[0009] An example provides a method of treating a viral infection, comprising:

administering an effective amount of an antimicrobial pharmaceutical composition to a subject in need thereof, wherein:

the antimicrobial pharmaceutical composition comprises:

an aqueous carrier; and

an antimicrobial synthetic cationic polypeptide(s) dispersed in the aqueous carrier; and

the antimicrobial synthetic cationic polypeptide(s) comprises a plurality of positively charged amino acid units at neutral pH.

[0009a] An aspect provides use of:

an aqueous carrier; and

a synthetic cationic polypeptide(s) dispersed in the aqueous carrier;

in the manufacture of a pharmaceutical composition for the treatment of a viral infection in a subject, wherein

the synthetic cationic polypeptide(s) comprises at least 40 amino acid units;

the synthetic cationic polypeptide(s) comprises a plurality of positively charged amino acid units at neutral pH;

the synthetic cationic polypeptide(s) comprises a plurality of hydrophobic amino acid units;

the synthetic cationic polypeptide(s) comprises a blocky sequence arrangement of hydrophobic amino acid units and positively charged amino acid units that is configured to promote self-assembly of the synthetic cationic polypeptide(s) into multimeric structures in aqueous media;

wherein the synthetic cationic polypeptide(s) displays surfactant activity in deionized water at room temperature and/or 37°C at a concentration of 1 wt%, as measured by a decrease in surface tension of at least 10% as compared to deionized water alone; and

wherein the synthetic cationic polypeptide(s) displays antiviral activity against both influenza A virus and coronavirus.

[0010] These and other examples are described in greater detail below.

WHAT IS CLAIMED IS:

1. Use of:

an aqueous carrier; and

a synthetic cationic polypeptide(s) dispersed in the aqueous carrier;

in the manufacture of a pharmaceutical composition for the treatment of a viral infection in a subject, wherein

the synthetic cationic polypeptide(s) comprises at least 40 amino acid units;

the synthetic cationic polypeptide(s) comprises a plurality of positively charged amino acid units at neutral pH;

the synthetic cationic polypeptide(s) comprises a plurality of hydrophobic amino acid units;

the synthetic cationic polypeptide(s) comprises a blocky sequence arrangement of hydrophobic amino acid units and positively charged amino acid units that is configured to promote self-assembly of the synthetic cationic polypeptide(s) into multimeric structures in aqueous media;

wherein the synthetic cationic polypeptide(s) displays surfactant activity in deionized water at room temperature and/or 37°C at a concentration of 1 wt%, as measured by a decrease in surface tension of at least 10% as compared to deionized water alone; and

wherein the synthetic cationic polypeptide(s) displays antiviral activity against both influenza A virus and coronavirus.

2. The use of claim 1, wherein the multimeric structures formed in aqueous media are selected from the group consisting of multimers in solution, micelles, sheets, vesicles, and fibrils.

3. The use of claim 1 or 2, wherein the multimeric structures can be measured by a critical aggregation concentration less than that of a synthetic cationic polypeptide of the same composition with a statistical distribution of amino acids.

4. The use of any one of claims 1 to 3, wherein the synthetic cationic polypeptide(s) self-assembles into multimeric structures, as measured by a critical aggregation concentration that is below 1000 μg/mL at room temperature and/or 37°C in deionized water.

5. The use of any one of claims 1 to 4, wherein the viral infection is a Coronavirus infection.

6. The use of claim 5, wherein the Coronavirus infection is caused by a coronavirus selected from CoV 229E, CoV NL63, CoV OC43, CoV HKU1, MERS-CoV, SARS-CoV, and SARS-CoV-2.

7. The use of any one of claims 1 to 6, wherein the subject is in need of treatment for multiple virus infections.

8. The use of claim 7, wherein one of the multiple virus infections is an influenza A virus infection.

9. The use of any one of claims 1 to 7, wherein the viral infection is not an influenza A virus infection.

10. The use of any one of claims 1 to 9, wherein the pharmaceutical composition is to be administered to the subject by a pulmonary route.

11. The use of claim 10, wherein the pharmaceutical composition is to be administered to the subject intranasally and/or by inhalation.

12. The use of any one of claims 1 to 9, wherein the pharmaceutical composition is to be administered to an oral cavity of the subject.

13. The use of any one of claims 1 to 9, wherein the pharmaceutical composition is to be administered to a vaginal cavity of the subject.

14. The use of any one of claims 1 to 13, wherein the pharmaceutical composition is to be administered to the subject prophylactically.

15. The use of any one of claims 1 to 14, wherein the pharmaceutical composition is to be administered to tissues capable of supporting viral infection and growth to physically and/or electrostatically prevent access by viral particles.

16. The use of any one of claims 1-15, wherein the subject is to be identified on the basis that the subject has one or more risk factors selected from: obesity, diabetes, an advanced age, a cancer, a reduced respiratory function, a reduced cardiovascular function, a reduced kidney function, a nutritional or vitamin deficiency (e.g., vitamin D deficiency), and a reduced immune response function.

17. The use of any one of claims 1 to 16, wherein the synthetic cationic polypeptide(s) is dispersed in the aqueous carrier at a concentration in the range of about 0.01% to about 5%, by weight based on total weight of the pharmaceutical composition.

18. The use of any one of claims 1 to 17, wherein the synthetic cationic polypeptide(s) at a concentration of 2 wt% in deionized water has a viscosity at room temperature and/or 37°C of 2 centistokes (cSt) or greater.

19. The use of any one of claims 1 to 18, wherein the aqueous carrier, containing the synthetic cationic polypeptide(s) at 2 wt%, has a viscosity at room temperature and/or 37°C that is greater than that of the aqueous carrier containing albumin at 2 wt% in place of the synthetic cationic polypeptide(s).

20. The use of any one of claims 1 to 19, wherein the aqueous carrier, containing the synthetic cationic polypeptide(s) at 2 wt%, has a viscosity at room temperature and/or 37°C that is at least about 5 cSt.

21. The use of any one of claims 1 to 20, wherein the aqueous carrier, containing the synthetic cationic polypeptide(s) at 2 wt%, has a viscosity at room temperature and/or 37°C that is at least about 10 cSt.

22. The use of any one of claims 1 to 21, wherein the aqueous carrier, containing the synthetic cationic polypeptide(s) at 2 wt%, has a viscosity at room temperature and/or 37°C that is at least about 25 cSt.

23. The use of any one of claims 1 to 22, wherein the aqueous carrier, containing the synthetic cationic polypeptide(s) at 2 wt%, has a viscosity at room temperature and/or 37°C that is at least about 50 cSt.

24. The use of any one of claims 1 to 23, wherein the pharmaceutical composition has a low toxicity after being infused into the peritoneal cavity of a plurality of healthy, young adult mice at a dose of 50 mg/kg, as measured by a mouse survival rate of 50% or greater at 72 hours.

25. The use of any one of claims 1 to 24, wherein the plurality of positively charged amino acid units at neutral pH is at least 5.

26. The use of any one of claims 1 to 25, wherein the aqueous carrier is water or an aqueous solution of a pharmaceutically acceptable salt.

27. The use of any one of claims 1 to 26, wherein the aqueous carrier further comprises a non-ionic additive(s).

28. The use of claim 27, wherein the non-ionic additive(s) is present in an amount effective to increase the osmotic concentration of the pharmaceutical composition to a value that is at least 10% greater than that of the pharmaceutical composition without said additive(s).

29. The use of claim 27 or 28, wherein the non-ionic additive is selected from the group consisting of dextrose, mannitol, glycerol, xylitol, sorbitol, surfactant(s), and combinations thereof.

30. The use of any one of claims 1 to 29, wherein the pharmaceutical composition is sterilized by a sterilization technique(s) configured to achieve a sterilized pharmaceutical composition with the synthetic cationic polypeptide(s) having a weight average molecular weight comparable to that of the synthetic cationic polypeptide(s) of the pharmaceutical composition without sterilization by said sterilization technique(s).

31. The use of any one of claims 1 to 30, wherein the pharmaceutical composition is sterilized by a sterilization technique(s) configured to achieve a sterilized pharmaceutical composition with the synthetic cationic polypeptide(s) having a weight average molecular weight and dispersity comparable to that of the synthetic cationic polypeptide(s) of the pharmaceutical composition without sterilization by said sterilization technique(s).

32. The use of any one of claims 1 to 31, wherein the synthetic cationic polypeptide(s) is further characterized by having antibacterial activity, wherein the antibacterial activity is determined by a 60 minute time-kill assay against at least one bacteria selected from the group consisting of *S. aureus*, *S. epidermidis*, *P. aeruginosa*, and *E. coli*.

33. The use of any one of claims 1 to 32, wherein the plurality of hydrophobic amino acid units comprises at least 5 hydrophobic amino acid units selected from leucine (L), isoleucine (l), valine (V), phenylalanine (F) or alanine (A).

34. The use of claim 33, wherein the plurality of hydrophobic amino acid units comprises at least 10 hydrophobic amino acid units selected from leucine (L), isoleucine (l), valine (V), phenylalanine (F) or alanine (A).

35. The use of claim 33 or 34, wherein the plurality of hydrophobic amino acid units comprises at least 15 hydrophobic amino acid units selected from leucine (L), isoleucine (l), valine (V), phenylalanine (F) or alanine (A).

36. The use of any one of claims 33 to 35, wherein the hydrophobic amino acid units comprise leucine units.

37. The use of any one of claims 1 to 36, wherein the plurality of positively charged amino acid units comprises lysine units.

38. The use of any one of claims 1 to 37, wherein the synthetic cationic polypeptide(s) is a block copolypeptide that comprises hydrophobic leucine units and positively charged lysine units.

39. The use of any one of claims 1 to 38, wherein the pharmaceutical composition further comprises an anti-inflammatory compound.

40. The use of claim 39, wherein the anti-inflammatory compound is selected from the group consisting of a corticosteroid, a histamine inhibitor and a cytokine inhibitor.