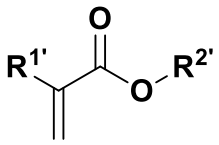
wherein R^1 is H or CH_3, and R^2 is a C3-C18 substituent with at least one oxygen or nitrogen atom, preferably at least one oxygen atom or R^2 is a poly(alkylene glycol) chain;

and at least one monomer of Formula (II),



(II)

wherein $R^{1'}$ is H or CH_3, and $R^{2'}$ is a C1-C20 hydrocarbyl;

wherein said hydrophilic copolymer is free of any metal-ion containing comonomers; and

said hydrophilic copolymer comprising less than 15 wt% comonomers other than those of Formula (I) or (II);

(ii) a cyclic monocarboxylic acid such as rosin or a derivative thereof (such as a salt thereof); and

(iii) a silyl ester copolymer comprising at least 15 wt% of silyl ester monomer and/or a non-hydrophilic (meth)acrylic polymer which comprises less than 10 wt% of a monomer of Formula (I).

The amount of component (i) in the binder is preferably in the range of 20 to 60 wt% (dry solids). The amount of component (ii) in the binder is preferably in the range of 10 to 70 wt% (dry solids). The amount of component (iii) in the binder is preferably in the range of 5 to 70 wt% (dry solids).

The disclosure also provides an antifouling coating composition comprising a binder as described herein, preferably dispersed in a solvent. The antifouling coating may further comprise an antifouling agent, preferably cuprous oxide, zinc ethylenebis(dithiocarbamate) and/or copper pyrithione.

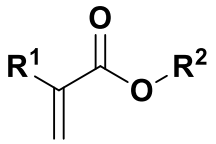
In another aspect, the present disclosure refers to an antifouling coating composition comprising a binder as disclosed herein and at least one antifouling agent.

In another aspect, the present disclosure refers to a process for protecting an object from fouling, said process comprising coating at least a part of said object which is subject to fouling with an antifouling coating composition as disclosed herein.

Claims

1. A binder for an antifouling coating composition comprising:

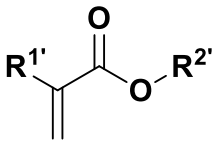
(i) a hydrophilic copolymer having a glass transition temperature of at least 0°C, said hydrophilic copolymer comprising at least 10 wt% of at least one monomer of Formula (I)



(I)

wherein R^1 is H or CH_3, and R^2 is a C3-C18 substituent with at least one oxygen or nitrogen atom, preferably at least one oxygen atom or R^2 is a poly(alkylene glycol) chain;

and at least one monomer of Formula (II),



(II)

wherein $R^{1'}$ is H or CH_3, and $R^{2'}$ is a C1-C20 hydrocarbyl;

wherein said hydrophilic copolymer is free of any metal-ion containing comonomers; and

said hydrophilic copolymer comprising less than 15 wt% comonomers other than those of Formula (I) or (II);

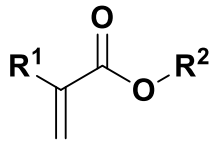
(ii) a cyclic monocarboxylic acid such as rosin or a derivative thereof (such as a salt thereof); and

(iii) a silyl ester (meth)acrylic copolymer comprising at least 15 wt% of silyl ester monomer and/or a non-hydrophilic (meth)acrylic polymer which comprises less than 10 wt% of a monomer of Formula (I).

2. A binder as claimed in claim 1 wherein component (iii) comprises silyl ester (meth)acrylic copolymer in which the monomer is triisopropylsilyl methacrylate (TISMA) or triisopropylsilyl acrylate (TISA).

3. A binder as claimed in any preceding claim wherein the hydrophilic copolymer (i) comprises

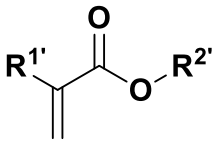
(a) 15 to 65 wt% of at least one monomer of Formula (I)



(I)

wherein R^1 is H or CH_3, and R^2 is a C3-C18 substituent with at least one oxygen or nitrogen atom, preferably at least one oxygen atom or R^2 is a poly(alkylene glycol) chain;

and (b) 85 to 35 wt% of at least one monomer of Formula (II),



(II)

wherein $R^{1'}$ is H or CH_3, and $R^{2'}$ is a C1-C8 hydrocarbyl;

wherein said hydrophilic copolymer is free of any metal-ion containing comonomers; and

said hydrophilic copolymer comprising less than 15 wt% comonomers other than those of Formula (I) or (II).

4. A binder according to any of claims 1 to 3 wherein the amount of component (ii) is in the range of 10 to 70 wt% of the binder (dry solids).

5. A binder as claimed in any preceding claim wherein component (ii) is a rosin or derivative thereof (such as a salt thereof).

6. A binder according to claim 1 to 5 wherein R^2 is a group of formula $(CH_2CH_2O)_n$-R^3 where R^3 is a C1-C10 alkyl or C6-C10 aryl substituent and n is an integer in the range of 1 to 6.

7. A binder as claimed in any preceding claim wherein the amount of component (i) is in the range of 20 to 60 wt% of the binder (dry solids).

8. A binder according to any preceding claim wherein the monomer of Formula (I) is 2-methoxyethyl methacrylate (MEMA), 2-methoxyethyl acrylate (MEA), 2-ethoxyethyl methacrylate (EEMA), 2-(2-ethoxyethoxy)ethyl acrylate (EDEGA) and tetrahydrofurfuryl acrylate (THFA).

9. A binder according to any preceding claim wherein the monomer of Formula (II) is methyl methacrylate (MMA), n-butyl methacrylate (n-BMA), 2-ethylhexyl acrylate (2-EHA) and n-butyl acrylate (n-BA).

10. A binder according to any of claims 1 to 9 comprising (iii) a silyl ester (meth)acrylic copolymer comprising at least 15 wt% of silyl ester monomer and a non-hydrophilic (meth)acrylic polymer which comprises less than 10 wt% of a monomer of Formula (I).

11. A binder according to any of claims 1 to 10 comprising a non-hydrophilic (meth)acrylic acid copolymer (iii-2) which comprises less than 10 wt% of a monomer of Formula (I).

12. A binder according to any of claims 1 to 11 comprising 10 to 60 wt% of component (iii) (dry solids).

13. A binder according to any of claims 1 to 10 wherein the Tg of the non-hydrophilic (meth)acrylic polymer is less than 0°C.

14. An antifouling coating composition comprising a binder according to any of claims 1 to 13 and at least one antifouling agent.

15. An antifouling coating composition according to claim 14, wherein said antifouling agent comprises cuprous oxide and/or copper pyrithione and/or zinc ethylenebis(dithiocarbamate).

16. An antifouling coating composition according to claim 14 or 15, wherein said binder comprises 15 to 50 wt% of the antifouling coating composition.

17. A process for protecting an object from fouling, said process comprising coating at least a part of said object which is subject to fouling with an antifouling coating composition as claimed in any of claims 14 to 16.

18. An object coated with the antifouling coating composition as claimed in any of claims 14 to 16.

19. An object as claimed in claim 17 wherein the object is coated with an anticorrosive coating layer, a tie layer and an antifouling coating composition as claimed in claim 14 to 16.

20. An object as claimed in claim 18 wherein the object is coated with an antifouling coating composition as claimed in claims 14 to 16 which covers a pre-existing antifouling coating composition on the substrate.