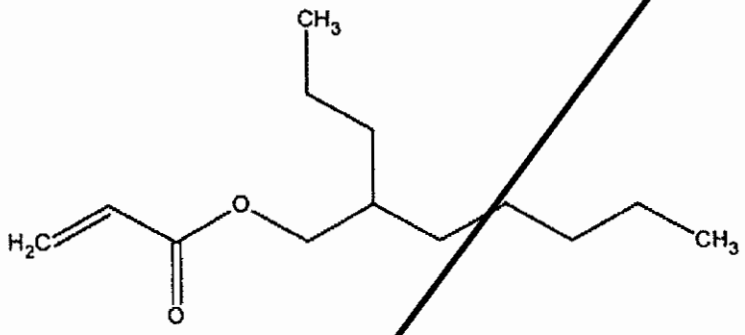
AMENDED SHEET

k) methoxy-polyethylene glycol methacrylate

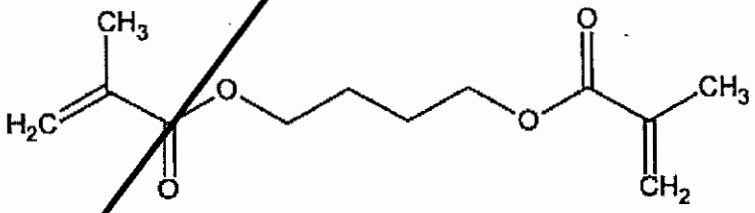


MPEG 350MA

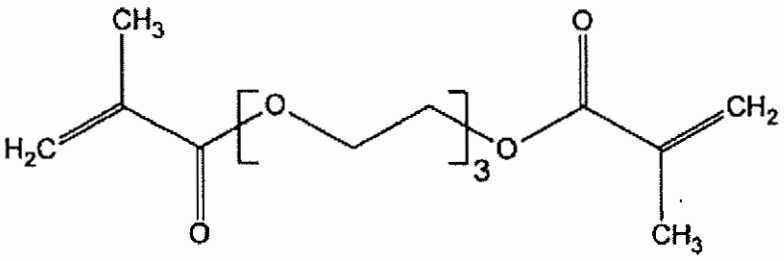
l) 2-propylheptyl acrylate (2-PHA)



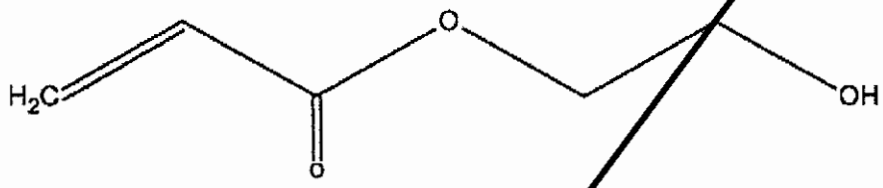
m) 1,3-butanediol dimethacrylate (BDDMA)



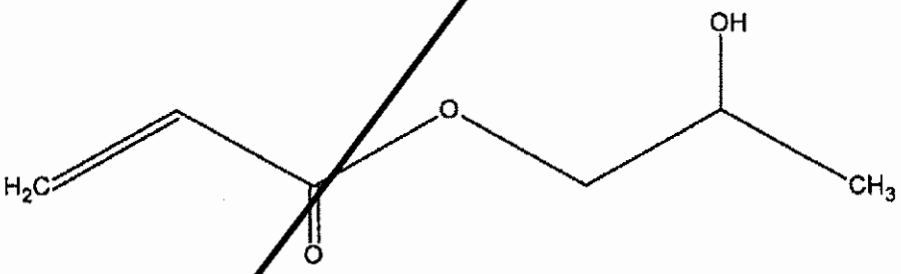
n) triethylene glycol dimethacrylate (TEGDMA)



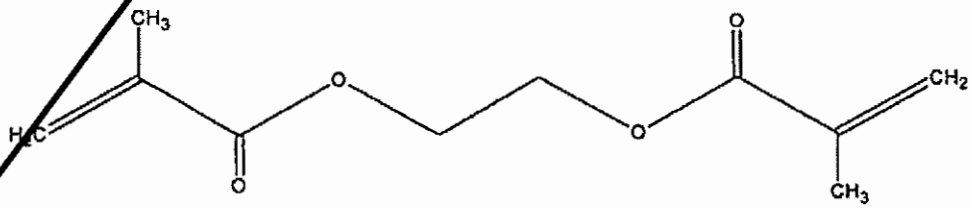
o) hydroxyethyl acrylate (HEA)



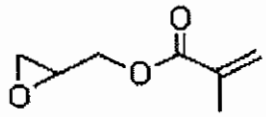
p) 2-hydroxypropyl acrylate (HPA)



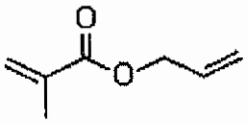
q) ethylene glycol dimethacrylate (EGDMA)



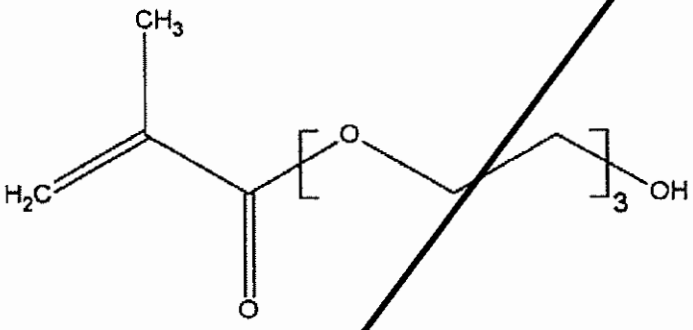
r) glycidyl methacrylate (GMA)



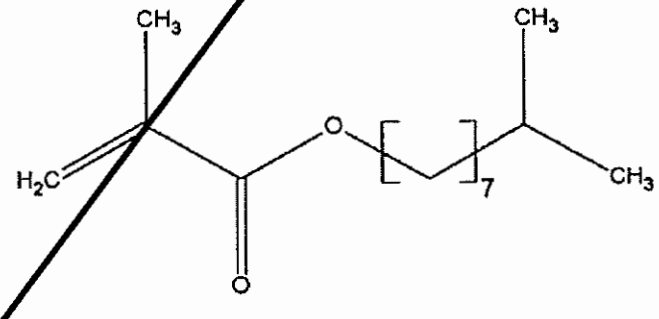
s) allyl methacrylate (ALMA)



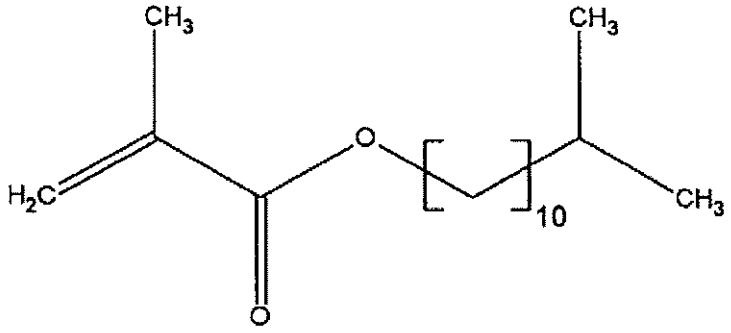
t) Bisomer PEM 3 (polyethylene glycol methacrylate)



u) Bisomer IDMA (isodecyl methacrylate)

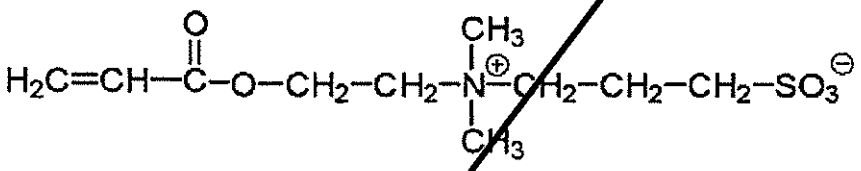


v) Bisomer C13MA (isotridecyl methacrylate)

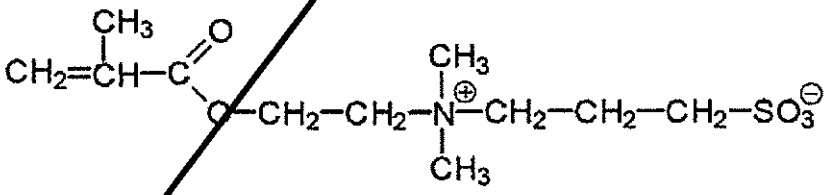


w) 3-sulfopropyl acrylate

x) N-(2-acryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine

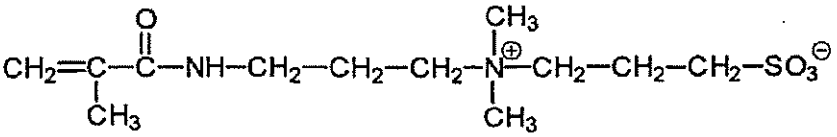


y) N-(2-methacryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



z) 3-sulfopropyl methacrylate,

z1) N-(3-methacrylamidopropyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



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17. The microcapsules as claimed in any of the preceding claims, wherein the copolymer c) comprises one or more further monomers selected from the group of vinyl compounds, unsaturated dicarboxylic or polycarboxylic acids, and the salts of amyl compounds or allyl compounds.

18. The microcapsules as claimed in any of the preceding claims, wherein the molar ratio of the at least one component a) to the at least one aldehydic component b) is between 1:1 and 1:5, preferably between 1:1 and 1:3.

19. The microcapsules as claimed in any of the preceding claims, wherein the capsule surface is aftertreated with a nitrogen-containing, oxygen-containing or silicon-containing agent, preferably with melamine, with silica gel or with aromatic alcohol a).

20. The microcapsules as claimed in any of the preceding claims, wherein at least one core material is enclosed in the capsule.

21. The microcapsules as claimed in any of the preceding claims, wherein the capsule is formaldehyde-free.

22. A microcapsule dispersion comprising one or more microcapsules as claimed in any of the preceding claims.

23. The use of a copolymer c) as defined in any of claims 1 and 14 to 17 for reacting one or more amines a1), defined as in any of claims 1 to 3, and/or one or more aromatic or heteroaromatic compounds a2), defined as in any of claims 1 and 4

to 8, with an aldehydic component b), defined as in any of claims 10 to 13, for forming the capsule walls of microcapsules.

24. A method for producing microcapsules as claimed in one or more of claims 1 to 21 or microcapsule dispersions as claimed in claim 22, wherein
a) one or more amines a1), defined as in any of claims 1 to 3, and/or one or more aromatic or heteroaromatic compounds a2), defined as in any of claims 1 and 4 to 8, are combined and reacted with an aldehydic component b), in the presence of a copolymer c) as defined in any of claims 1 and 14 to 17, optionally in the presence of a core material, and
b) later by temperature increase the curing of the capsules takes place.

25. The method for producing microcapsules or microcapsule dispersions as claimed in claim 24, wherein the pH is changed in the course of the method.

26. The method for producing microcapsules or microcapsule dispersions as claimed in one or both of claims 24 and 25, wherein the alkalinity is adjusted using an alkali metal salt, preferably alkali metal carbonate, more preferably sodium carbonate.

27. The method for producing microcapsules or microcapsule dispersions as claimed in any of claims 24 to 26, wherein stirring is carried out during the reaction of component a) with the aldehydic component b) and the copolymer c).

28. The method for producing microcapsules or microcapsule dispersions as claimed in one or both of claims 26 and 27, wherein the stirring speed is increased immediately before or during the raising of the alkalinity.

29. The method for producing microcapsules or microcapsule dispersions as claimed in claim 28, wherein the increased stirring speed is retained until the viscosity values of the mixture fall, the stirring speed being lowered after onset of a viscosity decrease.

30. The method for producing microcapsules or microcapsule dispersions as claimed in claim 29, wherein after the beginning of the viscosity decrease, stirring is continued for at least 20 minutes and preferably between 30 and 180 minutes, before the curing of the capsules while temperature increase takes place.

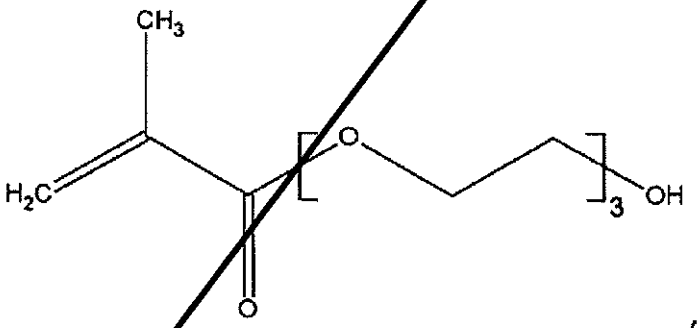
31. The use of microcapsules as claimed in one or more of claims 1 to 21 or of microcapsule dispersions as claimed in claim 22 for the release of hydrophilic or hydrophobic active ingredients, preferably selected from the group of fragrances, flavors, colors, latent heat storage materials, solvents, catalysts, coating systems, reactive (meth)acrylates, ene components, active antimicrobial ingredients, lubricants, glidants, active pharmaceutical ingredients, active cosmetic ingredients, self-healing agents, waxes, and pesticides such as fungicides, herbicides or insecticides.

32. Products comprising microcapsules as claimed in one or more of claims 1 to 21 or microcapsule dispersions as claimed in claim 22.

33. The use of products as claimed in claim 32 in at least one area of application selected from the fields of coatings, paint technology, construction chemicals, catalyst technology, corrosion control, dental technology, self-healing systems, cosmetics, pharmacy, laundering, cleaning, disinfecting, adhesive bonding, treatment of plants, preferably as fungicide, pesticide, insecticide or herbicide, or medical technology.

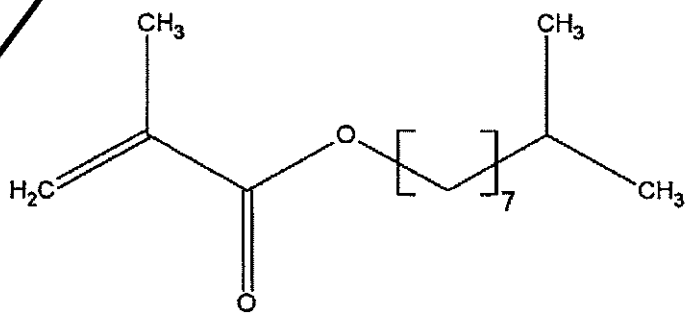
34. A copolymer comprising units derived from AMPS and one or more methacrylates from the group of

Bisomer PEM 3 (polyethylene glycol methacrylate)



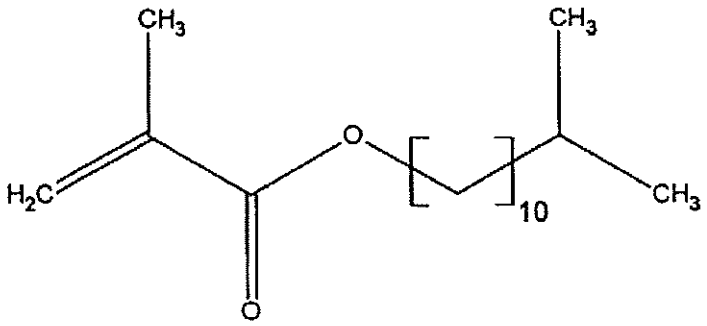
,

Bisomer IDMA (isodecyl methacrylate)



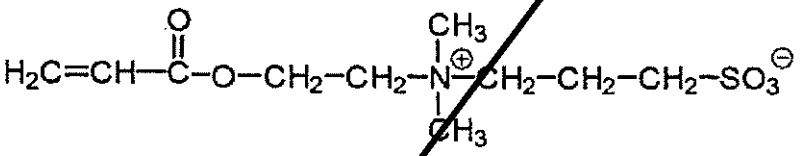
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Bisomer C13MA (isotridecyl methacrylate)



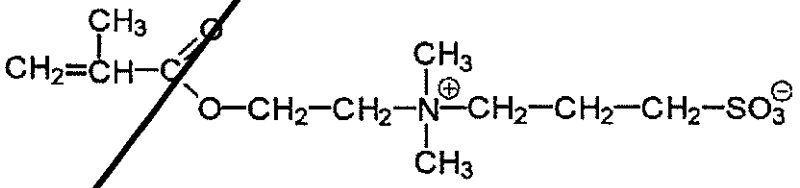
3-sulfopropyl acrylate,

N-(2-acryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



,

N-(2-methacryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



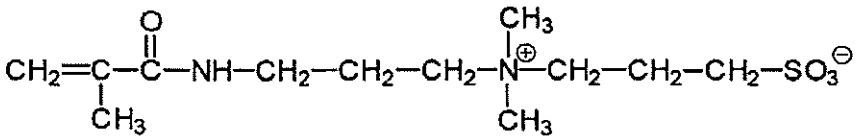
,

3-sulfopropyl methacrylate,

and

N-(3-methacrylamidopropyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine

AMENDED SHEET



CLAIMS

Claim 1: Microcapsules whose capsule walls comprise a resin which is obtained by reacting

a) at least one compound selected from the group consisting of

a1) amines, and

a2) aromatic or heteroaromatic compounds which are unsubstituted or substituted by one or more substituents selected from the group consisting of C_1-C_{20} alkyl, OH, OR, COOH, SH, SR, NHCOR, OCOR, halogen and aromatic, where R represents a C_1-C_{10} alkyl group,

with,

b) at least one aldehydic component which has at least two C atoms per molecule, in the presence of

c) at least one copolymer which comprises units of 2-acrylamido-2-methylpropanesulfonic acid or its salts (AMPS) and/or 2-acrylamido-2-methylpropanephosphonic acid or its salts (AMPP) and units of one or more (meth)acrylates,

wherein, the use of formaldehyde is excluded.

Claim 2: The microcapsules as claimed in claim 1, wherein one or more amines having at least two amine groups per molecule are selected as component a).

Claim 3: The microcapsules as claimed in claim 1, wherein one or more compounds selected from the group consisting of ureas, melamines, and benzoguanamines are selected as component a).

Claim 4: The microcapsules as claimed in claim 1, wherein one or more aromatic or heteroaromatic alcohols and/or one or more aromatic or heteroaromatic carboxylic acids are selected as component a).

Claim 5: The microcapsules as claimed in claim 1, wherein an aromatic alcohol or ether thereof or derivative thereof is selected as component a).

Claim 6: The microcapsules as claimed in claim 4, wherein the at least one aromatic alcohol has at least two aromatically attached free hydroxyl groups per molecule.

Claim 7: The microcapsules as claimed in claim 4, wherein the at least one aromatic alcohol is a phenol having two or more hydroxyl groups.

Claim 8: The microcapsules as claimed in claim 7, wherein the alcohols are present in the form of their salts, ethers or esters and the carboxylic acids are present in the form of their salts or esters.

Claim 9: A microcapsule as claimed in claim 1, wherein component a) comprises a mixture of a1) one or more amines, and a2) one or more aromatic or heteroaromatic alcohols and/or one or more aromatic or heteroaromatic carboxylic acids.

Claim 10: The microcapsules as claimed in claim 1, wherein the aldehydic component b) is selected from the group consisting of aliphatic and aromatic aldehydes.

Claim 11: The microcapsules as claimed in claim 10, wherein the aldehydic component is selected from valeraldehyde, caproaldehyde, caprylaldehyde, decanal, succinaldehyde, cyclohexanecarbaldehyde, cyclopentanecarbaldehyde, 2-methyl-1-propanal, 2-methylpropionaldehyde, acetaldehyde, acrolein, aldosterone, antimycin A, 8'-apo-β-caroten-8'-al, benzaldehyde, butanal, chloral, citral, citronellal, crotonaldehyde, dimethylaminobenzaldehyde, folic acid, fosmidomycin, furfural, glutaraldehyde, glyceraldehyde, glycolaldehyde, glyoxal, glyoxylic acid, heptanal, 2-hydroxybenzaldehyde, 3-hydroxybutanal, hydroxymethylfurfural, 4-hydroxynonenal, isobutanal, isobutyraldehyde, methacrolein, 2-methylundecanal, mucochloric acid, N-methylformamide, 2-nitrobenzaldehyde, nonanal, octanal, oleocanthal, orlistat, pentanal, phenylethanal, phycocyanin, piperonal, propanal, propenal, protocatechualdehyde, retinal, salicylaldehyde, secologanin, streptomycin, strophanthidin, tylosin, vanillin, and cinnamaldehyde.

Claim 12: The microcapsules as claimed in claim 1, wherein the at least one aldehydic component has at least two free aldehyde groups per molecule.

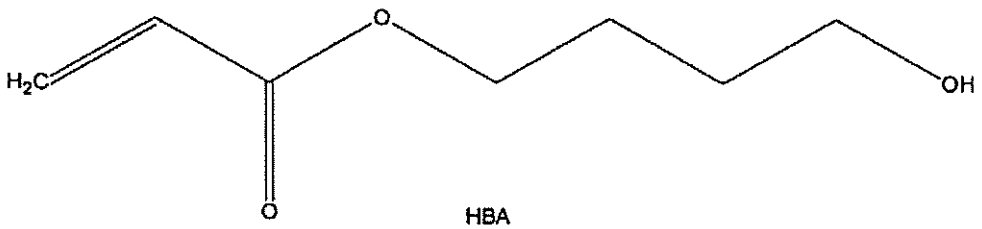
Claim 13: The microcapsules as claimed in claim 11, wherein the aldehydic component is selected from the group consisting of glutaraldehyde and succinaldehyde.

Claim 14: The microcapsules as claimed in claim 1, wherein the copolymer is a bipolymer or a terpolymer.

Claim 15: The microcapsules as claimed in claim 1, wherein the copolymer c) is constructed from units of AMPS or AMPPand one or more (meth)acrylates.

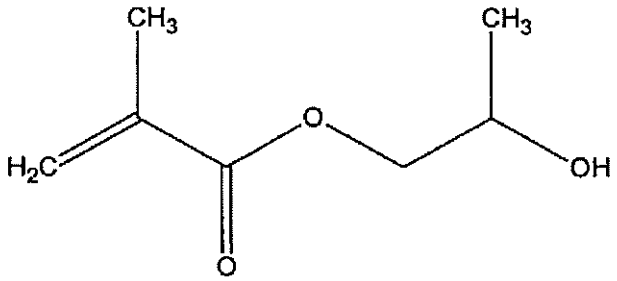
Claim 16: The microcapsules as claimed in claim 15, wherein the (meth)acrylates in copolymer c) are selected from the group consisting of

a) 4-hydroxybutyl acrylate



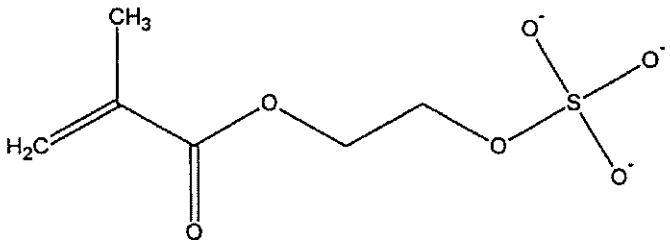
HBA

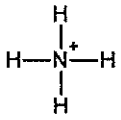
b) 2-hydroxypropyl methacrylate



HPMA

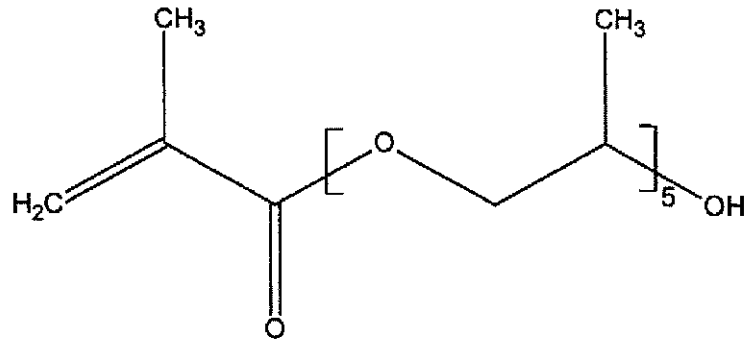
c) ammonium sulfatoethyl methacrylate





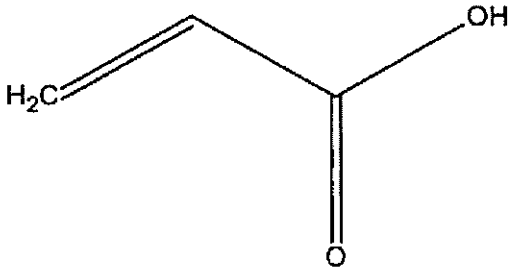
SEM

d) pentapropylene glycol methacrylate



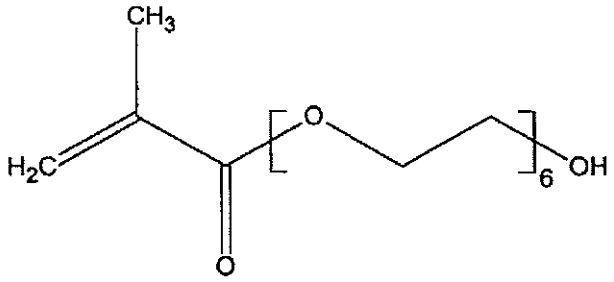
PPM 5 LI

e) acrylic acid



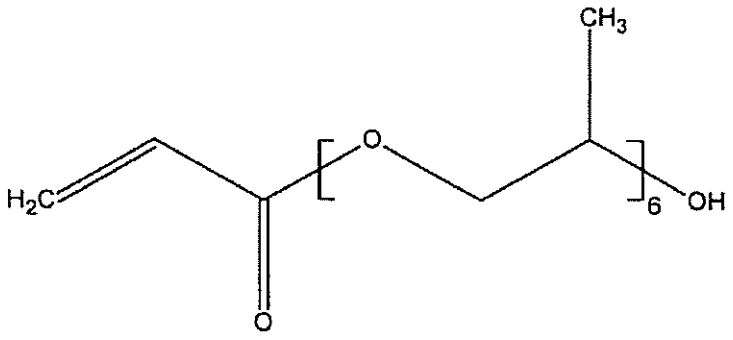
AS

f) hexaethylene glycol methacrylate



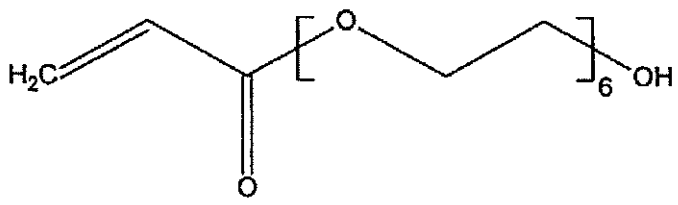
PEM 6 LD

g) hexapropylene glycol acrylate



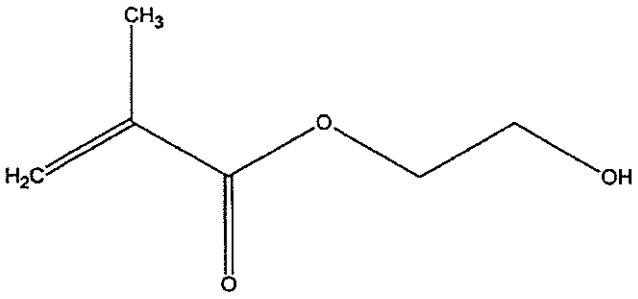
PPA 6

h) hexaethylene glycol acrylate



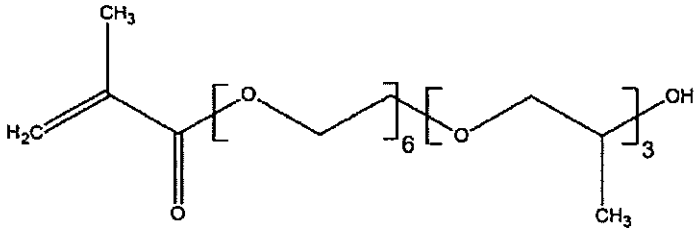
PEA 6

i) hydroxyethyl methacrylate



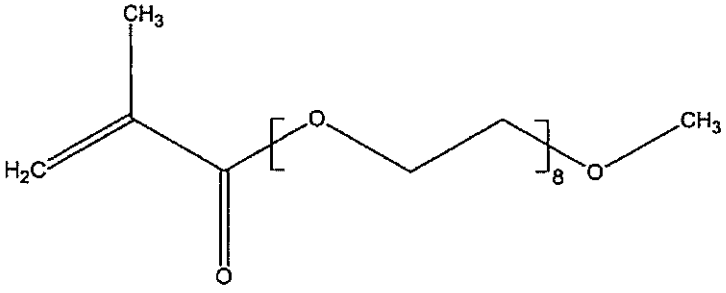
HEMA

j) polyalkylene glycol methacrylate (CAS No. 589-75-9)



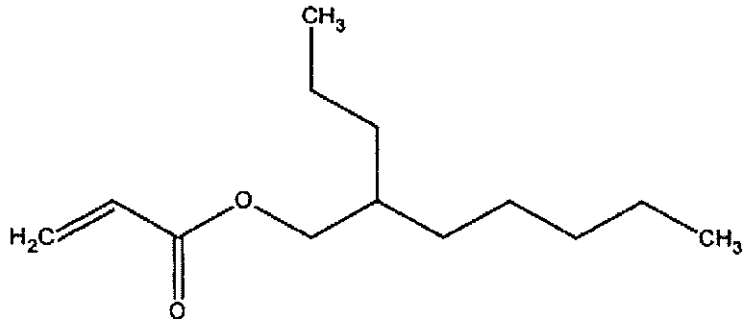
Bisomer PEM63PHD

k) methoxy-polyethylene glycol methacrylate

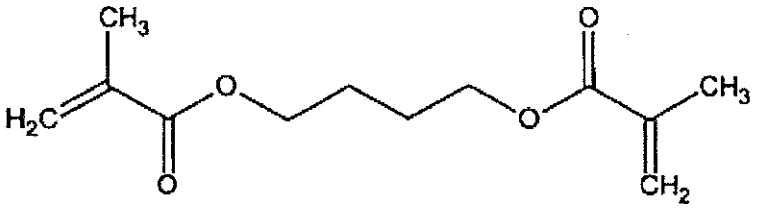


MPEG 350MA

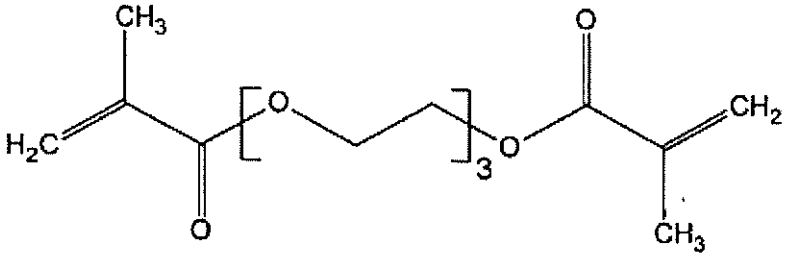
l) 2-propylheptyl acrylate (2-PHA)



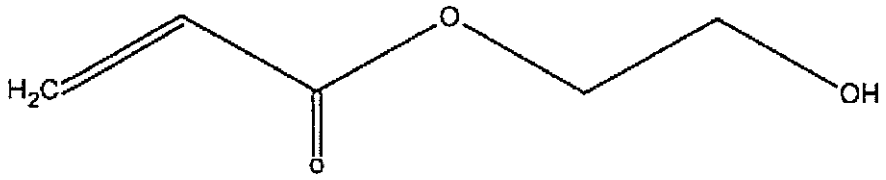
m) 1,3-butanediol dimethacrylate (BDDMA)



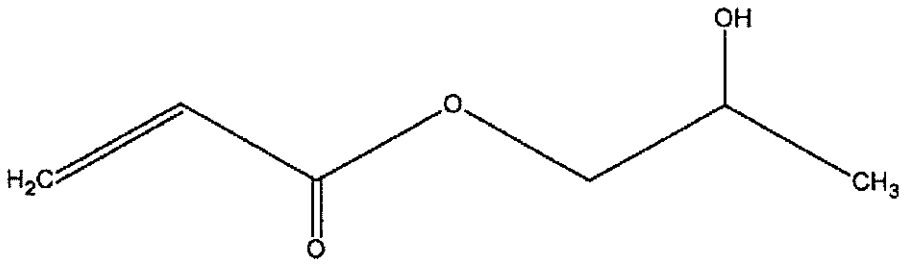
n) triethylene glycol dimethacrylate (TEGDMA)



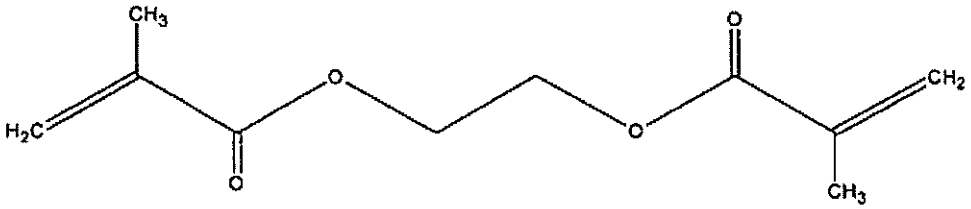
o) hydroxyethyl acrylate (HEA)



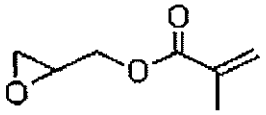
p) 2-hydroxypropyl acrylate (HPA)



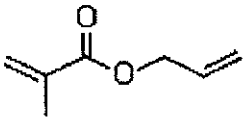
q) ethylene glycol dimethacrylate (EGDMA)



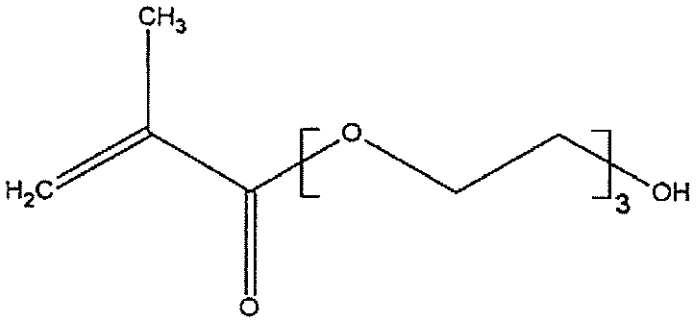
r) glycidyl methacrylate (GMA)



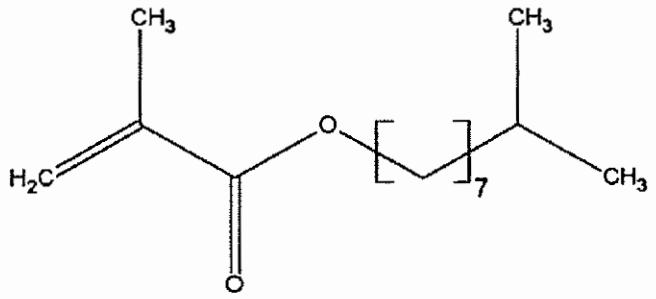
s) allyl methacrylate (ALMA)



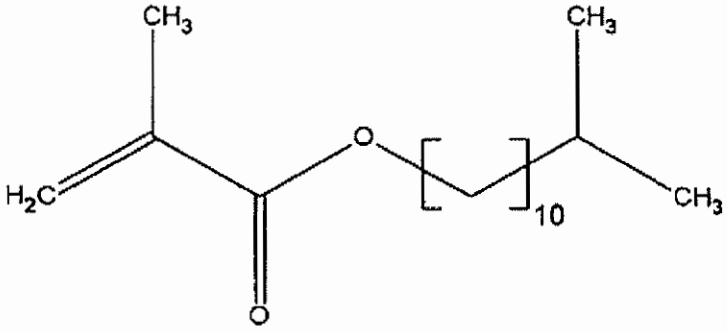
t) Bisomer PEM 3 (polyethylene glycol methacrylate)



u) Bisomer IDMA (isodecyl methacrylate)

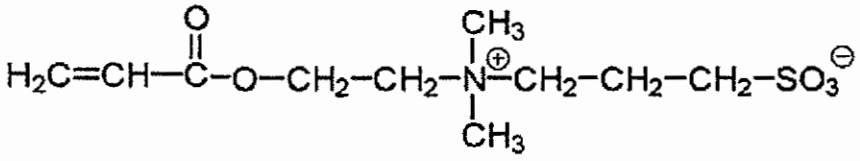


v) Bisomer C13MA (isotridecyl methacrylate)

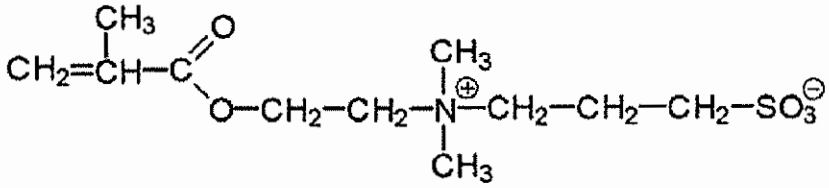


w) 3-sulfopropyl acrylate

x) N-(2-acryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine

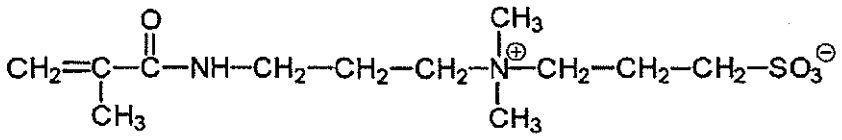


y) N-(2-methacryloyloxyethyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



z) 3-sulfopropyl methacrylate, and

z1) N-(3-methacrylamidopropyl)-N,N-dimethyl-N-(3-sulfopropyl)ammonium betaine



Claim 17: The microcapsules as claimed in claim 15, wherein the copolymer c) comprises one or more further monomers selected from the group consisting of vinyl compounds, unsaturated dicarboxylic or polycarboxylic acids, and the salts of amyl compounds or allyl compounds.

Claim 18: The microcapsules as claimed in claim 1, wherein the molar ratio of the at least one component a) to the at least one aldehydic component b) is between 1:1 and 1:5.

Claim 19: The microcapsules as claimed in claim 1, wherein the capsule surface is aftertreated with a nitrogen-containing agent, an oxygen-containing agent or a silicon-containing agent, with a silica gel, or with aromatic alcohol a).

Claim 20: The microcapsules as claimed in claim 1, wherein at least one core material is enclosed in the capsule.

Claim 21: The microcapsules as claimed in claim 1, wherein the capsule is formaldehyde-free.

Claim 22: A microcapsule dispersion comprising one or more microcapsules as claimed in claim 1.

Claim 23: A method of using microcapsules as claimed in claim 1 for the release of hydrophilic or hydrophobic active ingredients selected from the group consisting of fragrances, flavors, colors, latent heat storage materials, solvents, catalysts, coating systems, reactive (meth)acrylates, ene components, active antimicrobial ingredients, lubricants, glidants, active pharmaceutical ingredients, active cosmetic ingredients, self-healing agents, waxes, and pesticides, the method comprising:

providing microcapsules as claimed in claim 1 containing the hydrophilic or hydrophobic active ingredients; and

using the microcapsules to release the hydrophilic or hydrophobic active ingredients.

Claim 24: Products comprising microcapsules as claimed in claim 1.

Claim 25: A method of using the products as claimed in claim 24 in at least one area of application selected from the fields of coatings, paint technology, construction chemicals, catalyst technology, corrosion control, dental technology, self-healing systems, cosmetics, pharmacy, laundering, cleaning, disinfecting, adhesive bonding, treatment of plants, as a fungicide, a pesticide, an insecticide, a herbicide, or in medical technology, the method comprising:

providing products comprising microcapsules as claimed in claim 1; and

using the products in at least one area of application selected from the fields of coatings, paint technology, construction chemicals, catalyst technology, corrosion control, dental technology, self-healing systems, cosmetics, pharmacy, laundering, cleaning, disinfecting, adhesive bonding, treatment of plants, as a fungicide, a pesticide, an insecticide, a herbicide, or in medical technology.

Claim 26: The microcapsules as claimed in claim 7, wherein the at least one aromatic alcohol is selected from the group consisting of pyrocatechol, resorcinol, hydroquinone, 1,4-naphthohydroquinone, phloroglucinol, pyrogallol, and hydroxyhydroquinone.

Claim 27: The microcapsules as claimed in claim 26, wherein the at least one aromatic alcohol is selected from the group consisting of resorcinol and phloroglucinol.

Claim 28: The microcapsules as claimed in claim 15, wherein the copolymer c) is constructed from AMPS and one or more (meth)acrylates.