

Claims

1. 2-Deoxy-D-Glucose (2-DG) for use in a medical method to prevent and/or to treat a viral infection in a
5 subject by a virus comprising a spike protein,
wherein 2-DG is provided as a preparation in an amount and a formulation to tissue of a subject that results in an effective tissue concentration to partially or completely inhibit glycosylation of the
10 spike protein.
2. 2-DG according to claim 1, further comprising at least one of ribavirin, emetine, or NMS-873.
3. 2-DG according to claim 1 or claim 2, wherein the effective tissue concentration inhibits at least 30 %, in particular at least 50 %, 70 %, 80 %, 90 %, 95 % or
15 99 % of the glycosylation the spike protein.
4. 2-DG according to any one of the preceding claims, wherein the effective tissue concentration of 2-DG is in a range of between approximately 0.1 mM to 25 mM.
- 20 5. 2-DG according to any one of the preceding claims, wherein the tissue comprises respiratory tissue.
6. 2-DG according to any one of the preceding claims, wherein the virus is a Coronavirus.
7. 2-DG according to any one of the preceding claims,
25 wherein the viral spike protein comprises a SARS-CoV-2 spike protein.
8. 2-DG according to any one of the preceding claims, wherein the viral infection has developed into the viral disease Covid-19.

9. 2-DG according to any one of the previous claims,
wherein 2-DG is provided as a micron or a submicron
particle in a preparation, wherein in particular said
micron or submicron particle is a mechanically mi-
cronized particle or is a micronized particle ob-
tained by spray drying, or 2-DG is provided as a
preparation in a liposomal or a proliposomal formula-
tion, in particular obtained by spray drying.
10. 2-DG according to claim 9, wherein the preparation
comprises an amount of 2-DG in a range of between ap-
proximately 1% and 75% w/w of the total weight of the
preparation, in particular an amount of 2-DG in a
range with lower limit of approximately 10 % or 20 %
or 30 % and an upper limit of approximately 35 % or
45 % to 55 % w/w of the total weight of the prepara-
tion, in particular between approximately 10 % and
40 % w/w or between approximately 15 % w/w and 30 %
w/w of the total weight of the preparation.
11. 2-DG according to claim 9 or claim 10, wherein the
preparation comprises one or more further excipients
selected from the group of excipients comprising:
- an amino acid, in particular leucine or glycine, in
particular in an amount of 0 % w/w up to approxi-
mately 80 % w/w of the total weight of the prepara-
tion, more particular in an amount of approximately
10 % w/w up to approximately 80 % w/w, more particu-
lar in an amount of approximately 10 % w/w up to
50 % w/w, more particular in an amount of approxi-
mately 10 % w/w up to 30 % w/w;

- trehalose in an amount of 0 % w/w up to approximately 60 % w/w of the total weight of the preparation, more particular in an amount of approximately 5 % w/w up to 30 % w/w;

5 - mannitol, 0 % w/w up to 60 % w/w of the total weight of the preparation, more particular in an amount of 5 % w/w up to 30 % w/w;

-propylene glycol or/and, glycerol, ethyl alcohol in the concentration range from 10 to 80% of the total weight of the liquid preparation;

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- one or more further phospholipid, in particular a natural or a semi-synthetic phospholipid, one or more further negatively or a positively charged phospholipid, in particular in an amount of approximately 1 % up to 10 % of the molar % of the phospholipid fraction, more particular in an amount of approximately 5 molar % up to 10 molar %, wherein in particular the one or more further phospholipid is in particular selected from the group comprising phosphatidylglycerol, dimiristoyl phosphatidylglycerol, dipalmitoylphosphatidylglycerol, hydrogenated soybean phosphatidylcholine (HSPC), soybean phosphatidylcholine (SPC) and wherein optionally the phospholipids comprises DPPE or DSPE with covalently attached hydrophilic polymer, in particular a PEG or polyglycerol in a molar ratio of 0 to approximately 10 molar % of the total lipid fraction, more particular in an amount of approximately 5 molar % of total lipid fraction;

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- sterol, in particular cholesterol in an amount of 0 molar % up to approximately 55 molar % of the total the lipid fraction, more particular in an amount of approximately 30 molar % up to 45 molar %;
 - 5 - nicotinic acid amide, in an amount of approximately 10 % w/w up to 80 % w/w of the total weight of the preparation, more particular in an amount of approximately 20 to 60% w/w of the preparation; and
 - 10 - urea in an amount of approximately 20 % w/w up to 80 % w/w of the total weight of the preparation, more particular in an amount of approximately 40 to 60% w/w of the preparation.
12. 2-DG according to any one of claims 9 to 11, wherein the preparation further comprises an excipient comprising a lipid fraction comprising or consisting of
- 15 a phospholipid fraction in an amount of approximately 5 % to 80 % w/w, in particular approximately 15 % to 50 % w/w of the total weight of the preparation.
13. 2-DG according to any one of claims 9 to 12,
- 20 wherein:
- liposome sizes range from approximately 30 nm to 200 nm in particular for intravenous delivery;
 - liposome sizes range from approximately 50 nm to 5 μ m, in particular for pulmonary delivery;
 - 25 - unilamellar liposomes sizes range from approximately 30 to 120 nm.
14. 2-DG according to any one of claims 9 to 13, wherein the amount of 2-DG in the liposomal or proliposomal formulation is in a range of approximately 10 mg to

1000 mg, in particular approximately 50 mg to 500 mg, preferably, approximately 100-200 mg per unit dosage.

15. 2-DG according to any one of claims 1 to 8, wherein 2-DG is provided as a preparation for administration by inhalation, wherein the preparation comprises particles for inhalation with a diameter of approximately 10 μm or less, in particular less than approximately 5 μm , 3 μm , 1 μm , 0.3 μm or 0.1 μm , more particular particles with a diameter in a range with a lower limit between approximately 0.1 μm and 1 μm and with an upper limit between approximately 0.5 and 5 μm .
16. A process for preparing a proliposome- or liposome-encapsulated pharmaceutical composition comprising 2-DG for use in a medical method to prevent and/or to treat a viral infection in a subject by a virus comprising a spike protein, wherein 2-DG is provided as a preparation in an amount and a formulation to tissue of a subject that results in an effective tissue concentration to partially or completely inhibit glycosylation of the spike protein.
17. A method of manufacturing a proliposome- or liposome-encapsulated pharmaceutical composition comprising 2-DG for use in a medical method to prevent and/or to treat a viral infection in a subject by a virus comprising a spike protein, wherein 2-DG is provided as a preparation in an amount and a formulation to tissue of a subject that results in an effective tissue concentration to partially or completely inhibit glycosylation of the spike protein.

18. Use of a substance for inhalation, wherein the substance is provided in the form of aerosol particles or powder particles, and wherein the particles comprise 2-DG.
- 5 19. Device for inhaling a substance in the form of aerosol particles or powder particles, the device comprising:
- a discharge nozzle for dispensing the substance in the form of aerosol particles or powder particles,
 - 10 -a container for receiving and keeping the substance, and
 - an actuator for activating the device, the actuator being configured to release a certain amount or dose of the substance kept in the container for conveying
 - 15 the substance through the discharge nozzle of the device, wherein the particles comprise 2-DG.
20. The use of claim 18, or device of claim 19, wherein the substance comprises 2-DG and at least one active ingredient selected from the group comprising ribavirin, emetine, and NMS-873.
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