CLAIMS

What is claimed is:

1. A liquid-free trap for trace levels of an acidic or basic airborne molecular contaminant in a gas, comprising:

a housing, comprising an inlet and an outlet;

a flow path between the inlet and the outlet; and

a porous solid mass of rigid sintered hydrophilic material situated in the flow path between the inlet and the outlet and sealed in the housing, the rigid sintered hydrophilic material functionalized with a basic species for trapping an acidic airborne molecular contaminant in the gas or an acidic species for trapping a basic airborne molecular contaminant in the gas.

2. The liquid-free trap of claim 1, wherein the average pore size of the rigid sintered hydrophilic material is from about 1 micron to about 100 microns.

3. The liquid-free trap of claim 1, wherein the rigid sintered hydrophilic material is sintered metal.

4. The liquid-free trap of claim 1, wherein the rigid sintered hydrophilic material is sintered hydrophilic polyethylene, sintered hydrophilic ultrahigh molecular weight polyethylene, sintered hydrophilic polytetrafluoroethylene, sintered hydrophilic polyethersulfone or sintered hydrophilic nylon.

5. The liquid-free trap of claim 1, wherein the basic species is selected from an alkali or alkaline earth metal salt of bicarbonate, carbonate or hydroxide, or a combination thereof.

6. The liquid-free trap of claim 1, wherein the rigid sintered hydrophilic material is functionalized with a polyprotic acid.

7. The liquid-free trap of claim 1, wherein the housing further comprises an upstream component including the inlet, a downstream component including the outlet and a

locking nut to secure the upstream component to the downstream component and the housing is polyether ether ketone (PEEK).

8. The liquid-free trap of claim 1, wherein the rigid sintered hydrophilic material is chemically clean.

9. The liquid-free trap of claim 1, wherein the housing comprises:

a hollow, substantially cylindrical upstream component having a longitudinal axis comprising an inner surface, an outer surface, the inlet and an upstream surface, the inner surface having a tapered portion terminating at the upstream surface, the inner surface tapering from the upstream surface to the inlet;

a hollow, substantially cylindrical downstream component comprising the outlet and a downstream surface; and

a locking nut to secure the upstream component to the downstream component without causing the upstream and downstream components to rotate with respect to one another, the upstream surface and the downstream surface together creating a space that is sealed from the environment and situated in a flow path between the inlet and the outlet.

10. The liquid-free trap of claim 9, wherein the rigid sintered hydrophilic material is sealed in the housing and situated in the flow path in the space created by the upstream component and the downstream component between the inlet and the outlet.

11. The liquid-free trap of claim 1, wherein the rigid sintered hydrophilic material has a thickness of from about 0.1 centimeters to about 0.65 centimeters.

12. A liquid-free trap for trace levels of a basic airborne molecular contaminant in a gas, comprising:

a housing, comprising an inlet and an outlet;

a flow path between the inlet and the outlet; and

a porous solid mass of rigid sintered hydrophilic material situated in the flow path between the inlet and the outlet and sealed in the housing, wherein the rigid sintered hydrophilic material is hydrophilic ultrahigh molecular weight polyethylene

having an average pore size of from about 5 microns to about 50 microns and is functionalized with phosphoric acid.

13. A liquid-free trap for trace levels of an acidic airborne molecular contaminant in a gas, comprising:

a housing, comprising an inlet and an outlet;

a flow path between the inlet and the outlet; and

a porous solid mass of rigid sintered hydrophilic material situated in the flow path between the inlet and the outlet and sealed in the housing, wherein the rigid sintered hydrophilic material is sintered stainless steel having an average pore size of from about 5 microns to about 50 microns and is functionalized with an alkali metal carbonate or bicarbonate.

14. The liquid-free trap of claim 13, wherein the rigid sintered hydrophilic material is functionalized with sodium carbonate or sodium bicarbonate or potassium hydroxide.

15. A method for trapping trace levels of an acidic or basic airborne molecular contaminant in a gas stream, comprising:

passing a gas stream into the inlet through the flow path and out of the outlet of the liquid-free trap of claim 1 at a flow rate and for a period of time sufficient to trap a detectable quantity of the acidic or basic airborne molecular contaminant with the rigid sintered hydrophilic material.

16. The method of claim 15, wherein the period of time is from about 0.5 to about 8 hours.

17. The method of claim 15, wherein the flow rate is greater than zero and less than about 10 liters per minute.

18. The method of claim 15, wherein the gas stream is humidified prior to passing into the inlet of the liquid-free trap.

19. A method for detecting or measuring trace levels of an acidic or basic airborne molecular contaminant in a gas stream, comprising:

passing a gas stream into the inlet through the flow path and out of the outlet of the liquid-free trap of claim 1 at a flow rate and for a period of time sufficient to trap a detectable quantity of the acidic or basic airborne molecular contaminant with the rigid sintered hydrophilic material;

desorbing the trapped acidic or basic airborne molecular contaminant from the rigid sintered hydrophilic material, thereby providing a sample; and

analyzing the sample for trace levels of the acidic or basic airborne molecular contaminant, thereby detecting or measuring trace levels of an acidic or basic airborne molecular contaminant in the gas stream.

20. The method of claim 19, wherein analyzing the sample comprises analyzing the sample using ion chromatography.

21. The method of claim 19, wherein desorbing the trapped acidic or basic airborne molecular contaminant from the rigid sintered hydrophilic material comprises extracting the trapped acidic or basic airborne molecular contaminant from the rigid sintered hydrophilic material using a solvent.

22. The method of claim 21, wherein extracting the trapped acidic or basic airborne molecular contaminant using a solvent comprises ultrasonically treating a mixture of the rigid sintered hydrophilic material and the solvent.