

[00139] We claim:

1. A composition for treating a membrane in a fluid system to remediate biofilm, the composition comprising:

a surfactant;

a first chelating agent; and

a second chelating agent or other ingredient that will react with the first chelating agent to produce a second chelating agent;

wherein these ingredients are in amounts that when mixed with a volume of fluid in the fluid system or portion thereof being treated will provide concentrations of at least 0.00015 M for the surfactant, at least 0.001 M for the first chelating agent, and at least 0.0005 M for the second chelating agent.

2. The composition according to claim 1 wherein the first chelating agent is an organic acid and the second chelating agent is the corresponding neutral salt of the first chelating agent.

3. The composition according to claim 2 wherein the first chelating agent is citric acid and the second chelating agent is sodium citrate.

4. The composition according to claim 3 wherein the other ingredient is sodium bicarbonate.

5. The composition according to claim 3 wherein the surfactant is an ammonium bromide compound, an ammonium chloride compound, or a sodium sulfonate compound.

6. The composition of claim 1 wherein the amounts of ingredients will provide concentrations of the first chelating agent in the range of about 0.001 M to 0.01 M, the second chelating agent in the range of about 0.0005 M to 0.005 M, and the surfactant in the range of about 0.00015 M to 0.0015 M when mixed with the volume of fluid in the fluid system containing the membrane being treated.

7. The composition according to claim 1 wherein the surfactant, the first chelating agent, and the second chelating agent or other ingredient are in solid form prior to being mixed with the fluid in the fluid system containing the membrane being treated.
8. The composition according to claim 1 further comprising a corrosion inhibitor and a secondary biocide.
9. The composition according to claim 8 wherein the corrosion inhibitor is a tolyltriazole compound.
10. The composition according to claim 9 wherein the corrosion inhibitor is in a concentration in the range of about 2 ppm to 20 ppm based on the volume of fluid in the fluid system containing the membrane being treated.
11. The composition according to claim 8 further comprising an anti-foaming agent.
12. The composition according to claim 8 wherein the secondary biocide is hypochlorite.

13. A method of removing biofilm and treating a fluid system containing a membrane, the method comprising the steps of:

adding a surfactant, a first chelating agent, and a second chelating agent or other ingredient that will react with the first chelating agent to produce a second chelating agent to the fluid system in amounts sufficient to provide concentrations of at least 0.00015 M for the surfactant, at least 0.001 M for the first chelating agent, and at least 0.0005 M for the second chelating when mixed with a volume of fluid in the fluid system containing the membrane or portion thereof being treated;

circulating the fluid containing the surfactant and chelating agents through at least a portion of the fluid system to contact the membrane; and

wherein the fluid system is a nanofiltration, ultrafiltration, microfiltration, forward osmosis, reverse osmosis, or conventional particle filtration system.

14. The method of claim 13 further comprising the steps of:

adding a corrosion inhibitor and a secondary biocide to the fluid in the fluid system; and

circulating the fluid containing the corrosion inhibitor and secondary biocide through at least a portion of the fluid system.

15. The method of claim 14 wherein the corrosion inhibitor is added and circulated for a period of time prior to adding the surfactant.

16. The method of claim 14 wherein the surfactant is added and circulated for a period of time prior to adding the first chelating agent.

17. The method of claim 14 wherein the surfactant and chelating agents circulate for a period of time prior to adding the secondary biocide.

18. The method of claim 14 wherein the surfactant, the first chelating agent, the second chelating agent or other ingredient that will react with the first

chelating agent to produce a second chelating agent, and secondary biocide are added at substantially the same time.

19. The method according to claim 13 wherein the first chelating agent is citric acid and the second chelating agent is sodium citrate.

20. The method according to claim 19 wherein the other ingredient is sodium bicarbonate.

21. The method according to claim 19 wherein the surfactant is an ammonium bromide compound, an ammonium chloride compound, or a sodium sulfonate compound.

22. The method of claim 13 wherein the fluid system is a reverse osmosis system, the method further comprising the steps of:

decreasing pressure in the reverse osmosis system to temporarily cease collection of permeate.

23. The method of claim 22 further comprising the steps of removing substantially all of the fluid containing the surfactant and chelating agents from the reverse osmosis system after the circulating step; and

rinsing the reverse osmosis system after the removing step and prior to resuming normal operations of the reverse osmosis system.

24. The method according to claim 22 wherein the amounts of ingredients added will provide concentrations of the first chelating agent in the range of about 0.001 M to 0.01 M, the second chelating agent in the range of about 0.0005 M to 0.005 M, and the surfactant in the range of about 0.00015 M to 0.0015 M when mixed with the volume of fluid in the reverse osmosis system being treated.

25. The method of claim 22 further comprising the step of filtering the fluid as it circulates through the reverse osmosis system to remove dislodged biofilm material.

26. The method according to claim 22 wherein the first chelating agent is an organic acid and the second chelating agent is the corresponding neutral salt of the first chelating agent.
27. The method according to claim 25 wherein the first chelating agent is citric acid and the second chelating agent is sodium citrate.
28. The method according to claim 26 wherein the other ingredient is sodium bicarbonate.
29. The method according to claim 26 wherein the surfactant is an ammonium bromide compound, an ammonium chloride compound, or a sodium sulfonate compound.
30. The method according to claim 22 wherein the surfactant, the first chelating agent, and the second chelating agent or other ingredient that will react with the first chelating agent to produce a second chelating agent are in solid form prior to being added to the fluid of the reverse osmosis system being treated.
31. The method of claim 19 wherein the corrosion inhibitor is added and circulated for a period of time prior to adding the surfactant.
32. The method of claim 19 wherein the surfactant is added and circulated for a period of time prior to adding the first chelating agent.
33. The method of claim 19 wherein the surfactant and chelating agents circulate for a period of time prior to adding the secondary biocide.