CLAIMS

1. A rhinal spray nozzle used for a medical syringe having a tip opening in fluid communication with a syringe barrel for storing a formulation, the rhinal spray nozzle comprising:

a hollow nozzle body having a tip portion defining a nozzle orifice thereon;

a solid packing rod arranged within the nozzle body; and

a nozzle chamber defined between the packing rod and the nozzle body to allow a fluid communication between the tip opening and the nozzle orifice;

wherein the formulation comprises the gel material containing viscosity modification agent and carboxy vinyl polymer of which viscosity is modified by applying an exogenous shear force, and

wherein the nozzle orifice has a diameter in a range between 0.25 mm and 0.30 mm,

wherein the nozzle orifice includes no curved portion,

wherein the nozzle body includes an inner wall having at least a portion formed in a cylindrical shape and the packing rod includes an outer wall at least a portion formed in a cylindrical shape having a plurality of circumferentially spaced grooves,

wherein the nozzle chamber is defined between the at least portion of the inner wall of the nozzle body and the at least portion of the outer wall of the packing rod,

wherein the packing rod includes a vortex-flow generation member opposed to the tip portion of the nozzle body, and

wherein the vortex-flow generation member includes a recess and grooves formed around and connected to the

recess, and is formed so that a flow direction of the formulation from the grooves of the packing rod is offset to a central axis, thereby to generate a vortex flow of the formulation.

2. The rhinal spray nozzle according to claim 1, wherein the formulation comprises the gel material containing an electrolyte as the viscosity modification agent which is selected from a group consisting of sodium chloride, potassium chloride, dibasic sodium phosphate hydrate, and sodium dihydrogenphosphate, of which viscosity is modified by applying an exogenous shear force.

3. The rhinal spray nozzle according to any one of the preceding claims, wherein the tip portion has thickness along an injection direction of the formulation which is in a range between 0.20 mm and 0.30 mm.

4. The rhinal spray nozzle according to claim 1, wherein the at least portion of the inner wall of the nozzle body is formed to have a cross section perpendicular to the injection direction which is continuously or step-wisely reduced towards the injection direction.

5. The rhinal spray nozzle according to any one of the preceding claims, wherein the gel material has a viscosity of 2500 mPa・s or less.

6. The rhinal spray nozzle according to claim 5, wherein the gel material has a viscosity of 1000 mPa・s or less.

7. The rhinal spray nozzle according to any one of the preceding claims, wherein a spray angle of the formulation sprayed from the nozzle orifice is in a range 45 degrees and 60 degrees.

8. The rhinal spray nozzle according to any one of the preceding claims, wherein an average particle size of formulation droplets sprayed from the nozzle orifice is in a range 50 microns and 80 microns.

9. The rhinal spray nozzle according to any one of the preceding claims, wherein counts of formulation droplets sprayed from the nozzle orifice having the particle size in a range between 10 to 100 microns are 70% or more of the total counts of the particle.