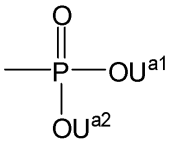
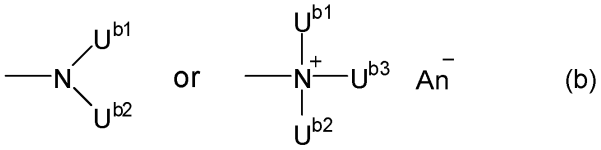
CLAIMS

1. A coating film which has a function of inhibiting adhesion of a biological substance, obtained by a method comprising a process of applying a composition for forming a coating film which comprises a copolymer comprising a recurring unit containing an organic group of the following formula (a) and a recurring unit containing an organic group of the following formula (b):



(a)



(b)

wherein U^{a1} and U^{a2} represent hydrogen atoms, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, 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 a solvent onto a substrate;
a process of drying at a temperature of -200°C to 180°C; and
a process of washing a film obtained after the process of drying with at least one solvent selected from the group consisting of water and an aqueous solution containing an electrolyte, wherein a film thickness of the coating film is 10 to 1,000Å.

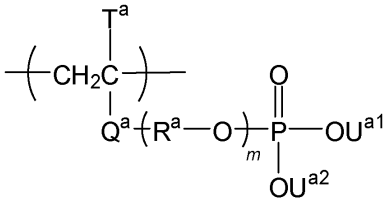
2. The coating film according to Claim 1, wherein the solvent comprises water or an alcohol.

3. The coating film according to Claim 1 or 2, wherein a concentration of the copolymer in the composition for forming a coating film is 0.01% by mass to 4% by mass.

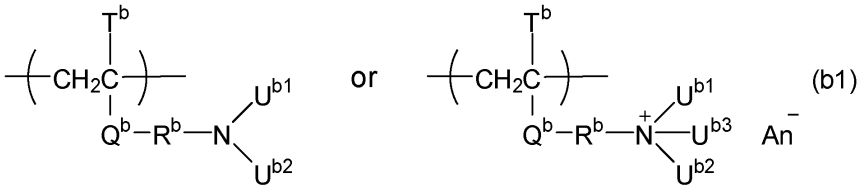
4. The coating film according to any one of Claims 1 to 3, wherein the substrate is selected from the group consisting of glass, a metal containing compound, a semi-metal containing compound and a resin.

5. The coating film according to any one of Claims 1 to 4, wherein the copolymer

comprises recurring units of the following formula (a1) and the formula (b1):



(a1)



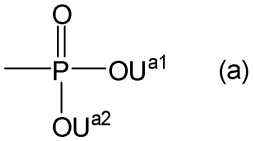
(b1)

wherein U^{a1} and U^{a2} represent hydrogen atoms, T^a, T^b, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, Q^a and Q^b each independently represents a single bond, an ester bond or an amide bond, R^a and R^b each independently represents a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom, 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 is an integer of 0 to 6.

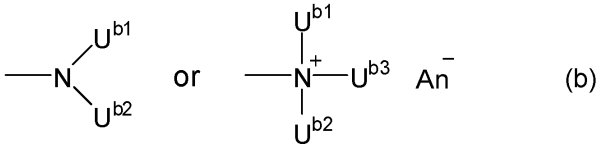
6. The coating film according to any one of Claims 1 to 5, wherein m is 1, and R^a and R^b each independently represents an ethylene group or a propylene group.

7. The coating film according to any one of Claims 1 to 6, wherein the method further comprises a process of previously adjusting a pH of the composition for forming a coating film.

8. A method for manufacturing a coating film which has a function of inhibiting adhesion of a biological substance, comprising a process of applying a composition for forming a coating film which comprises a copolymer comprising a recurring unit containing an organic group of the following formula (a) and a recurring unit containing an organic group of the following formula (b):



(a)



(b)

wherein U^{a1} and U^{a2} represent hydrogen atoms, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion,

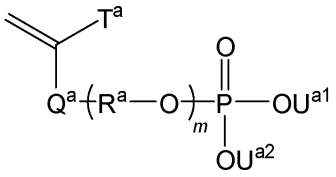
and a solvent onto a substrate;

a process of drying at a temperature of -200°C to 180°C; and

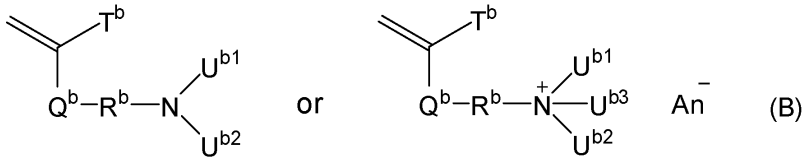
a process of washing a film obtained after the process of drying with at least one solvent selected from the group consisting of water and an aqueous solution containing an electrolyte,

wherein a film thickness of the coating film is 10 to 1,000Å.

9. A copolymer obtained by copolymerizing a monomer mixture comprising at least compounds of the following formula (A) and the formula (B):



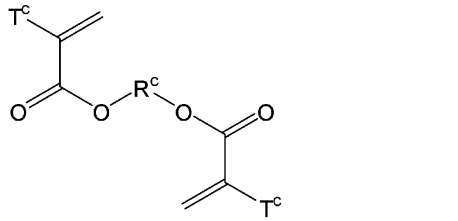
(A)



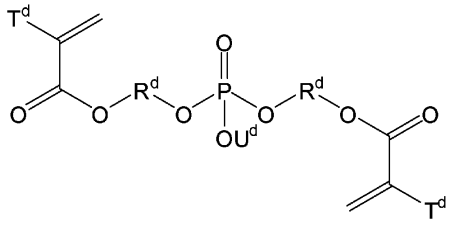
(B)

wherein U^{a1} and U^{a2} represent hydrogen atoms, T^a, T^b, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, Q^a and Q^b each independently represents a single bond, an ester bond or an amide bond, R^a and R^b each independently represents a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom, 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 is an integer of 0 to 6,

and a compound of the following formula (C) or (D):



(C)

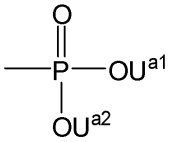


(D)

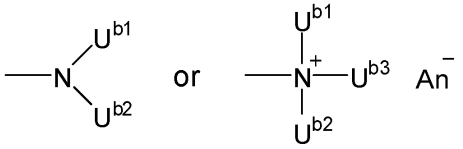
wherein T^c, T^d and U^d each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, R^c and R^d each independently represents a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom

wherein a ratio of the compound of the formula (A) based on the whole monomers forming the copolymer is 20 to 80 mol%.

10. A composition for forming a coating film which comprises (i) a copolymer comprising a recurring unit containing an organic group of the following formula (a) and a recurring unit containing an organic group of the following formula (b):



(a)



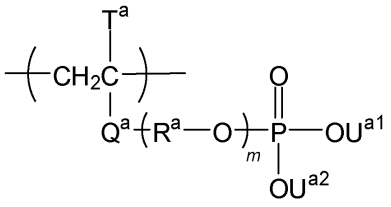
(b)

wherein U^{a1} and U^{a2} represent hydrogen atoms, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, An^- represents an anion selected from the group consisting of a halide ion, an inorganic acid ion, a hydroxide ion and an isothiocyanate ion;

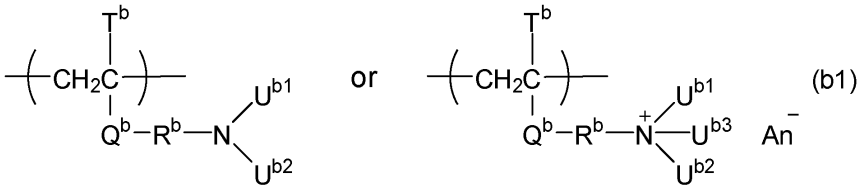
(ii) a solvent; and

(iii) a pH adjusting agent selected from the group consisting of ammonia, diethanolamine, pyridine, N-methyl-D-glucamine, tris(hydroxymethyl)aminomethane, potassium hydroxide, sodium hydroxide, sulfuric acid, phosphoric acid, hydrochloric acid, carbonic acid and choline.

11. The composition according to Claim 10, wherein the copolymer comprises recurring units of the following formula (a1) and the formula (b1):



(a1)



(b1)

wherein U^{a1} and U^{a2} represent hydrogen atoms, T^a, T^b, U^{b1}, U^{b2} and U^{b3} each independently represents a hydrogen atom or a linear or branched alkyl group having 1 to 5 carbon atoms, Q^a and Q^b each independently represents a single bond, an ester bond or an amide bond, R^a and R^b each independently represents a linear or branched alkylene group having 1 to 10 carbon atoms which may be substituted by a halogen atom, 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 is an integer of 0 to 6.