

(C-3),

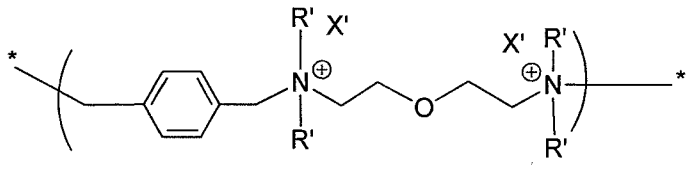
wherein

each X' is an independent negative-charged counterion,

each R' is an independent monovalent radical selected from the group consisting of methyl, ethyl and propyl, and

each R" is an independent monovalent radical selected from the group consisting of methyl, ethyl and propyl.

[0009] There is also disclosed a cationic polymer comprising a cationic repeat unit of formula (C-5):



(C-5),

wherein

each R' is an independent monovalent radical selected from the group consisting of methyl, ethyl and propyl, and

each X' is an independent negative-charged counterion.

[0010] Also disclosed in another aspect, is an antimicrobial composition, comprising an above-described cationic copolymer or cationic polymer and a second component.

[0011] Further disclosed is a method of killing a microbe, comprising contacting the microbe with an above-described cationic copolymer or polymer. Further disclosed in another aspect is the cationic copolymer as above-described for use in killing a microbe.

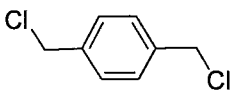
[0012] Also disclosed is a method of forming the cationic polymer as above-described, comprising:

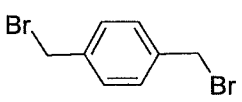
forming a reaction mixture comprising i) a solvent, ii) an electrophilic agent comprising two leaving groups Y' and an aromatic ring between the two leaving groups, wherein Y' is a leaving group capable of undergoing a nucleophilic substitution reaction with a tertiary amine to form a positive-charged quaternary amine and iii) a nucleophilic agent comprising two tertiary amine groups; and

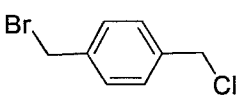
heating the reaction mixture at an elevated temperature with agitation, thereby forming the cationic polymer by addition polymerization of the electrophilic agent and the nucleophilic agent, wherein the cationic polymer is not soluble in the solvent at the elevated temperature.

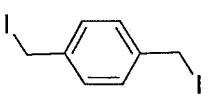
[0012a] In another aspect, there is provided a method of forming the above-described cationic copolymer wherein R" and R' are methyl, comprising:

forming a reaction mixture comprising i) a solvent, ii) an electrophilic agent selected from the group consisting of:





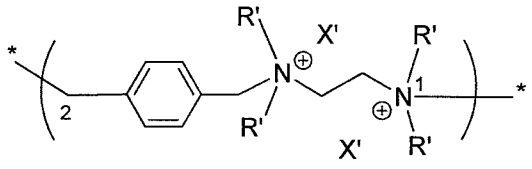




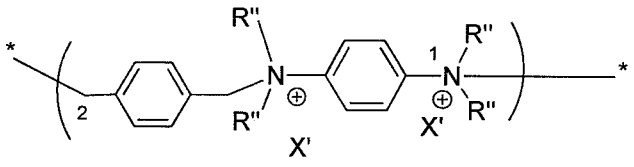
CLAIMS

What is claimed is:

1. A cationic copolymer comprising cationic repeat units of formulae (C-1) and (C-3):



(C-1),



(C-3),

wherein

each X' is an independent negative-charged counterion,

each R' is an independent monovalent radical selected from the group consisting of methyl, ethyl and propyl, and

each R" is an independent monovalent radical selected from the group consisting of methyl, ethyl and propyl.

2. The cationic copolymer of claim 1, wherein each X' is an independent anion selected from the group consisting of chloride, bromide, and iodide.

3. The cationic copolymer of claim 1, wherein the cationic copolymer is toxic to a microbe selected from the group consisting of Gram-positive microbes, Gram-negative microbes, fungi, and combinations thereof.

4. The cationic copolymer of claim 1, wherein the cationic copolymer has a number average molecular weight of about 1,000 to about 10,000.

5. The cationic copolymer of claim 1, wherein each R' is methyl.

6. The cationic copolymer of claim 1, wherein each X' is a chloride ion.

7. The cationic copolymer of claim 1, wherein the cationic polymer is a random copolymer.

8. The cationic copolymer of claim 1, wherein the cationic copolymer comprises the cationic repeat units of formulas (C-1) and (C-3) in a (C-1):(C-3) molar ratio of 90:10 to 10:90.

9. The cationic copolymer of claim 1, wherein each R" is methyl.

10. An antimicrobial composition, comprising the cationic copolymer of claim 1 and a second component.

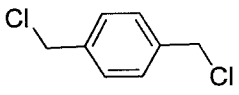
11. The antimicrobial composition of claim 10, wherein the composition is an aqueous mixture of the cationic copolymer.

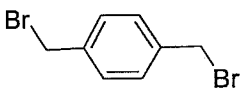
12. The antimicrobial composition of claim 10, wherein the antimicrobial composition is selected from the group consisting of laundry detergents, cosmetics, soaps, hand washes, lotions, and contact lens disinfectants.

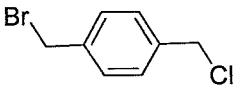
13. The cationic copolymer of claim 1 for use in killing a microbe.

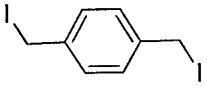
14. A method of forming the cationic copolymer of claim 1 wherein R" and R' are methyl, comprising:

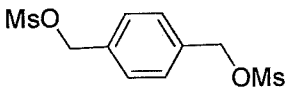
forming a reaction mixture comprising i) a solvent, ii) an electrophilic agent selected from the group consisting of:

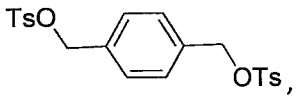


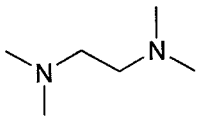
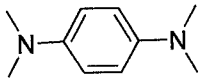










and iii) a mixture of nucleophilic agents selected from  and ; and

heating the reaction mixture at an elevated temperature with agitation, thereby forming the cationic copolymer by addition polymerization of the electrophilic agent and the nucleophilic agents, wherein the cationic copolymer precipitates out of the solvent at the elevated temperature.