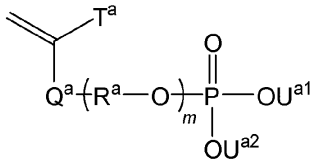
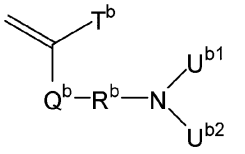
CLAIMS

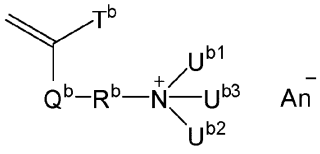
1. A copolymer which is obtainable by polymerizing a monomer mixture containing at least compounds of the following formulae (A), (B) and (C):



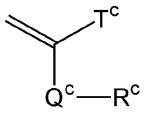
(A)



or



(B)



(C)

wherein

T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond, Q^c represents a single bond, an ether bond or an ester bond;

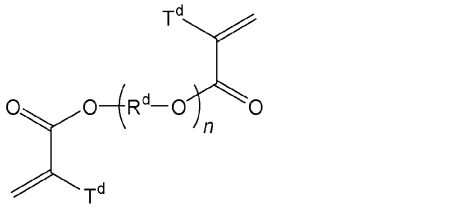
R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s), R^c represents a linear or branched alkyl group having 1 to 18 carbon atoms, a cyclic hydrocarbon group having 3 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s);

An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion; and

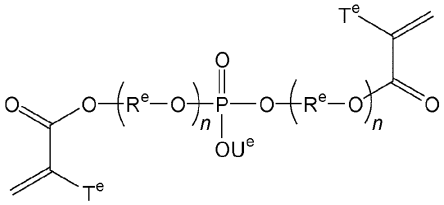
m represents an integer of 0 to 6;

and

further containing a compound of the following formula (D) or (E):



(D)



(E)

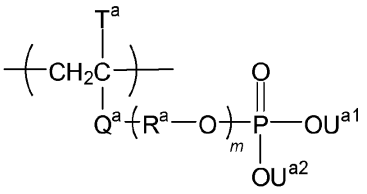
wherein

T^d, T^e and U^e each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

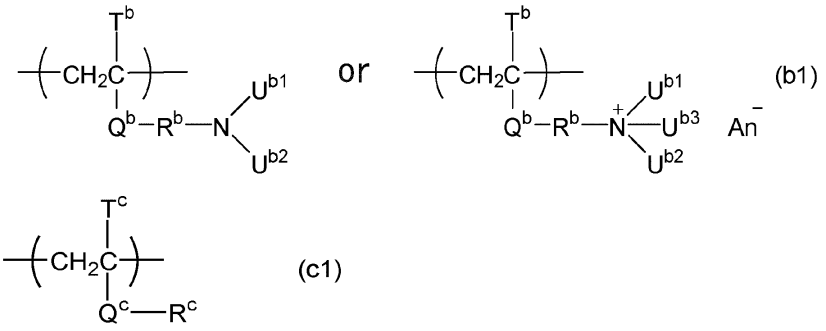
R^d and R^e each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s); and n represents an integer of 1 to 6.

2. A composition for forming a coating film having a function of inhibiting adhesion of a biological substance which comprises

(i) a copolymer which contains recurring units of the following formulae (a1), (b1) and (c1):



(a1)



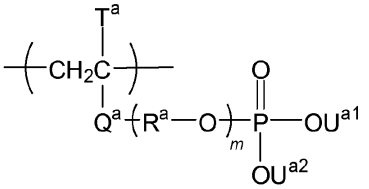
(b1)

wherein

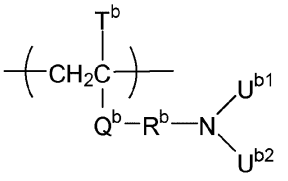
T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond,
Q^c represents a single bond, an ether bond or an ester bond;
R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s),
R^c represents a linear or branched alkyl group having 4 to 18 carbon atoms, an alicyclic hydrocarbon group having 3 to 10 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s); and
An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion; and
m represents an integer of 0 to 6,
wherein a ratio of the recurring unit containing the organic group of the formula (c1) in the copolymer is 3 mol% to 88 mol%, and
(ii) a solvent selected from water, a phosphate buffered physiological saline and an alcohol.

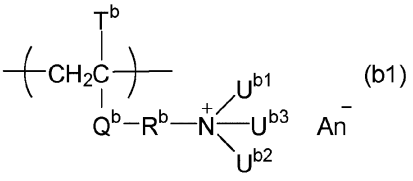
3. A composition for forming a coating film having a function of inhibiting adhesion of a biological substance which comprises
(i) a copolymer which contains recurring units of the following formulae (a1), (b1) and (c1):



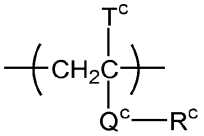
(a1)



or



(b1)

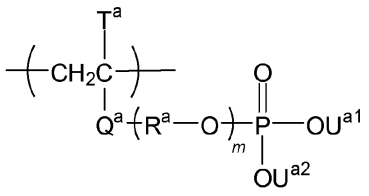


(c1)

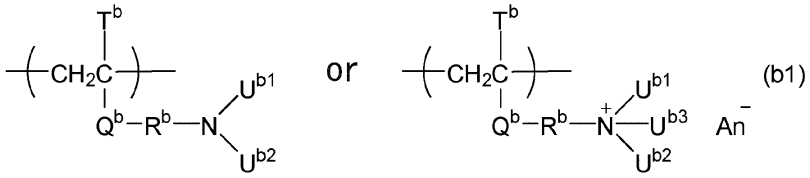
wherein
T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or

a linear or branched alkyl group having 1 to 5 carbon atoms;
Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond,
Q^c represents a single bond, an ether bond or an ester bond;
R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s), R^c represents a linear or branched alkyl group having 4 to 18 carbon atoms, an alicyclic hydrocarbon group having 3 to 10 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s);
An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion; and
m represents an integer of 0 to 6,
wherein a ratio of the recurring unit of the formula (a1) in the copolymer is 3 mol% to 80 mol%, and
(ii) a solvent selected from water, a phosphate buffered physiological saline and an alcohol.

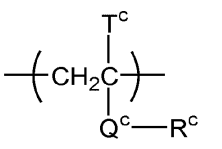
4. A coating film having a function of inhibiting adhesion of a biological substance obtainable by a method which comprises:
a process of coating a composition for forming a coating film which contains a copolymer containing recurring units of the following formulae (a1), (b1) and (c1):



(a1)



(b1)



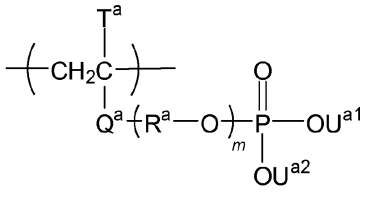
(c1)

wherein

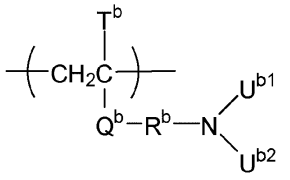
T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;
Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond,
Q^c represents a single bond, an ether bond or an ester bond;
R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s), R^c represents a linear or branched alkyl group having 4 to 18 carbon atoms, an alicyclic hydrocarbon group having 3 to 10 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s); and
An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion, and
m represents an integer of 0 to 6,
wherein a ratio of the recurring unit of the formula (a1) in the copolymer is 3 mol% to 80 mol%, and
a solvent selected from water, a phosphate buffered physiological saline and an alcohol onto a substrate,
and
a process of washing the film obtained after a drying process by at least one kind of a solvent selected from the group consisting of water and an aqueous solution containing an electrolyte(s).

5. The coating film according to Claim 4, wherein the method contains a process of provisionally adjusting a pH of the composition for forming a coating film.

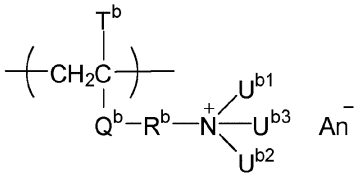
6. A method for manufacturing a coating film comprising a process of coating a composition for forming a coating film which comprises a copolymer containing recurring units of the following formulae (a1), (b1) and (c1):



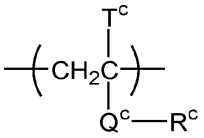
(a1)



or



(b1)



(c1)

wherein

T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond,

Q^c represents a single bond, an ether bond or an ester bond;

R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s),

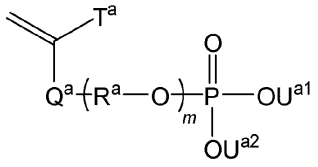
R^c represents a linear or branched alkyl group having 4 to 18 carbon atoms, an alicycloalkyl group having 3 to 8 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where, the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s); and

An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion,

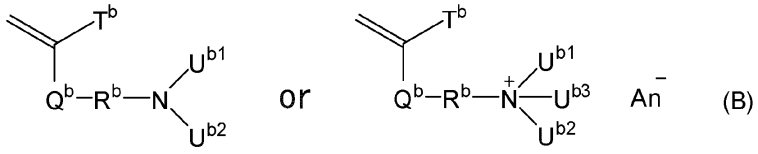
wherein a ratio of the recurring unit containing an organic group of the formula (c1) in the copolymer is 3 mol% to 88 mol%, and

a solvent selected from water, a phosphate buffered physiological saline and an alcohol, onto a substrate.

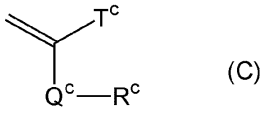
7. A method for producing a copolymer which comprises a process of polymerizing a monomer mixture containing at least compounds of the following formulae (A), (B) and (C):



(A)



(B)



(C)

wherein

T^a, T^b, T^c, U^{a1}, U^{a2}, U^{b1}, U^{b2} and U^{b3} each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

Q^a and Q^b each independently represent a single bond, an ester bond or an amide bond, Q^c represents a single bond, an ether bond or an ester bond;

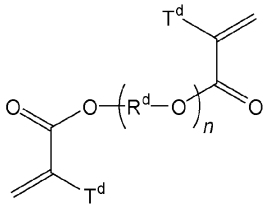
R^a and R^b each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s), R^c represents a linear or branched alkyl group having 1 to 18 carbon atoms, a cyclic hydrocarbon group having 3 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, an aralkyl group having 7 to 14 carbon atoms or an aryloxyalkyl group having 7 to 14 carbon atoms, where the above-mentioned aryl portion may be substituted by a linear or branched alkyl group having 1 to 5 carbon atoms which may be substituted by a halogen atom(s);

An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion; and

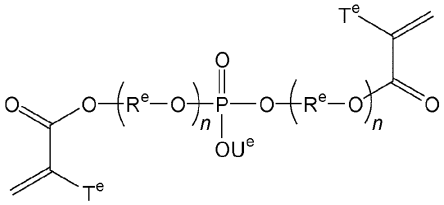
m represents an integer of 0 to 6;

and

further containing a compound of the following formula (D) or (E):



(D)



(E)

wherein

T^d, T^e and U^e each independently represent a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms;

R^d and R^e each independently represent a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom(s); and n represents an integer of 1 to 6.

8. The copolymer according to Claim 1, wherein which is for forming a coating film having a function of inhibiting adhesion of a biological substance.

9. The manufacturing method according to Claim 6, wherein the coating film has a function of inhibiting adhesion of a biological substance.

10. The producing method according to Claim 7, wherein the copolymer is for forming a coating film having a function of inhibiting adhesion of a biological substance.