this figure, the efficiency increases linearly with Ke. This figure also shows that the deposition efficiency may be well above 100%, reaching values above 200% in some cases.

Visualization of the "turn-around phenomenon" and effect on the rate of the collection

The enhancement in collection with corona discharge can also be visually observed directly. Snapshots of a collecting mesh at different times after exposure to fog, with and without electric field, are shown in FIGS. 11A-C. It can be observed that, as soon as the electric field is turned on, the number of collected droplets on the mesh increases dramatically. There are much more droplets on the mesh after one second of exposure with corona discharge than after 20 seconds without discharge. In FIB. 11B, the turn-around can be observed in some spots where there are droplets that are collected on the backside of the mesh. This enhances the collection rate since the area available for collection is doubled with the turn-around, as schematically shown in FIG. 11C.

Collection on a single cylindrical wire

The typical setup that is used in this study is shown in FIG. 12A. A sharp electrode with a high curvature is placed at a distance d from the collector, a horizontal cylindrical wire of radius R_c. d is much larger than R_c, which is much larger than the radius of the fog particles R_p. The collector is electrically grounded (V=0), while a high voltage V is applied to the discharge electrode. When V is above a critical value, corona discharge occurs and the air is ionized. Corona discharge occurs when the electric field around the electrode is high enough to form a plasma region: Electrons in the air are accelerated and have enough energy to ionize the air atoms when they collide with them. A chain reaction starts with every collision creating additional electrons and ions. After a collision, electrons and ions are pulled in opposite directions by the electric field, preventing recombination. At a certain distance from the electrode, the electric field can no more give enough energy to the electrons to sustain the reaction. In this region, escaped ions travel freely in the air towards the opposite electrode and potentially attach to the fog particles they collide with. The particles then acquire a net charge q of the same sign as V.

As d is much larger than R_c, apart from small regions around the emitter and the collector, the electric field lines are essentially parallel and horizontal in the central region. It is assumed in all the following that the electric field is not disrupted by the presence of the

CLAIMS

What is claimed is:

1. A method of collecting a species present in a gas stream, comprising:

establishing a plurality of charged species in the gas stream, electrically biased against a collector; and

collecting the charged species at the collector at a collection efficiency of greater than or equal to 10%.

2. A method of collecting a species present in a gas stream, comprising:

arranging at least a first and second electrode so as to apply an electric field to at least a portion of the gas stream thereby urging the species toward the second electrode and isolating at least a portion of the species from the gas stream,

wherein a minimum distance between the first electrode and the second electrode is between 2 cm and 50 cm.

3. A method of collecting a species present in a gas stream, comprising:

arranging, within the gas stream, a first electrode and a second electrode proximate the first electrode;

applying a potential to the first electrode such that at least a portion of a fluid present in the gas stream deposits on the second electrode; and

collecting the fluid,

wherein a minimum distance between the first electrode and the second electrode is between 2 cm and 50 cm.

4. A method of collecting a species present in a gas stream, comprising:

arranging, within the gas stream, a first electrode and a second electrode proximate the first electrode;

applying a potential to the first electrode such that at least a portion of a fluid present in the gas stream deposits on the second electrode; and

collecting the fluid at an energy efficiency of greater than or equal to 1 liter per kWh of energy applied in creating a field.

5. A collection system, comprising:

a first electrode and

a second electrode configured to be positioned proximate the first electrode;

a power source in electrical communication with at least the first electrode; and

a collector,

wherein the system is configured to collect a species present within a gas stream with an energy efficiency of greater than or equal to 1 liter per kWh of energy applied in creating the field.

6. The method or collection system of any preceding claim, wherein the species comprises water.

7. The method or collection system of any preceding claim, wherein the second electrode comprises a mesh.

8. The method or collection system of any preceding claim, wherein the second electrode comprises parallel wires.

9. The method or collection system of any preceding claim, wherein the first electrode comprises needles.

10. The method or collection system of any preceding claim, wherein the average radius of curvature of the needles is greater than or equal to 10 microns.

11. The method or collection system of any preceding claim, wherein the second electrode is positioned downstream of the first electrode.

12. The method or collection system of any preceding claim, wherein the second electrode is positioned upstream of the first electrode.

13. The method or collection system of any preceding claim, wherein the first electrode is held at a negative potential.

14.The method or collection system of any preceding claim, wherein the first electrode is held at a positive potential.

15. The method or collection system of any preceding claim, wherein the second electrode is grounded.

16. The method or collection system of any preceding claim, wherein the second electrode is held at a negative potential.

17. The method or collection system of any preceding claim, wherein the second electrode is held at a positive potential.

18. The method or collection system of any preceding claim, wherein water is collected on a surface of the second electrode facing the first electrode.

19. The method or collection system of any preceding claim, wherein water is collected on a surface of the second electrode not facing the first electrode.

20. The method or collection system of any preceding claim, wherein a difference in potential between the first electrode and the second electrode is greater than or equal to 2 kV and less than or equal to 100 kV.

21. The method or collection system of any preceding claim, wherein applying the potential to the first electrode comprises ionizing at least a portion of the air stream.

22. A method as in any preceding claim, comprising exposing the air steam to ozone.

23. A method as in any preceding claim, comprising applying the potential to the first electrode such that ozone is generated.

24. A method as in any preceding claim, wherein a corona discharge is generated by the first electrode.

25. A method as in any preceding claim, wherein the corona discharge purifies at least a portion of the fluid collected.

26. A method or collection system as in any preceding claim, further comprising a third electrode.

27. The method or collection system of claim 26, wherein the third electrode is positioned downstream of the second electrode.

28. The method or collection system of any one of claims 26-27, wherein the third electrode is capable of charging the species.

29. The method or collection system of any preceding claim, wherein the electrode or component used to charge species does not contribute to the electric field used to collect the species.

30. The method or collection system of any one of claims 1-28, wherein the electrode or component used to charge species does contribute to the electric field used to collect the species.

31. The method or collection system of any preceding claim, wherein the combination of a perforated plate and a grounded electrode is used to charge the species.

32. The method or collection system of any preceding claim, wherein a Taylor cone of an ionic liquid is used to generate space charge.

33. The method or collection system of any preceding claim, wherein electrospraying a volatile liquid is used to generate space charge.