SUBMERGIBLE BIOCIDE REACTOR AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Patent Application Serial No. 62/152,342 filed on April 24, 2015, and U.S. Patent Application Serial No. 15/135,036 filed on April 21, 2016, the disclosures of which are incorporated herein by reference in their entireties.

BACKGROUND

[0002] Biocides can be used to control, reduce, and/or eliminate microbial growth that may occur on inner surfaces of industrial water systems. For example, inner surfaces of cooling water systems may become fouled with scale, which can provide a medium for microbial growth and lead to ineffective performance of the cooling water system. Control, reduction, and/or elimination of microbial growth can be important for efficient operation of industrial water systems.

SUMMARY

[0003] A method of administering biocide to industrial water in an industrial water process is provided. The method comprises diverting a portion of industrial water to a side stream at a water level. The industrial water side stream is filtered. A first reactant and a second reactant are added to a biocide-forming reactor at a ratio sufficient to form biocide. The biocide-forming reactor is located at least partially below the industrial water level. The filtered industrial water side stream is treated with biocide from the biocide-forming reactor. The biocide-treated industrial water side stream is returned to the industrial water in the industrial water process.

[0004] A reactor for generating an oxidative biocide and delivering the oxidative biocide to a liquid stream is provided. The reactor comprises a body, a reaction chamber, a first inlet port for receiving a first biocide reactant, a second inlet port for receiving a second biocide reactant, and an outlet port in fluid communication with the reaction chamber. Each of the inlet ports is in fluid communication with the reaction chamber. Packing is positioned within the reaction chamber to facilitate mixing of the first and second reactants.

[0004a] In one aspect, there is provided a reactor for generating an oxidative biocide and delivering the oxidative biocide to a liquid stream, the reactor comprising:

a body comprising a reaction chamber, a first inlet port for receiving a first biocide reactant, a second inlet port for receiving a second biocide reactant, each of the inlet ports in fluid communication with the reaction chamber, and an outlet port in fluid communication with the reaction chamber; and

packing formed by a plurality of packing members and positioned within the reaction chamber to facilitate mixing of the first and second reactants,

wherein the reaction chamber defines a first diameter and each packing member defines a second diameter, the ratio of the first diameter to the second diameter being from about 3:1 to about 8:1.

CLAIMS:

What is claimed is:

1. A reactor for generating an oxidative biocide and delivering the oxidative biocide to a liquid stream, the reactor comprising:

a body comprising a reaction chamber, a first inlet port for receiving a first biocide reactant, a second inlet port for receiving a second biocide reactant, each of the inlet ports in fluid communication with the reaction chamber, and an outlet port in fluid communication with the reaction chamber; and

packing formed by a plurality of packing members and positioned within the reaction chamber to facilitate mixing of the first and second reactants,

wherein the reaction chamber defines a first diameter and each packing member defines a second diameter, the ratio of the first diameter to the second diameter being from about 3:1 to about 8:1.

2. The reactor of claim 1, wherein the packing occupies from about 25 percent to about 75 percent of the volume of the reaction chamber.

3. The reactor of any one of claims 1 and 2, wherein the packing members are selected from the group consisting of: glass balls, ceramic balls, Raschig rings, Berl saddles, and combinations thereof.

4. The reactor of any one of claims 1 to 3, wherein the body is formed from a halogenated plastic.

5. The reactor of any one of claims 1 to 4, wherein the packing is formed by a fixed packing insert.

6. The reactor of claim 5, wherein the fixed packing insert is fixably attached to the body.

7. The reactor of any one of claims 1 to 6, wherein each of the first inlet port and the second inlet port are in fluid communication with the reaction chamber via respective inlet channels.

8. The reactor of claim 7, wherein the inlet channels are arranged to deliver each of the first reactant and the second reactant into the reaction chamber via separate streams.

9. The reactor of claim 7, wherein the inlet channels are arranged to deliver the first reactant and the second reactant into the reaction chamber via a single stream.

10. The reactor of claim 9, wherein the inlet channels merge at tapered angles to form the single stream.

11. The reactor of claim 10, wherein the tapered angles form a right angle at the single stream.

12. The reactor of claim 1, wherein the ratio of the first diameter to the second diameter is from about 4:1 to about 6:1.