CLAIMS

1. A method for separating components of a sample, the components comprising full capsid viral particles and empty and/or partially filled capsids, the method comprising:

labeling the sample with a chemical agent, wherein the labeling modifies a response of the empty and/or partially filled capsids to at least one dielectrophoretic force acting on the sample relative to a response of the full capsid viral particles to the at least one dielectrophoretic force acting on the sample;

directing the sample through at least one channel of a microfluidic device having at least one electrode arranged therein;

separating the full capsid viral particles from the empty and/or partially filled capsids at least in part by generating, using the at least one electrode, the at least one dielectrophoretic force that acts on the sample, wherein the empty and/or partially filled capsids respond differently to the at least one dielectrophoretic force than the full capsid viral particles at least in part due to the labeling; and

differentiating between the empty and/or partially filled capsids and the full capsid viral particles based on responses of the components of the sample to the at least one dielectrophoretic force.

2. The method of claim 1, wherein the labeling increases a difference between a dielectric function and/or a complex permittivity of each empty and/or partially filled capsid and a dielectric function and/or a complex permittivity of each full capsid viral particle.

3. The method of claim 1, wherein the chemical agent comprises gadolinium triacetate.

4. The method of claim 1, wherein the labeling increases a difference between a mass of each empty and/or partially filed capsid and a mass of each full capsid viral particle.

5. The method of claim 1, further comprising determining a ratio of full capsid viral particles to empty and/or partially filled capsids.

6. The method of claim 1, further comprising separating the full capsid viral particles from the empty and/or partially filled capsids by condensing the full capsid viral particles into a region.

7. The method of claim 1, further comprising flushing the empty and/or partially filled capsids from a region of the microfluidic device containing the at least one electrode.

8. The method of claim 1, wherein the at least one electrode comprises at least one circular-shaped and/or partially-center-symmetric electrode.

9. The method of claim 1, wherein an infectivity of the full capsid viral particles is unaffected by

the labeling, directing, generating, and differentiating.

10. The method of claim 1, wherein each of the full capsid viral particles and the empty and/or partially filled capsids have a diameter of 400 nm or less.

11. A system configured to separate components of a sample, the components comprising full capsid viral particles and empty and/or partially filled capsids, the system comprising:

a microfluidic device comprising at least one channel having at least one electrode arranged therein, wherein the at least one channel is configured to receive the sample; and

a controller configured to:

direct the sample through the at least one channel of the microfluidic device, the sample being labeled with a chemical agent that modifies a response of the empty and/or partially filled capsids to at least one dielectrophoretic force acting on the sample relative to a response of the full capsid viral particles to the at least one dielectrophoretic force acting on the sample;

separate the full capsid viral particles from the empty and/or partially filled capsids at least in part by generating, using the at least one electrode, the at least one dielectrophoretic force that acts on the sample, wherein the empty and/or partially filed capsids respond differently to the at least one dielectrophoretic force than the full capsid viral particles at least in part due to the labeling; and

differentiate between the empty and/or partially filled capsids and the full capsid viral particles based on responses of the components of the sample to the at least one dielectrophoretic force.

12. The system of claim 11, wherein the labeling increases a difference between a dielectric function and/or a complex permittivity of each empty and/or partially filled capsid and a dielectric function and/or a complex permittivity of each full capsid viral particle.

13. The system of claim 11, wherein the chemical agent comprises gadolinium triacetate.

14. The system of claim 11, wherein the labeling increases a difference between a mass of each empty and/or partially filed capsid and a mass of each full capsid viral particle.

15. The system of claim 11, wherein the controller is further configured to determine a ratio of full capsid viral particles to empty and/or partially filled capsids.

16. The system of claim 11, wherein the controller is further configured to separate the full capsid viral particles from the empty and/or partially filled capsids by condensing the full capsid viral particles into a region.

17. The system of claim 11, wherein the controller is further configured to flush the empty and/or

partially filled capsids from a region of the microfluidic device containing the at least one electrode.

18. The system of claim 11, wherein the at least one electrode comprises at least one circular-shaped and/or partially-center-symmetric electrode.

19. The system of claim 11, wherein an infectivity of the full capsid viral particles is unaffected by the directing, generating, and differentiating.

20. The system of claim 11, wherein each of the full capsid viral particles and the empty and/or partially filled capsids have a diameter of 400 nm or less.