CLAIMS

What is claimed is:

1. A dispensable composition comprising metal-associated cerium oxide nanoparticles (mCNP) and an excipient, wherein the metal comprises silver, and the mCNPs are Ag cerium oxide nanoparticles (AgCNPs), wherein at least a portion of the mCNPs are spherically shaped, wherein an average diameter of the spherically shaped mCNPs comprises a first range from 20 nm to 24 nm in size or a second range from 3 nm to 5 nm in size, and wherein the mCNPs have ionized metal removed.

2. The dispensable composition of claim 1, wherein the silver is in an amount of less than 10% by weight of the mCNPs.

3. The dispensable composition of any of claims 1-2, wherein the excipient is selected from the group consisting of water, chloroform, methylene chloride, acetone, methyl ethyl ketone, cyclohexane, ethyl acetate, diethyl ether, lower alcohols, lower diols, THF, DMSO, or DMF.

4. The dispensable composition of claim 3, wherein the excipient comprises water.

5. The dispensable composition of claim 1, wherein the mCNPs are further doped with fluorine.

6. The dispensable composition of any of claims 1-2, wherein the mCNPs are less than 100nm in size.

7. The dispensable composition of any of claims 1-4, wherein the mCNPs comprise predominantly 3+ surface charge.

8. The dispensable composition of any of claims 1-4, wherein the mCNPs comprise a predominantly 4+ surface charge.

9. The dispensable composition of any of claims 1-8, wherein the AgCNPs are produced via a method comprising dissolving cerium and silver precursor salts such as cerium and silver nitrates and oxidizing the dissolved cerium and silver precursor salts.

10. The dispensable composition of any of claims 1-8, wherein the AgCNPs are

produced via a method comprising dissolving cerium and silver precursor salts such as cerium and silver nitrates; oxidizing the dissolved cerium and silver precursor salts via admixture with peroxide; and precipitating nanoparticles by subjecting the admixture with ammonium hydroxide.

11. The dispensable composition of any of claims 1-8, wherein the AgCNPs are produced via a method comprising (i) dissolving cerium and silver precursor salts such as cerium and silver nitrates; (ii) oxidizing and precipitating the dissolved cerium and silver precursor salts via admixture with ammonium hydroxide; (iii) wash and resuspend precipitated nanoparticles in water; (iv) subject the resuspended nanoparticles with hydrogen peroxide; and (v) washing the nanoparticles from step (iv) to remove ionized silver.

12. A formulation for a disinfectant comprising the dispensable composition of any of claims 1-11, a drying agent, an organic acid, surfactants, a polymer binder, and water.

13. The formulation of claim 12, wherein the formulations contains one or multiple of the dispensable compositions of any of claims 1-11.

14. The formulation of claim 13, wherein the formulation contains AgCNPs.

15. The formulation of claim 12, wherein the dispensable composition of any of claims 1-11 is in an amount ranging from about 0.1 -10% by weight.

16. The formulation of claim 12, wherein the drying agent is selected from the group comprising of ethanol and isopropanol.

17. The formulation of claim 16, wherein the drying agent is ethanol.

18. The formulation of claim 17, wherein the ethanol is in an amount ranging from about 0 to 40% by weight.

19. The formulation of claim 12, wherein the organic acid is citric acid.

20. The formulation of claim 19, wherein the citric acid is in an amount ranging from about 0.5 - 2% by weight.

21. The formulation of claim 12, wherein the surfactants are selected from the group comprising of lauramine oxide, myristamine oxide, other zwitterionics, tergitol 15-S-15

or other secondary alcohol ethoxylate.

22. The formulation of claim 12, wherein the surfactants are in an amount ranging from about 0.5 - 3% by weight.

23. The formulation of claim 21, wherein the surfactants are lauramine oxide and tergitol 15-S-15.

24. The formulation of claim 23, wherein the lauramine oxide is in an amount ranging from about 0.25-2% by weight.

25. The formulation of claim 23, wherein the tergitol 15-S-15 is in an amount ranging from about 0 -1% by weight.

26. The formulation of claim 12, wherein the polymer binder is selected from the group comprising of Poly(2-ethyl-2-oxazoline) and PVP-Vinyl Acetate copolymers.

27. The formulation of claim 26, wherein the polymer binder is Poly(2-ethyl-2-oxazoline).

28. The formulation of claim 27, wherein the Poly(2-ethyl-2-oxazoline) is in an amount ranging from about 1-25% by weight.

29. The formulation of claim 26, wherein the PVP-Vinyl Acetate copolymer is in an amount ranging from about 1-30% by weight.

30. The formulation of claim 12, wherein the water is in an amount ranging from about 15 - 45% by weight.

31. An apparatus comprising a container into which the formulation of any of claims 12-30 is disposed and a nozzle for dispensing the dispensable composition.

32. The apparatus of claim 31, wherein the apparatus further comprises a pump in communication with the dispensable composition.

33. The apparatus of claim 32, wherein the container is fluid tight and wherein the dispensable composition further comprises a propellant.

34. A disinfecting film comprising the composition of any of claim 1-11 disposed on a substrate.

35. The disinfecting film of claim 34, wherein the disinfecting film can perform a residual disinfection.

36. The disinfecting film of claim 35, wherein the residual disinfection occurs in 15 to 30 minutes.

37. The disinfecting film of claim 34, wherein the disinfecting film can perform a rapid disinfection.

38. The disinfecting film of claim 37, wherein the rapid disinfection occurs in less than 1 minute.

39. The disinfecting film of claim 38, wherein the disinfecting film is active for 1 to 14 days.

40. The disinfecting film of any of claims 34-39, wherein the disinfecting film is activated upon exposure to water.

41. The disinfecting film of any of claims 34-40, wherein a dried disinfecting film can be reactivated by exposing to water.

42. A method of disinfecting a surface, the method comprises dispensing the dispensable composition of any of claims 1-11 onto the surface.

43. A fabric comprising the composition of any of claims 1-15 disposed on a surface thereof.

44. The fabric of claim 43, wherein the fabric is configured to comprise at least a portion of a garment, mask, glove, or any other PPE.

45. A dispensable composition comprising CNPs and/or AgCNPs and an excipient.