Claims

1. A method for preparing a dry powder comprising a long-chain RNA molecule, wherein the method comprises the following steps:
a) providing a liquid comprising the long-chain RNA molecule, wherein the long-chain RNA molecule is in a complex with a cationic or polycationic compound, wherein the long-chain RNA molecule comprises more than 200 nucleotides,
b) drying the liquid provided in step a) by spray-freeze drying to produce a dry powder composition, wherein the spray-freeze drying comprises a step of atomization of the liquid at a temperature below −50° C.

2. The method of claim 1, wherein the dry powder composition comprises a plurality of particles.

3. The method of claim 1, wherein the dry powder composition has a residual moisture content of 7% (w/w) or less.

4. The method of claim 1, wherein the dry powder composition has a median particle size in a volume weighted distribution is at least 1 μm.

5. The method of claim 1, wherein the dry powder composition has an average sphericity of the particles is in a range from 0.7 to 1.0.

6. The method of claim 1, wherein the long-chain RNA molecule comprises at least one open reading frame (ORF) encoding a protein or a peptide.

7. The method of claim 1, wherein the long-chain RNA molecule is an mRNA molecule.

8. The method of claim 1, wherein the long-chain RNA molecule comprises at least one modification.

9. The method of claim 1, wherein the dry powder composition comprises at least one further excipient.

10. The method according to claim 1, wherein the liquid comprising the long-chain RNA molecule further comprises at least one excipient selected from a cryoprotectant, a lyoprotectant and a bulking agent.

11. The method according to claim 1, wherein the liquid comprising the long-chain RNA molecule does not contain a lipid compound.

12. The method according to claim 1, wherein the drying comprises a step of spray-freezing and a step of lyophilization.

13. The method according to claim 1, wherein the droplets resulting from the atomization of the liquid are characterized by a mass median aerodynamic diameter of 300 nm to 200 μm.

14. A pharmaceutical composition comprising or consisting of the dry powder composition produced by the method of claim 1.

15. The method according to claim 1, wherein the cationic or polycationic compound is a cationic or polycationic polymer, a cationic or polycationic peptide or protein, and/or a cationic or polycationic lipid.