WO 2011/076856 discloses a fouling control coating composition comprising a polysiloxane-based binder system, one or more hydrophilic-modified polysiloxanes, and one or more biocides. It is disclosed that hydrophilic-modified polysiloxane serves to facilitate the dissolution and transport of biocide to the surface of a coating.

KR 2014/0117922 discloses an antifouling paint composition comprising a metal ester binder, a polyether modified silicone oil and fumed silica.

SUMMARY

The present inventors have now found that by re-designing erodible antifouling coating compositions by including therein polyoxyalkylene-modified silicone oils of the nature specified herein, it is possible to retard the otherwise free diffusion of biocide along the leach layer. This provides a more efficient use of metal-containing biocides leading to improved antifouling performance by using the same level of biocide, and/or reduction of the amount of biocide needed for obtaining the same antifouling performance, as this controlled release will increase bioavailability of biocide against fouling species for a prolonged period of time.

Without being bound to any particular theory, it is currently believed that the function of the non-reactive polyoxyalkylene-modified silicone oils is to create an interaction with the metal-containing biocide which improves the antifouling performance and/or durability of the antifouling effect. The ways to control the leach rate include the molecule size of the polyoxyalkylene-modified silicone oils, the overall hydrophilicity and the miscibility with the binder. The latter may be expressed by the so-called HLB value (hydrophilic-lipophilic balance). A very small molecule tends to diffuse and leach out of the film without achieving the intended effect, while a too large molecule would modify the film interaction with water and alter the desired leaching of biocides.

So, in a first aspect the present disclosure refers to a solvent-borne antifouling coating composition, cf. claim 1.

A second aspect of the present disclosure refers to an antifouling coat, cf. claim 11.

A third aspect of the present disclosure refers to an antifouling coating system, cf. claim 12.

A fourth aspect of the present disclosure refers to a marine structure, cf. claim 14.

A fifth aspect of the present disclosure refers to the use of the combination of one or more non-reactive polyoxyalkylene-modified silicone oils and one or more metal-containing biocides for improving the antifouling properties of a coating composition comprising an erodible non-silicone based binder system, cf. claim 15.

DETAILED DESCRIPTION OF THE INVENTION

The solvent-borne antifouling coating composition

The present invention i. a. provides a solvent-borne antifouling coating composition comprising

a. an erodible non-silicone based binder system,

b. one or more metal-containing biocides, and

c. one or more non-reactive polyoxyalkylene-modified silicone oils,

wherein the one or more non-reactive polyoxyalkylene-modified silicone oils are present in a total amount of 0.05-10 % by dry weight based on the coating composition.

Coating compositions (occasionally referred to as "paints" or "paint compositions") typically consists of a binder phase (which forms the paint film upon drying and thereby corresponds to the continuous phase of the final paint coat) and a pigments phase (corresponding to the discontinuous phase of the final paint coat). According to this simplified understanding, the one or more metal-containing biocides as well as the non-reactive polyoxyalkylene-modified silicone oils are not part of the continuous phase (the binder phase), but instead forms part of the "pigment phase".

In the present context, the term "solvent-borne" is understood as coating compositions in which the components of the binder system is dissolved in a non-aqueous solvent, and wherein a coat corresponding to the coating composition is formed upon evaporation of the solvent and, in some instance, further upon curing of the binder components.

In a currently preferred embodiment, the solvent-borne coating composition comprises a *physically drying* binder system which differs from a *chemically hardening* binder system (see below) in that the binder components (i.e. individual molecules) of the binder system in the

CLAIMS

1. A solvent-borne antifouling coating composition comprising

a. an erodible non-silicone based binder system,

b. one or more metal-containing biocides, and

c. one or more non-reactive polyoxyalkylene-modified silicone oils

wherein the one or more non-reactive polyoxyalkylene-modified silicone oils are present in a total amount of 0.15-5 % by dry weight based on the coating composition and wherein the one or more non-reactive polyoxyalkylene-modified silicone oils each have an HLB value in the range of 9-18.

2. The coating composition according to claim 1, wherein the polyoxyalkylene-modified silicone oils carry polyoxyalkylene chains selected from poly(ethylene glycol) chains, poly(propylene glycol) chains and poly(ethylene glycol-co-propylene glycol) chains.

3. The coating composition according to claim 2, wherein the poly(oxyalkylene) chains are selected from poly(ethylene glycol) chains and poly(ethylene glycol-co-propylene glycol) chains wherein the weight ratio between ethylene glycol (PEG) and propylene glycol (PPG) is 90:10 to 30:70, preferably 75:25 to 35:65, more preferably 60:40 to 40:60.

4. The coating composition according to any one of the preceding claims, wherein the one or more non-reactive polyoxyalkylene-modified silicone oils each have an HLB value in the range 11-17.

5. The coating composition according to any one of the preceding claims, wherein the non-silicone based binder system comprises constituents selected from rosin based binder systems, silyl acrylate binder systems, non-aqueous dispersion based binder systems, and metal-acrylate based binder systems; preferably from rosin based binder systems, silyl acrylate binder systems, and metal-acrylate based binder systems; more preferably from rosin based binder systems, silyl acrylate binder systems.

6. The coating composition according to any one of the preceding claims, wherein the one or more metal-containing biocides are present in a total amount of 3-65%, such as 5-60 % by dry weight based on the coating composition.

7. The coating composition according to any one of the preceding claims, wherein the one or more metal-containing biocides are selected from metallo-dithiocarbamates; bis(1-hydroxy-2(1H)-pyridinethionato-O,S)-copper (copper pyrithione); copper acrylate; bis(1-hydroxy-2(1H)-pyridinethionato-O,S)-zinc (zinc pyrithione); cuprous oxide, metallic copper; copper metal alloys; metal salts; and bis(N-cyclohexyl-diazenium dioxy) copper.

8. The coating composition according to claim 7, wherein the one or more metal-containing biocides is selected from cuprous oxide, copper pyrithione and zinc pyrithione.

9. The coating composition according to claim 8, wherein the one or more metal-containing biocides includes cuprous oxide and at least one of copper pyrithione and zinc pyrithione.

10. The coating composition according to claim 9, wherein the weight ratio between cuprous oxide and the combined amount of copper pyrithione and/or zinc pyrithione is in the range of 25:1 to 1:1.

11. A antifouling coat comprising

a. an erodible non-silicone based binder matrix,

b. one or more metal-containing biocides, and

c. one or more non-reactive polyoxyalkylene-modified silicone oils

wherein the one or more non-reactive polyoxyalkylene-modified silicone oils are present in a total amount of 0.15-5 % by dry weight based on the coating composition and wherein the one or more non-reactive polyoxyalkylene-modified silicone oils each have an HLB value in the range of 9-18.

12. An antifouling coating system on a substrate, said antifouling coating system comprising at least a first coat and a second coat,

a. said first coat comprising an erodible non-silicone based binder system, said first coat further comprising one or more non-reactive polyoxyalkylene-modified silicone oils; wherein the one or more non-reactive polyoxyalkylene-modified silicone oils are present in a total amount of 0.15-5 % by dry weight based on the coating composition, and wherein the one or more non-reactive polyoxyalkylene-modified silicone oils each have an HLB value in the range of 9-18, and

b. said second coat comprising an erodible non-silicone based binder system, said second coat further comprising one or more metal-containing biocides.

wherein the first coat and the second coat are prepared on said substrate in such a way that the second coat is prepared on top of the first coat.

13. The antifouling coat according to claim 11 or the antifouling coating system according to claim 12, wherein the coating system comprises 2-30 g/m^2 of said one or more non-reactive polyoxyalkylene-modified silicone oils and 20-250 g/m^2 of said one or more metal-containing biocides.

14. A marine structure comprising on at least a part of the outer surface thereof an outermost antifouling coat as defined in any one of claims 11 and 13 or a coating system as defined in any one of the claims 12-13.

15. The use of the combination of one or more non-reactive polyoxyalkylene-modified silicone oils and one or more metal-containing biocides for improving the antifouling properties of a coating composition comprising an erodible non-silicone based binder system wherein the one or more non-reactive polyoxyalkylene-modified silicone oils are present in a total amount of 0.15-5 % by dry weight based on the coating composition and wherein the one or more non-reactive polyoxyalkylene-modified silicone oils each have an HLB value in the range of 9-18.