So, in a first aspect the present disclosure relates to a cured paint coat comprising a polysiloxane-based binder matrix and one or more biocides, said binder matrix having included as a part thereof hydrophilic oligomer/polymer moieties, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder matrix is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix and that the covalent bond(s) are non-hydrolysable. In one example, there is a cured paint coat comprising a polysiloxane-based binder matrix and one or more biocides, said binder matrix having included as a part thereof hydrophilic oligomer/polymer moieties, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder matrix is represented by polysiloxane parts.

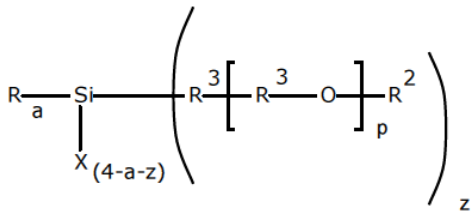
A second aspect of the disclosure relates to a marine structure comprising on at least a part of the outer surface thereof a paint coat as defined herein.

In a third aspect the present disclosure relates to a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more reactive polysiloxane components modified with hydrophilic oligomer/polymer moieties, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable. In one example, there is a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more reactive polysiloxane components modified with hydrophilic oligomer/polymer moieties, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts. In one example, there is a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more polysiloxane components modified with hydrophilic oligomer/polymer moieties, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts.

In a fourth aspect, the present disclosure relates to a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising

one or more hydrophilic oligomer/polymer moieties which at one or both ends carry –Si(R*)3 groups, wherein each R* independently is selected from C1-4-alkyl and C1-4-alkoxy, at least one being C1-4-alkoxy, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable. In one example, there is a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more hydrophilic oligomer/polymer moieties which at one or both ends carry $–Si(R^*)_3$ groups, wherein each R* independently is selected from C_{1-4}-alkyl and C_{1-4}-alkoxy, or R* is another condensation curable termination, at least one being C_{1-4}-alkoxy, or at least one being another condensation curable termination, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts.

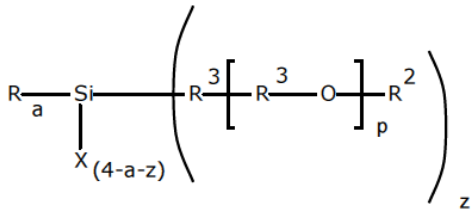
A fifth aspect of the disclosure relates to a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising a cross-linker of formula (2a)



(2a)

wherein, each R represents, independently, an unsubstituted or substituted monovalent hydrocarbon group of 1 to 6 carbon atoms or a hydrolysable group; each X represents, independently, a hydrolysable group; each R^2 is independently selected from -H, C_{1-4}-alkyl (e.g. $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH_2CH_2CH_3$), phenyl ($-C_6H_5$), and C_{1-4}-alkylcarbonyl (e.g. $–C(=O)CH_3$, $-C(=O)CH_2CH_3$ and $-C(=O)CH_2CH_2CH_3$), in particular -H and methyl; each R^3 is independently selected from C_{2-5}-alkylene (e.g. $-CH_2CH_2-$, $-CH_2CH(CH_3)-$, $-CH_2CH_2CH_2-$, $-CH_2CH_2CH_2CH_2-$, $-CH_2CH(CH_2CH_3)-$), arylene (e.g. 1,4-phenylene) and C_{2-5}-alkylene substituted with aryl (e.g. 1-phenyl ethylene), in particular from C_{2-5}-alkylene such as $-CH_2CH_2-$ and $-CH_2CH(CH_3)-$); p is 0-50; a is 0-2; z is 1-3;

and one or more biocides, wherein the weight ratio between the groups $-R^3-[-R^3-O-]_p-R^2$ in formula (2a) and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts. In one example, there is a fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising a cross-linker of formula (2a)



(2a)

wherein, each R represents, independently, an unsubstituted or substituted monovalent hydrocarbon group of 1 to 6 carbon atoms or a hydrolysable group; each X represents, independently, a hydrolysable group; each R^2 is independently selected from -H, C_{1-4}-alkyl (e.g. $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH_2CH_2CH_3$), phenyl ($-C_6H_5$), and C_{1-4}-alkylcarbonyl (e.g. $-C(=O)CH_3$, $-C(=O)CH_2CH_3$ and $-C(=O)CH_2CH_2CH_3$), in particular -H and methyl; each R^3 is independently selected from C_{2-5}-alkylene (e.g. $-CH_2CH_2-$, $-CH_2CH(CH_3)-$, $-CH_2CH_2CH_2-$, $-CH_2CH_2CH_2CH_2-$, $-CH_2CH(CH_2CH_3)-$), arylene (e.g. 1,4-phenylene) and C_{2-5}-alkylene substituted with aryl (e.g. 1-phenyl ethylene), in particular from C_{2-5}-alkylene such

as -CH_2CH_2- and -$CH_2CH(CH_3)$-); p is 0-50; a is 0-2; z is 1-3;

and one or more biocides, wherein the weight ratio between the poly(oxyalkylene) and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts.

A sixth aspect of the disclosure relates to the use of the combination of one or more reactive polysiloxane binder components modified with hydrophilic oligomer/polymer moieties and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable, for improving the antifouling properties of a polysiloxane based coating composition. In one example, there is the use of the combination of one or more reactive polysiloxane binder components modified with hydrophilic oligomer/polymer moieties and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, for improving the antifouling properties of a polysiloxane based coating composition. In one example, there is the use of the combination of one or more polysiloxane components modified with hydrophilic oligomer/polymer moieties and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, for improving the antifouling properties of a polysiloxane based coating composition.

DETAILED DISCLOSURE OF THE INVENTION

The cured paint coat

As mentioned above, the present invention provides a cured paint coat comprising a polysiloxane-based binder matrix and one or more biocides, said binder matrix having included as a part thereof hydrophilic oligomer/polymer moieties, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, such as 1:0.05 to 1:10, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts.

The paint coat is preferably used as the top coat in a coating system comprising two or more paint coat layers (e.g. at least a primer coat and a tie coat in addition to the top coat).

Without being bound to any particular theory, it is believed that the function of the polysiloxane-based binder matrix rendered hydrophilic by means of oligomer/polymer moieties is to facilitate the transport and accessibility of the biocide at the surface upon contact with sea-water. Potentially, a hydrated layer formed at the coating-water interphase

CLAIMS

1. A cured paint coat comprising a polysiloxane-based binder matrix and one or more biocides, said binder matrix having included as a part thereof hydrophilic oligomer/polymer moieties, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder matrix is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix and that the covalent bond(s) are non-hydrolysable.

2. The paint coat according to claim 1, wherein the hydrophilic oligomer/polymer moieties are selected from poly(vinyl pyrrolidone), poly[N-(2-hydroxypropyl)methacryl-amide], poly(acrylic acid), poly(glycerol), polyHEMA, polysaccharides, poly(vinyl alcohol), polyketones, poly(aldehyde guluronate), polyvinylamine, polycaprolactones, poly(vinyl acetate), polyoxyalkylenes like poly(ethylene glycol), poly(propylene glycol), poly(2-methyl-2-oxazoline), including copolymers of the foregoing, in particular poly(oxyalkylenes).

3. The paint coat according to claim 2, wherein the poly(oxyalkylene) is selected from polyoxyethylene, polyoxypropylene and poly(oxyethylene-co-oxypropylene).

4. The paint coat according to any one of the preceding claims, wherein at least one biocide is an organic biocide.

5. The paint coat according to any one of the preceding claims, wherein the one or more biocides constitutes 0.1-10 % by dry weight of the paint coat.

6. The paint coat according to any one of the preceding claims, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.05 to 1:5.

7. A marine structure comprising on at least a part of the outer surface thereof a paint coat as defined in any one of the preceding claims.

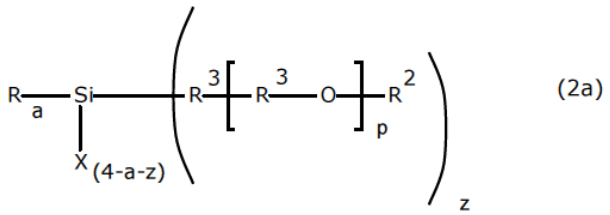
8. The structure according to claim 7, wherein at least as part of the outer surface carrying the outermost coating is a submerged part of said structure.

9. A fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more reactive polysiloxane components modified with

hydrophilic oligomer/polymer moieties, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable.

10. A fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising one or more hydrophilic oligomer/polymer moieties which at one or both ends carry $-Si(R^*)_3$ groups, wherein each R* independently is selected from C_{1-4}-alkyl and C_{1-4}-alkoxy, at least one being C_{1-4}-alkoxy, and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable.

11. A fouling control coating composition comprising a polysiloxane-based binder system, said binder system comprising a cross-linker of formula (2a)



(2a)

wherein, each R represents, independently, an unsubstituted or substituted monovalent hydrocarbon group of 1 to 6 carbon atoms or a hydrolysable group; each X represents, independently, a hydrolysable group; each R^2 is independently selected from -H, C_{1-4}-alkyl (e.g. $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH_2CH_2CH_3$), phenyl ($-C_6H_5$), and C_{1-4}-alkylcarbonyl (e.g. $-C(=O)CH_3$, $-C(=O)CH_2CH_3$ and $-C(=O)CH_2CH_2CH_3$), in particular -H and methyl; each R^3 is independently selected from C_{2-5}-alkylene (e.g. $-CH_2CH_2-$, $-CH_2CH(CH_3)-$, $-CH_2CH_2CH_2-$, $-CH_2CH_2CH_2CH_2-$, $-CH_2CH(CH_2CH_3)-$), arylene (e.g. 1,4-phenylene) and C_{2-5}-alkylene substituted with aryl (e.g. 1-phenyl ethylene), in particular from C_{2-5}-alkylene such as $-CH_2CH_2-$ and $-CH_2CH(CH_3)-$); p is 0-50; a is 0-2; z is 1-3;

and one or more biocides, wherein the weight ratio between the groups $-R^3-[-R^3-O-]_p-R^2$ in

formula (2a) and the one or more biocides is in the range 1:0.02 to 1:20, and wherein more than 50 % by weight of the binder system is represented by polysiloxane parts.

12. The coating composition according to any one of the claims 9 and 10, wherein the hydrophilic oligomer/polymer moieties are selected from poly(vinyl pyrrolidone), poly[N-(2-hydroxypropyl)methacrylamide], poly(acrylic acid), poly(glycerol), polyHEMA, polysaccharides, poly(vinyl alcohol), polyketones, poly(aldehyde guluronate), polyvinylamine, polycaprolactones, poly(vinyl acetate), polyoxyalkylenes like poly(ethylene glycol), poly(propylene glycol), poly(2-methyl-2-oxazoline), including copolymers of the foregoing, in particular poly(oxyalkylenes).

13. The coating composition according to claims 12, wherein the poly(oxyalkylene) is selected from polyoxyethylene, polyoxypropylene and poly(oxyethylene-co-oxypropylene).

14. The coating composition according to any one of the claims 9-13, wherein at least one biocide is an organic biocide.

15. The coating composition according to any one of the claims 9-14, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.05 to 1:5.

16. Use of the combination of one or more reactive polysiloxane binder components modified with hydrophilic oligomer/polymer moieties and one or more biocides, wherein the weight ratio between the hydrophilic oligomer/polymer moieties and the one or more biocides is in the range 1:0.02 to 1:20, wherein the hydrophilic oligomer/polymer moieties are covalently incorporated into the binder matrix formed when the coating composition is cured and the covalent bond(s) are non-hydrolysable, for improving the antifouling properties of a polysiloxane based coating composition.