CLAIMS

1. A composition comprising:

   one or more peroxides; and

   stable free available chlorine, wherein the stable free available chlorine comprises at least 70 ppm to at most 1,000 ppm of stable hypochlorous acid;

   wherein the one or more peroxides and the stable free available chlorine coexist.

2. The composition according to Claim 1, wherein the one or more peroxides is present in an amount of at least 0.1 ppm to at most 1,000 ppm.

3. The composition according to Claim 2, wherein the one or more peroxides is present in an amount of at least 1 ppm to at most 500 ppm.

4. The composition according to Claim 3, wherein one or more peroxides is present in an amount of at least 10 ppm to at most 250 ppm.

5. The composition according to any one of Claims 1-4, wherein the one or more peroxides comprises hydrogen peroxide.

6. The composition according to any one of Claims 1-5, wherein the amount of the stable hypochlorous acid is at least 80 ppm.

7. The composition according to Claim 6, wherein the amount of the stable hypochlorous acid is at least 90 ppm.

8. The composition according to Claim 7, wherein the amount of the stable hypochlorous acid is at least 100 ppm.

9. The composition according to any one of Claims 1 to 5, wherein the amount of the stable hypochlorous acid is at least 100 ppm to at most 700 ppm.

10. The composition according to Claim 9, wherein the amount of the stable hypochlorous acid is at least 100 ppm to at most 500 ppm.

11. The composition according to Claim 10, wherein the amount of the stable hypochlorous acid is at least 100 ppm to at most 450 ppm.

12. The composition according to any one of Claims 1-11, wherein the stable free available chlorine further comprises hypochlorite (OCl^-), chlorine gas (Cl_2), superchloride (Cl_2^-), chlorine oxide radical (ClO), peroxyhypochlorous acid (HOOCl), another reactive chlorine species (RCS), or a combination thereof.

13. The composition of any one of Claims 1-12, further comprising a reactive oxygen species (ROS).

14. The composition of Claim 13, wherein the reactive oxygen species includes oxygen gas (O_2), superoxide (O_2^-), singlet oxygen ($^1O_2$), α-oxygen (α-O), protonated oxygen (HO_2^+), hydroperoxyl radical (HO_2), hydroxyl radical (OH), peroxide (O_2^{-2}), ozone (O_3), ozonide (O_3^-), or a combination thereof.

15. A method of making a composition according to any one of Claims 1-14, the method composting hydrolyzing a solution comprising sodium hydroxide, phosphate, and sodium peroxide in the presence of chloride gas.

16. Sodium peroxide for use in the manufacture of a composition according to any one of Claims 1-14.

17. A method of producing a composition according to any one of Claims 1-14, the method comprising

    preparing a first solution comprising purified water and a trace amount of one or more peroxides;

    introducing chlorine gas to the first solution for a first period of time to produce a first reaction solution;

    adding a trace amount of one or more peroxides the first reaction solution; and

    introducing chlorine gas to the first reaction solution for a second period of time to produce a second reaction solution,

    wherein the resulting second reaction solution has higher levels of one or more free available chlorine species and one or more peroxides as compared to the first reaction solution.

18. The method according to Claim 17, wherein the first reaction solution comprises approximately equimolar amounts of the one or more free available chlorine species and the one or more peroxide species and has a pH below 4.

19. The method according to Claim 17 or 18, wherein the second reaction solution comprises approximately equimolar amounts of the one or more free available chlorine species and the one or more peroxide species and has a pH below 4.

20. The method according to any one of Claim 17-19, wherein the trace amount of the one or more peroxides in the first solution is 0.01% to 0.15%, 0.02% to 0.12%, 0.03% to 0.11%, 0.04% to 0.10%, 0.05% to 0.09%, or 0.06% to 0.08% by weight of the first solution.

21. The method according to any one of Claims 17-20, wherein the trace amount of the one or more peroxides in the first reaction solution is 0.001% to 0.01%, 0.001% to 0.0125%, 0.001% to 0.015%, 0.001% to 0.0175%, 0.001% to 0.02%, 0.001% to 0.03%, 0.001% to 0.04%, 0.0025% to 0.01%, 0.0025% to 0.0125%, 0.0025% to 0.015%, 0.0025% to 0.0175%, 0.0025% to 0.02%, 0.0025% to 0.03%, 0.0025% to 0.04%, 0.005% to 0.01%, 0.005% to 0.0125%, 0.005% to 0.015%, 0.005% to 0.0175%, 0.005% to 0.02%, 0.005% to 0.03%, 0.005% to 0.04%, 0.0075% to 0.01%, 0.0075% to 0.0125%, 0.0075% to 0.015%, 0.0075% to 0.0175%, 0.0075% to 0.02%, 0.0075% to 0.03%, 0.0075% to 0.04%, 0.01% to 0.0125%, 0.01% to

0.015%, 0.01% to 0.0175%, 0.01% to 0.02%, 0.01% to 0.03%, or 0.01% to 0.04% by weight of the first reaction solution.

22. The method according to any one of Claims 17-21, wherein the first period of time is longer in duration than the second period of time.

23. The method according to any one of Claims 17-22, wherein the first period of time is 30 minutes to 40 minutes, 30 minutes to 45 minutes, 30 minutes to 50 minutes, 30 minutes to 55 minutes, or 30 minutes to 60 minutes.

24. The method according to any one of Claims 17-23, wherein the second period of time is 5 minutes to 10 minutes, 5 minutes to 15 minutes, 5 minutes to 20 minutes, 5 minutes to 30 minutes, 10 minutes to 15 minutes, 10 minutes to 20 minutes, 10 minutes to 30 minutes, 15 minutes to 20 minutes, 15 minutes to 30 minutes, or 20 minutes to 30 minutes.

25. The method according to any one of Claims 17-24, further comprising

    adding an appropriate trace amount of one or more peroxides the second reaction solution; and

    introducing chlorine gas to the second reaction solution for a third period of time to produce a third reaction solution,

    wherein the resulting third reaction solution has higher levels of one or more free available chlorine species and one or more peroxides as compared to the second reaction solution.

26. The method according to Claim 25, wherein the trace amount of the one or more peroxides in the second reaction solution is 0.001% to 0.01%, 0.001% to 0.0125%, 0.001% to 0.015%, 0.001% to 0.0175%, 0.001% to 0.02%, 0.001% to 0.03%, 0.001% to 0.04%, 0.0025% to 0.01%, 0.0025% to 0.0125%, 0.0025% to 0.015%, 0.0025% to 0.0175%, 0.0025% to 0.02%, 0.0025% to 0.03%, 0.0025% to 0.04%, 0.005% to 0.01%, 0.005% to 0.0125%, 0.005% to 0.015%, 0.005% to 0.0175%, 0.005% to 0.02%, 0.005% to 0.03%, 0.005% to 0.04%, 0.0075% to 0.01%, 0.0075% to 0.0125%, 0.0075% to 0.015%, 0.0075% to 0.0175%, 0.0075% to 0.02%, 0.0075% to 0.03%, 0.0075% to 0.04%, 0.01% to 0.0125%, 0.01% to 0.015%, 0.01% to 0.0175%, 0.01% to 0.02%, 0.01% to 0.03%, or 0.01% to 0.04% by weight of the first reaction solution.

27. The method according to Claim 25 or 26, wherein the second period of time is longer in duration than the third period of time.

28. The method according to any one of Claims 25-27, wherein the third period of time is 5 minutes to 10 minutes, 5 minutes to 15 minutes, 5 minutes to 20 minutes, 5 minutes to 30 minutes, 10 minutes to 15 minutes, 10 minutes to 20 minutes, 10 minutes to 30 minutes, 15 minutes to 20 minutes, 15 minutes to 30 minutes, or 20 minutes to 30 minutes.

29. The method according to any one of Claims 25-28, further comprising

    adding a trace amount of one or more peroxides the third reaction solution; and

    introducing chlorine gas to the third reaction solution for a fourth period of time to produce a fourth reaction solution,

wherein the resulting fourth reaction solution has higher levels of one or more free available chlorine species and one or more peroxides as compared to the third reaction solution.

30. The method according to Claim 29, wherein the trace amount of the one or more peroxides in the third reaction solution is 0.001% to 0.01%, 0.001% to 0.0125%, 0.001% to 0.015%, 0.001% to 0.0175%, 0.001% to 0.02%, 0.001% to 0.03%, 0.001% to 0.04%, 0.0025% to 0.01%, 0.0025% to 0.0125%, 0.0025% to 0.015%, 0.0025% to 0.0175%, 0.0025% to 0.02%, 0.0025% to 0.03%, 0.0025% to 0.04%, 0.005% to 0.01%, 0.005% to 0.0125%, 0.005% to 0.015%, 0.005% to 0.0175%, 0.005% to 0.02%, 0.005% to 0.03%, 0.005% to 0.04%, 0.0075% to 0.01%, 0.0075% to 0.0125%, 0.0075% to 0.015%, 0.0075% to 0.0175%, 0.0075% to 0.02%, 0.0075% to 0.03%, 0.0075% to 0.04%, 0.01% to 0.0125%, 0.01% to 0.015%, 0.01% to 0.0175%, 0.01% to 0.02%, 0.01% to 0.03%, or 0.01% to 0.04% by weight of the first reaction solution.

31. The method according to Claim 29 or 30, wherein the third period of time is longer in duration than the fourth period of time.

32. The method according to any one of Claims 29-31, wherein the fourth period of time is 5 minutes to 10 minutes, 5 minutes to 15 minutes, 5 minutes to 20 minutes, 5 minutes to 30 minutes, 10 minutes to 15 minutes, 10 minutes to 20 minutes, 10 minutes to 30 minutes, 15 minutes to 20 minutes, 15 minutes to 30 minutes, or 20 minutes to 30 minutes.

33. The method according to any one of Claims 29-32, further comprising repeating the peroxide addition and the chlorine introduction steps as defined in Claims 29-32 one or more additional times, wherein the resulting subsequent reaction solution has higher levels of one or more free available chlorine species and one or more peroxides as compared to the previous reaction solution.