Claims

1. An erodible antifouling coating composition comprising:

an erodible binder system excluding a triorgano tin based binder;

one or more antifouling agents; and

1 to 10% solids of a mixture of silicone oils, based on the total solids of the composition,

wherein the erodible binder system is present in an amount of between 10% to 60% by weight of the solid content of the antifouling coating composition; and

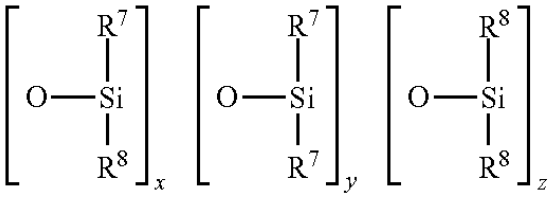
wherein the mixture of silicone oils comprises at least a first silicone oil and a second silicone oil, wherein the first silicone oil comprises alkyl and aryl organo groups attached to silicon in a first ratio and the second silicone oil comprises alkyl and aryl organo groups attached to silicon in a second ratio, wherein the first ratio and the second ratio are different.

2. The erodible antifouling coating composition according to claim 1,

wherein the mixture of silicone oils comprises a polyorganosiloxane having a structure comprising diorganosiloxane residues and terminal organosiloxane residues, and, optionally, branched organosiloxane residues;

wherein the diorganosiloxane residues of the polyorganosiloxane comprise one or more of

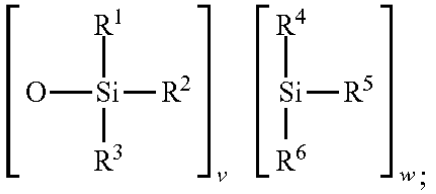
(i)



and;

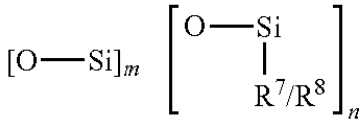
the terminal organosiloxane residues comprise

(ii)



whereas the optional branched organosiloxane residues comprise;

(iii)



wherein R^1 to R^6 independently comprise an inert organic group;

R^7 comprises an inert organic group;

R^8 comprises an inert organic group;

v=n+2m+1;

w=1;

n is 0 to x+y+z/3, rounded to the nearest whole number;

m is 0 to x+y+z/10, rounded to the nearest whole number;

x+y+z is 5 to 1000, with the proviso that diorganosiloxane residues selected from the structures in (i) above having R^7 groups and diorganosiloxane residues selected from the structures in (i) above having R^8 groups are present in the polyorganosiloxane.

3. The erodible antifouling coating composition according to claim 2, wherein each of the R^1 to R^6 groups independently comprise alkyl or aryl groups, R^7 comprises an aryl group, and R^8 comprises an alkyl group.

4. The erodible antifouling coating composition according to claim 3,

wherein the alkyl groups comprise saturated hydrocarbon radicals being straight or branched, polycyclic, acyclic, cyclic or part cyclic/acyclic moieties or combinations thereof and contain 1 to 10 carbon atoms; and/or

wherein the aryl groups comprise an organic radical derived from an aromatic hydrocarbon by removal of one hydrogen and include any monocyclic, bicyclic or polycyclic carbon ring of up to 7 members in each ring, wherein at least one ring is aromatic, wherein said radical may be optionally substituted with one or more substituents independently comprising alkyl or alkoxy radicals; and/or

wherein the aryl groups comprise phenyl, naphthyl, idenyl and alkyl substituted phenyl.

5. The erodible antifouling coating composition according to claim 2, wherein at least 10% of the total R^7 and R^8 groups comprise alkyl groups and at least 10% of total R^7 and R^8 groups comprise aryl groups.

6. The erodible antifouling coating composition according to claim 2, wherein the mixture of silicone oils comprises a methyl phenyl silicone oil in which at least 25% of the diorganosiloxane units are methylphenylsiloxane units and the silicone oil comprises a trimethylsilyl-terminated poly(methylphenylsiloxane).

7. The erodible antifouling coating composition according to claim 1, wherein a total of the organo groups of the first silicone oil comprises 70% to 95% alkyl groups and 5% to 30%

aryl groups, and the total of the organo groups of the second silicone oil comprises 50% to 80% alkyl groups and 20% to 50% aryl groups.

8. The erodible antifouling coating composition according to claim 1, wherein the erodible binder system is self-polishing and/or ablative.

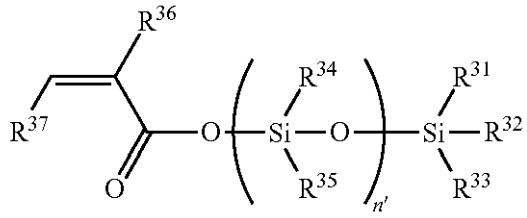
9. The erodible antifouling coating composition according to claim 1, wherein the erodible binder system comprises an alkaline soluble binder.

10. The erodible antifouling coating composition according to claim 1, wherein the erosion rate of the dried coating on a substrate in seawater is at least 1 µm per month at 10 knots.

11. The erodible antifouling coating composition according to claim 9, wherein the alkaline soluble binder optionally comprises a rosin based binder, a zinc resinate based binder, a copper resinate based binder, a silyl acrylate based binder or a metal acrylate based binder including copolymers and/or mixtures thereof.

12. The erodible antifouling coating composition according to claim 11, wherein the rosin based binder comprises a resin acid; and/or wherein the silyl acrylate based binder is a binder comprising residues of monomers in accordance with formula I:

Formula I



wherein

R^{31}, R^{32}, R^{33}, R^{34}, R^{35} each independently comprise an alkyl, an aryl group or a hydrogen atom,

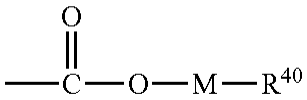
R^{36} comprises a hydrogen atom or a methyl group,

R^{37} comprises a hydrogen atom or an alkyl group,

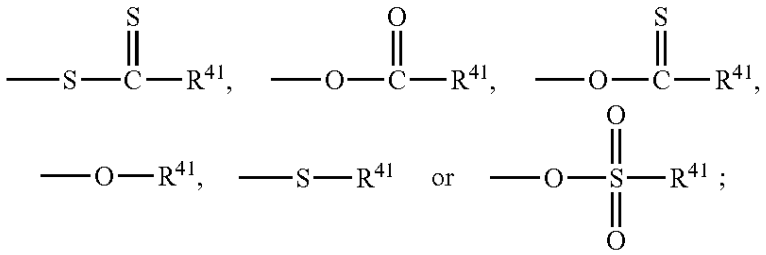
n′ represents a number of diorganosilxoane units from 0 to 200; and/or

the metal acrylate based binder comprises an acrylic copolymer having at least one side chain bearing a group of the formula II

II



wherein M comprises Zn, Ca, Mg or Cu, and R^{40} represents an organic acid residue selected from



wherein R^{41} is a monovalent organic residue.

13. The erodible antifouling coating composition according to claim 12, wherein

R^{31}, R^{32}, R^{33}, R^{34}, R^{35} each independently comprise an alkyl, an aryl group or a hydrogen atom, R^{36} represents a hydrogen atom or a methyl group, and

R^{37} represents a hydrogen atom.

14. The erodible antifouling coating composition according to claim 9, wherein the binder system comprises either a copolymer and/or a co-binder (co)polymer that incorporates acrylic and/or vinyl monomer residues.

15. The erodible antifouling coating composition according to claim 1, wherein the antifouling agent comprises an inorganic compounds, a metal-containing organic compounds, and/or metal-free organic compounds.

16. A substrate at least partially coated with a dried coating composition according to claim 1.

17. A process for producing an erodible antifouling coating composition according to claim 1, wherein the coating composition is prepared by combining the erodible binder system, the one or more antifouling agents, the mixture of silicone oils, and a solvent; and mixing them by a suitable method.

18. A process of coating at least a portion of a substrate with an erodible antifouling coating according to claim 1 by applying the undried antifouling coating composition onto the surface of a leach layer free substrate to be coated and then removing the solvent through evaporation and wherein for a coating process that is over-coating of an old coating then when over-coating

with the erodible antifouling coating, the old coating is washed and/or sweep blasted such that whatever leach layer is present, if any, is removed before over-coating with the new over-coating layer.

19. The erodible antifouling coating composition according to claim 1, wherein the first ratio of alkyl:aryl groups is 5:1 to 20:1 and the second ratio of alkyl:aryl groups is 1:1 to 5:1.

20. The erodible antifouling coating composition according to claim 1, wherein the first and second silicone oils are present in the composition at 3 to 8%, based on the total solids weight of the composition.