CLAIMS

[Claim 1]

A formulation for spraying nasal vaccine, comprising an antigen and a formulation base prepared by adding polyethylene glycol to crosslinked polyacrylic acid.

[Claim 2]

The formulation of claim 1, wherein the polyethylene glycol is macrogol 400 and/or macrogol 4000, and the content ratio of the polyethylene glycol is 0.1 – 10.0 w/w % of the formualtion base.

[Claim 3]

The formulation of claim 1 or 2, wherein the crosslink location and crosslink density in the crosslinked polyacrylic acid are adjusted so that the carboxyl content in the crosslinked polyacrylic acid is 60.0 – 62.0 w/w %, and the crosslinked polyacrylic acid is carboxy vinyl polymer with a high crosslink density to the extent that is does not cause spinnability.

[Claim 4]

The formulation of any one of claims 1 to 3, wherein

the formulation base is prepared by thickening the crosslinked polyacrylic acid with an inorganic base and/or a basic amino acid, adjusting the viscosity of the thickened one with a viscosity modulating agent and/or an outside shearing force, and then adding polyethylene glycol to the obtained one, and said formulation base has an optimized spray pattern to allow the formulation base to target both of the nasal mucosa and nasopharynx simultaneously.

[Claim 5]

The formulation of claim 4, wherein the inorganic base is sodium hydroxide, potassium hydroxide, sodium salt of a weak inorganic acid, and/or potassium salt of a weak inorganic acid,

the basic amino acid is lysine, arginine, and/or ornithine, and

the viscosity modulating agent is sodium chloride, potassium chloride, and/or calcium chloride.

[Claim 6]

The formulation of any one of claims 1 to 5, wherein the antigen is live or inactivated bacteria, virus, and/or mycoplasma.

[Claim 7]

The formulation of claim 6, wherein the virus is COVID-19, severe acute respiratory syndrome (SARS), influenza virus such as influenza type A/B, hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV), varicella virus, measles virus, mumps virus, poliovirus, rotavirus, adenovirus, herpesvirus, human papillomavirus, or rubella virus, and

the bacteria is *Streptococcus pneumoniae*, *Mycobacterium tuberculosis*, *Bordetella pertussis*, *Neisseria meningitidis*, *Haemophilus influenzae type b*, *Vibrio cholerae*, or *Corynebacterium diphtheriae*.

[Claim 8]

The formulation of any one of claims 1 to 5, wherein the antigen is whole antigen, split antigen, or subunit antigen of influenza virus.

[Claim 9]

The formulation of any one of claims 1 to 5, wherein the antigen is inactivated whole COVID-19 antigen, recombinant protein antigen thereof, or various viral vectors incorporating genes encoding the antigen proteins.

[Claim 10]

The formulation of any one of claims 1 to 5, wherein the antigen is hepatitis B surface antigen (HBs antigen) and/or hepatitis B nucleocapsid antigen (HBc antigen).

[Claim 11]

A formulation base used in a formulation for spraying nasal vaccine, which is prepared by adding polyethylene glycol to crosslinked polyacrylic acid.

[Claim 12]

A rhinovaccination system of vaccine comprising a spray device comprising the formulation of any one of claims 1 - 10 as a filling, wherein nozzle of the spray device is configured to contact periphery of external nostril to fix direction of spraying.

[Claim 13]

The formulation of any one of claims 1 to 5 for use as a medicament.

[Claim 14]

The formulation for use of claim 13, wherein the medicament is to be intranasally administered at one-shot volume of 250 – 750 µL per nose to target both of nasal mucosa and nasopharynx simultaneously.

[Claim 15]

Use of the formulation of any one of claims 1 to 5, in the manufacture of a medicament for preventing or treating of a viral or bacterial infection, wherein

the viral infection is caused by COVID-19, severe acute respiratory syndrome (SARS), influenza virus such as influenza type A/B, hepatitis B virus, hepatitis C virus, human immunodeficiency virus (HIV), varicella virus, measles virus, mumps virus, poliovirus, rotavirus, adenovirus, herpesvirus, human papillomavirus, or rubella virus;

the bacterial infection is caused by *Streptococcus pneumoniae*, *Mycobacterium tuberculosis*, *Bordetella pertussis*, *Neisseria meningitidis*, *Haemophilus influenzae type b*, *Vibrio cholerae*, or *Corynebacterium diphtheria*; and

wherein the medicament is to be intranasally administered at one-shot volume of 250 - 750 μL per nose to target both of nasal mucosa and nasopharynx simultaneously.