and fouling mitigation include phosphorus, such as orthophosphates, polyphosphates, or organic phosphates commonly known as phosphonates. While there has been some success attributed to phosphorus containing corrosion and fouling inhibitor compositions, it has recently been discovered that phosphorus is not environmentally friendly and thus environmental agencies have either mandated a reduction in its use or banned its use altogether.

As such, there exists a need for corrosion and fouling mitigating compositions that do not include phosphorus, and methods for providing corrosion or fouling mitigation using such non-phosphorus containing compositions.

BRIEF SUMMARY OF THE INVENTION

Water treatment compositions useful for mitigating fouling and corrosion are disclosed. The water treatment compositions can include one or more azole compounds, one or more transition metals, and one or more dispersants. The water treatment compositions can exclude, or not comprise, phosphorus.

In one aspect, the present disclosure provides a water treatment composition comprising: an effective amount of one or more azole compounds, an effective amount of one or more transition metals, and an effective amount of one or more dispersants, wherein said water treatment composition does not comprise phosphorus, wherein said one or more dispersants comprises a mixture of polymaleic acid and a copolymer comprising acrylic acid and 2-acrylamido-2-methylpropane sulfonic acid, said one or more transition metals comprises zinc, and said one or more azole compounds comprises a mixture of butylbenzotriazole and tolyltriazole.

Methods for mitigating corrosion and fouling of a surface in an aqueous system are also disclosed. The methods can include the steps of providing a housing having at least one metal surface, introducing an aqueous medium into the housing, and injecting a water treatment composition comprising an effective amount of one or more azole compounds, an effective amount of one or more transition metals, and an effective amount of one or more dispersants into the aqueous medium. The water treatment compositions can exclude, or not comprise, phosphorus.

The present disclosure provides an automated, on-line method of monitoring and controlling one or more properties of water. The method comprises:

(a) providing a storage device;

(b) introducing water into the storage device;

(c) providing a monitoring and controlling unit comprising a controller and a plurality of sensors in communication with the controller, wherein each of the plurality of sensors is operable to measure a property of the water;

CLAIMS

What is claimed is:

1. A water treatment composition comprising:

an effective amount of one or more azole compounds, an effective amount of one or more transition metals, and an effective amount of one or more dispersants, wherein said water treatment composition does not comprise phosphorus,

wherein said one or more dispersants comprises a mixture of polymaleic acid and a copolymer comprising acrylic acid and 2-acrylamido-2-methylpropane sulfonic acid, said one or more transition metals comprises zinc, and said one or more azole compounds comprises a mixture of butylbenzotriazole and tolyltriazole.

2. The water treatment composition of Claim 1, wherein said one or more dispersants are present in an amount ranging from 2 ppm to 50 ppm.

3. The water treatment composition of Claim 1, wherein said one or more azole compounds are present in an amount ranging from 1 ppm to 50 ppm.

4. The water treatment composition of Claim 1, wherein said one or more azole compounds are present in an amount ranging from 3 ppm to 20 ppm.

5. The water treatment composition of Claim 1, wherein said one or more transition metals are present in an amount ranging from 2 ppm to 4 ppm.

6. The water treatment composition of Claim 1, wherein said one or more dispersants comprises a mixture of polymaleic acid and a copolymer comprising acrylic acid and 2-acrylamido-2-methylpropane sulfonic acid in an amount of 3 ppm, said one or more transition metals comprises zinc in an amount of 4 ppm, and said one or more azole compounds comprises a mixture of butylbenzotriazole and tolyltriazole in an amount of 3 ppm.