CLAIMS:

1. An aqueous pharmaceutical composition comprising vitamin A palmitate and at least one surfactant, wherein

95% or more of the vitamin A palmitate of the aqueous pharmaceutical composition comprises particles formed by the vitamin A palmitate and the at least one surfactant in the configuration of micelles;

the vitamin A palmitate is present in the aqueous pharmaceutical composition at a concentration of 0.03% (w/w) to 4.0% (w/w);

the weight of the at least one surfactant present in the aqueous pharmaceutical composition is 4.0 to 5.0 times the weight of the vitamin A palmitate present in the aqueous pharmaceutical composition;

each of the micelles has a diameter of less than or equal to 500 nm; and

the aqueous pharmaceutical formulation is in liquid aerosol form.

2. The aqueous pharmaceutical composition according to claim 1, wherein the at least one surfactant comprises polysorbate 20, polysorbate 60, polysorbate 80, stearyl alcohol, sorbitan monolaurate, sorbitan monopalmitate, sorbitan monostearate, polyoxyethylene (20) oleyl ether, polyoxyethylene (20) cetyl ether, polyoxyethylene (10) cetyl ether, polyoxyethylene (10) oleyl ether, polyoxyethylene (100) stearyl ether, polyoxyethylene (10) stearyl ether, polyoxyethylene (20) stearyl ether, polyoxyethylene (4) lauryl ether, polyoxyethylene (2) cetyl ether, caprylocaproyl polyoxyl-8 glyceride, polyethylene glycol (20) stearate, polyethylene glycol (40) stearate, polyethylene glycol, polyethylene glycol (8) stearate, polyoxyl 40 stearate, poloxamer 188, polaxamer 312, or a mixture thereof.

3. The aqueous pharmaceutical composition according to claim 1, wherein the at least one surfactant comprises polysorbate 80.

4. The aqueous pharmaceutical composition according to claim 1, wherein:

the at least one surfactant comprises polysorbate 80; and

the fatty acid content of the polysorbate 80 is 85% to 100% oleic acid.

5. The aqueous pharmaceutical composition according to claim 1, wherein the aqueous pharmaceutical composition further comprises:

at least one antibiotic compound comprising at least one penicillin, at least one tetracycline, at least one cephalosporin, at least one quinolone, at least one lincomycin, at least one macrolide, at least one sulfonamide, at least one glycopeptide, at least one amino glycoside, a carbapenem, or a mixture thereof;

at least one insoluble vitamin comprising Vitamin D, Vitamin E, Vitamin K, Vitamin B6, niacinamide, Vitamin B2, Vitamin B1, dexpanthenol, biotin, folic acid, or vitamin B12, or a mixture thereof;

an anti-viral compound comprising oseltamivir, zanamivir, peramivir, ribavirin, remdesivir, at least one nucleoside analog, at least one interferon, at least one protease inhibitor, at least one reverse transcriptase inhibitor, or at least one neuramidinidase inhibitor, or a mixture thereof; and/or

at least one sugar comprising glucose, arabinose, maltose, sucrose, dextrose, lactose, or a mixture thereof; and/or

caffeine or epinephrine or a mixture thereof.

6. The aqueous pharmaceutical composition according to claim 1, wherein the aqueous pharmaceutical composition does not comprise a preservative.

7. The aqueous pharmaceutical composition according to claim 1, wherein the at least one surfactant comprises a non-natural surfactant.

8. An aqueous pharmaceutical composition according to claim 1, wherein the aqueous pharmaceutical composition consists essentially of the vitamin A palmitate and the at least one surfactant.

9. A system for use in the prophylaxis or treatment of a vitamin deficiency disorder, hyperoxia damage, lung damage caused by oxidative lung injury, lung damage caused by chemical or environmental exposure, lung damage caused by a biological/infectious agent, lung damage caused by a chemical, biological, or radio-nuclear (CBRN) agent, lung damage caused by radio-nuclear exposure, bronchopulmonary dysplasia, retinopathy of prematurity, neonatal sepsis,

hypovitaminosis A, hospital-acquired sepsis, sepsis from premature rupture of membranes, meningitis, pneumonia, necrotizing enterocolitis, radiation-induced pneumonitis, a viral infection, and/or a bacterial infection, the system comprises an aqueous pharmaceutical composition and a device configured for the generation of a liquid aerosol form from the aqueous pharmaceutical composition, wherein:

the aqueous pharmaceutical composition comprises vitamin A palmitate and at least one surfactant;

95% or more of the vitamin A palmitate of the aqueous pharmaceutical composition comprises particles formed by the vitamin A palmitate and the at least one surfactant in the configuration of micelles;

the vitamin A palmitate is present in the aqueous pharmaceutical composition at a concentration of 0.03% (w/w) to 4.0% (w/w);

the weight of the at least one surfactant present in the aqueous pharmaceutical composition is 4.0 to 5.0 times the weight of the vitamin A palmitate present in the aqueous pharmaceutical composition;

each of the micelles has a diameter of less than or equal to 500 nm; and

the liquid aerosol form comprises the micelles disposed in liquid droplets having a mass median aerodynamic diameter of less than 15 microns.

10. The system according to claim 9, wherein the liquid droplets have a mass median aerodynamic diameter of less than 5 microns.

11. Use of an aqueous pharmaceutical composition in the preparation of a medicament for the treatment or prophylaxis of a vitamin deficiency disorder, hyperoxia damage, lung damage caused by oxidative lung injury, lung damage caused by chemical or environmental exposure, lung damage caused by a biological/infectious agent, lung damage caused by a chemical, biological, or radio-nuclear (CBRN) agent, lung damage caused by radio-nuclear bronchopulmonary dysplasia, retinopathy of prematurity, neonatal sepsis, hypovitaminosis A, hospital-acquired sepsis, sepsis from premature rupture of membranes, meningitis, pneumonia, necrotizing enterocolitis, radiation-induced pneumonitis, a viral infection, and/or a bacterial infection, wherein:

the aqueous pharmaceutical composition comprises vitamin A palmitate and at least one surfactant;

95% or more of the vitamin A palmitate of the aqueous pharmaceutical composition comprises particles formed by the vitamin A palmitate and the at least one surfactant in the configuration of micelles;

the vitamin A palmitate is present in the aqueous pharmaceutical composition at a concentration of 0.03% (w/w) to 4.0% (w/w);

the weight of the at least one surfactant present in the aqueous pharmaceutical composition is 4.0 to 5.0 times the weight of the vitamin A palmitate present in the aqueous pharmaceutical composition; and

each of the micelles has a diameter of less than or equal to 500 nm.

12. Use of the aqueous pharmaceutical composition according to claim 1 in the preparation of a medicament for supporting a patient's immune response in improving the efficacy of a vaccine against an infectious agent in the patient.