

WHAT IS CLAIMED IS:

1. A storage device for a process solution comprising:
 - (a) a housing having a substrate disposed therein;
 - (b) a process solution contained within the housing and in fluid contact with the substrate such that the solution is adsorbed onto the substrate, thereby diluting the solution within the substrate; and
 - (c) a head space contained within the housing and separated from the process solution by the substrate,wherein the housing is configured to allow a carrier gas to flow through the head space or is configured to allow a vacuum to be drawn through the head space to produce a gas stream comprising a gas phase of the process solution to deliver the gas stream to a critical process, application or storage vessel.
2. The storage device of claim 1, wherein the process solution is a liquid solution or a gaseous solution.
3. The storage device of claim 2, wherein the process solution is selected from the group consisting of hydrogen peroxide, hydrazine, mono-methyl hydrazine, tertiary butyl hydrazine, dimethylhydrazine, and any derivative thereof.
4. The storage device of claim 3, wherein the process solution is an anhydrous hydrogen peroxide solution or an anhydrous hydrazine solution.
5. The storage device of claim 4, wherein the anhydrous hydrogen peroxide solution or anhydrous hydrazine solution contains less than 2%, 0.5%, 0.1%, 0.01 %, 0.001%, 0.0001% or 0.00001% water.
6. The storage device of claim 1, wherein the substrate is formed from a material selected from the group consisting of alumina, aluminum oxide, titanium dioxide, silica, silicon dioxide, quartz, activated carbon, carbon molecular sieve, carbon pyrolyzate, polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), rayon, zirconium oxide, zeolite, high silica zeolite, polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene

(HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), silk, tencel, sponge materials, polyethylene glycol (PEG), polyvinyl alcohol (PVA), and/or polyvinylpyrrolidone (PVP), polypyridine, polyacrylates, polyacrylic acid, polyacrylic acid/acrylate co-polymers, polycarbonates, polyacrylamides, polyacrylate/acrylamide co-polymers, cellulosic materials, and any combination thereof.

7. The storage device of claim 1, wherein the substrate is formed from a material selected from the group consisting of, silicon dioxide, quartz, activated carbon, polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene (HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), and any combination thereof.
8. The storage device of claim 1, wherein the substrate is PTFE.
9. The storage device of claim 1, wherein the substrate is Polyethylene/Polyethylene terephthalate co-polymer.
10. The storage device of claim 1, wherein the substrate is a porous structure with a surface area ranging from about 100m²/g to 1000m²/g.
11. The storage device of claim 7, wherein the substrate is configured to adsorb over 30% w/w hydrogen peroxide.
12. The storage device of claim 7, wherein the substrate is configured to adsorb over 100% w/w hydrogen peroxide.
13. The storage device of claim 7, wherein the substrate is configured to adsorb over 1000% w/w hydrogen peroxide

14. The storage device of claim 7, wherein the substrate is configured to adsorb over 1900% w/w hydrogen peroxide.
15. The storage device of claim 4, wherein the concentration of the hydrogen peroxide solution is below 30% w/w.
16. The storage device of claim 4, wherein the concentration of the hydrogen peroxide solution is stable over the course of a known period of time.
17. The storage device of claim 7, wherein the substrate is formed as a fabric, a powder, one or more bricks, one or more blocks, one or more beads, one or more particles, one or more extrudates, or one or more pellets.
18. The storage device of claim 7, wherein the substrate is formed as a mesh.
19. The storage device of claim 18, wherein the mesh substrate is spiral-wound within the housing.
20. The storage device of claim 19, further comprising a separator disposed adjacent to the mesh, wherein the separator is configured to support and separate layers of the spiral-wound mesh.
21. The storage device of claim 20, wherein the separator is formed from PTFE.
22. The storage device of claim 1, wherein the substrate is a hydrogel selected from the group consisting of polyethylene glycol (PEG), polyvinyl alcohol (PVA), polyvinylpyrrolidone (PVP), polypyridine, and any combination thereof.
23. The storage device of claim 22, wherein the hydrogel is a 20% PEG hydrogel.
24. The storage device of claim 22, wherein the hydrogel is a 40% PEG hydrogel.
25. The storage device of claim 22, wherein the hydrogel is wrapped in a PTFE mesh.
26. The storage device of any one of claims 1-25, wherein the quantity of the process solution in the device is about 30 to 1900 weight percent of the process solution/substrate complex.

27. The storage device of claim 26, wherein the quantity of the process solution in the device is about 30 to 800 weight percent of the process solution/substrate complex.
28. The storage device of claim 26, wherein the quantity of the process solution in the device is about 30 to 100 weight percent of the process solution/substrate complex.
29. A method for delivering a gas comprising:
- (a) contacting a process solution with a substrate within an enclosed housing such that the solution is adsorbed onto the substrate, thereby diluting the process solution within the substrate;
 - (b) exposing the substrate to a carrier gas or a vacuum, thereby forming a gas stream comprising a gas phase of the process solution; and
 - (c) delivering the gas stream to a critical process, application, or storage vessel,
- wherein the housing is configured to allow the carrier gas to flow through a head space contained within the housing or is configured to allow vacuum to be drawn through the head space, and wherein the head space is separated from the process solution by the substrate.
30. The method of claim 29, wherein the process solution is a liquid solution or a gaseous solution.
31. The method of claim 30, wherein the process solution is selected from the group consisting of hydrogen peroxide, hydrazine, mono-methyl hydrazine, tertiary butyl hydrazine, dimethylhydrazine, and any derivative thereof.
32. The method of claim 31, wherein the process solution is an anhydrous hydrogen peroxide solution, or an anhydrous hydrazine solution.
33. The method of claim 29, wherein the anhydrous hydrogen peroxide solution or anhydrous hydrazine solution contains less than 2%, 0.5%, 0.1%, 0.01 %, 0.001%, 0.0001% or 0.00001% water.
34. The method of claim 29, wherein the substrate is formed from a material selected from the group consisting of alumina, aluminum oxide, titanium dioxide, silica, silicon dioxide, quartz, activated carbon, carbon molecular sieve, carbon pyrolyzate,

polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), rayon, zirconium oxide, zeolite, high silica zeolite, polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene (HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), silk, tencel, sponge materials, polyethylene glycol (PEG), polyvinyl alcohol (PVA), and/or polyvinylpyrrolidone (PVP), polypyridine, polyacrylates, polyacrylic acid, polyacrylic acid/acrylate co-polymers, polycarbonates, polyacrylamides, polyacrylate/acrylamide co-polymers, cellulosic materials, and any combinations thereof.

35. The method of claim 29, wherein the substrate is formed from a material selected from the group consisting of silicon dioxide, quartz, activated carbon, polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene (HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), and any combination thereof.
36. The method of claim 29, wherein the substrate is PTFE.
37. The method of claim 29, wherein the substrate is Polyethylene/Polyethylene terephthalate co-polymer.
38. The method of claim 29, wherein the substrate is a porous structure with a surface area ranging from about 100 m²/g to 1000 m²/g.
39. The method of claim 31, wherein the substrate is configured to adsorb over 30% w/w hydrogen peroxide.
40. The method of claim 31, wherein the substrate is configured to adsorb over 100% w/w hydrogen peroxide.

41. The method of claim 31, wherein the substrate is configured to adsorb over 1000% w/w hydrogen peroxide.
42. The method of claim 31, wherein the substrate is configured to adsorb over 1900% w/w hydrogen peroxide.
43. The method of claim 31, wherein the concentration of the hydrogen peroxide solution is below 30% w/w.
44. The method of claim 29, wherein the gas phase concentration of the process solution is stable for at least 100 hours.
45. The method of claim 29, wherein the housing is provided at a temperature of 0°C to about 100°C.
46. The method of claim 45, wherein the housing is provided at about 25°C to 85°C.
47. The method of claim 46, wherein the housing is provided at about 35°C to 50°C.
48. The method of claim 29, wherein the substrate is formed as a fabric, a powder, one or more bricks, one or more blocks, one or more beads, one or more particles, one or more extrudates, or one or more pellets.
49. The method of claim 48, wherein the substrate is a non-woven fabric that has been treated with a mechanical finishing process selected from the group consisting of spun bonding, needle bonding, perforation bonding, carding, and any combination thereof.
50. The method of claim 29, wherein the substrate is PTFE.
51. The method of claim 29, wherein the substrate is Polyethylene/Polyethylene terephthalate co-polymer.
52. The method of claim 48, wherein the substrate is formed as a mesh.
53. The method of claim 52, wherein the mesh is spiral-wound within the housing.

54. The method of claim 53, wherein the housing comprises a separator disposed adjacent to the mesh, wherein the separator is configured to support and separate layers of the spiral-wound mesh.
55. The method of claim 29, wherein the separator is formed from PTFE.
56. The method of claim 29, wherein the substrate is a hydrogel selected from the group consisting of polyethylene glycol (PEG), polyvinyl alcohol (PVA), polyvinylpyrrolidone (PVP), polypyridine, and any combination thereof.
57. The method of claim 56, wherein the hydrogel is a 20% PEG hydrogel.
58. The method of claim 56, wherein the hydrogel is a 40% PEG hydrogel.
59. The method of claim 56, wherein the hydrogel is wrapped in a PTFE mesh.
60. The method of claim 29, wherein the carrier gas is a substantially dry carrier gas.
61. The method of claim 29, wherein the carrier gas is selected from the group consisting of nitrogen, argon, oxygen, hydrogen, clean dry air, helium, ammonia, and any combination thereof.
62. The method of claim 29, wherein the housing is configured to permit continuous flow of the gas stream delivered to the critical process, application, and/or storage vessel.
63. The method of claim 62, wherein the gas stream delivers about 0.10 mg/min to 10 gm/min of the gas phase of the process solution.
64. The method of claim 29, wherein total mass of the process solution in the housing is about 1 gm to 5000 kg.
65. The method of claim 64, wherein the total mass of the process solution in the enclosed chamber is about 300 gm to 1.2 kg.
66. The method of any one of claims 29-65, wherein the quantity of the process solution in the housing is about 30 to 1900 weight percent of the process solution/substrate complex.

67. The method of claim 66, wherein the quantity of the process solution in the device is about 30 to 800 weight percent of the process solution/substrate complex.
68. The method of claim 66, wherein the quantity of the process solution in the device is about 30 to 100 weight percent of the process solution/substrate complex.
69. A chemical delivery system comprising:
- (a) a process solution provided within a housing, wherein the process solution is in contact with a substrate disposed within the housing such that the solution is adsorbed onto the substrate, thereby diluting the process solution within the substrate;
 - (b) a carrier gas or vacuum in fluid contact with a gas phase of the process solution, thereby forming a gas stream within the housing; and
 - (c) an apparatus in fluid communication with the housing and configured for delivering the gas stream to a critical process, application or storage vessel,
- wherein the housing is configured to allow the carrier gas to flow through a head space contained within the housing or is configured to allow vacuum to be drawn through the head space.
70. The chemical delivery system of claim 69, wherein the process solution is a liquid solution or a gaseous solution.
71. The chemical delivery system of claim 70, wherein the process solution is selected from the group consisting of hydrogen peroxide, hydrazine, mono-methyl hydrazine, tertiary butyl hydrazine, dimethylhydrazine, and any derivative thereof.
72. The chemical delivery system of claim 71, wherein the process solution is an anhydrous hydrogen peroxide solution or an anhydrous hydrazine solution.
73. The chemical delivery system of claim 72, wherein the anhydrous hydrogen peroxide solution or anhydrous hydrazine solution contains less than 2%, 0.5%, 0.1%, 0.01 %, 0.001%, 0.0001% or 0.00001% water.
74. The chemical delivery system of claim 69, wherein the substrate is formed from a material selected from the group consisting of alumina, aluminum oxide, titanium

dioxide, silica, silicon dioxide, quartz, activated carbon, carbon molecular sieve, carbon pyrolyzate, polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), rayon, zirconium oxide, zeolite, high silica zeolite, polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene (HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), silk, tencel, sponge materials, polyethylene glycol (PEG), polyvinyl alcohol (PVA), and/or polyvinylpyrrolidone (PVP), polypyridine, polyacrylates, polyacrylic acid, polyacrylic acid/acrylate co-polymers, polycarbonates, polyacrylamides, polyacrylate/acrylamide co-polymers, cellulosic materials, and any combination thereof.

75. The chemical delivery system of claim 69, wherein the substrate is formed from a material comprised from the group consisting of, silicon dioxide, quartz, activated carbon, polytetrafluoroethylene (PTFE), polyester (PE), polyethylene terephthalate (PET), polyethylene/polyethylene terephthalate co-polymer (PE/PET), polypropylene (PP), polymethylpentene (PMP), polybutylene terephthalate (PBT), polyethylene/polypropylene co-polymers, Hydrophilic High Density Polyethylene (HDPE), Hydrophobic High Density Polyethylene (HDPE), Hydrophilic UHMW Polyethylene, Hydrophobic UHMW Polyethylene, perfluoroalkoxy alkane (PFA), polyvinylidene fluoride (PVF), and any combination thereof.
76. The chemical delivery system of claim 69, wherein the substrate is PTFE.
77. The chemical delivery system of claim 69, wherein the substrate is Polyethylene/Polyethylene terephthalate co-polymer.
78. The chemical delivery system of claim 69, wherein the substrate is a porous structure with a surface area ranging from 100 m²/g to 1000 m²/g.
79. The chemical delivery system of claim 78, wherein the substrate is configured to adsorb over 30% w/w hydrogen peroxide.

80. The chemical delivery system of claim 78, wherein the substrate is configured to adsorb over 100% w/w hydrogen peroxide.
81. The chemical delivery system of claim 78, wherein the substrate is configured to adsorb over 1000% w/w hydrogen peroxide.
82. The chemical delivery system of claim 78, wherein the substrate is configured to adsorb over 1900% w/w hydrogen peroxide.
83. The chemical delivery system of claim 71, wherein the concentration of the hydrogen peroxide solution is below 30% w/w.
84. The chemical delivery system of claim 71, wherein the concentration of the gas phase hydrogen peroxide solution is stable for at least 100 hours.
85. The chemical delivery system of claim 69, wherein the housing is provided at a temperature of 0°C to about 100°C.
86. The chemical delivery system of claim 85, wherein the housing is provided at about 25°C to 85°C.
87. The chemical delivery system of claim 86, wherein the housing is provided at about 35°C to 50°C.
88. The chemical delivery system of claim 69, wherein the substrate is formed as a fabric, a powder, one or more bricks, one or more blocks, one or more beads, one or more particles, one or more extrudates, or one or more pellets.
89. The chemical delivery system of claim 88, wherein the substrate is a non-woven fabric that has been treated with a mechanical finishing process selected from the group consisting of spun bonding, needle bonding, perforation bonding, carding, and any combination thereof.
90. The chemical delivery system of claim 69, wherein the substrate is formed as a mesh.
91. The chemical delivery system of claim 90, wherein the mesh is spiral-wound within the housing.

92. The chemical delivery system of claim 91, further comprising a separator disposed adjacent to the mesh, wherein the separator is configured to support and separate layers of the mesh within the housing.
93. The chemical delivery system of claim 92, wherein the separator is formed from PTFE.
94. The chemical delivery system of claim 69, wherein the substrate is a hydrogel selected from the group consisting of polyethylene glycol (PEG), polyvinyl alcohol (PVA), polyvinylpyrrolidone (PVP), polypyridine, and any combination thereof.
95. The chemical delivery system of claim 94, wherein the hydrogel is a 20% PEG hydrogel.
96. The chemical delivery system of claims 94, wherein the hydrogel is a 40% PEG hydrogel.
97. The chemical delivery system of claim 94, wherein the hydrogel is wrapped in a PTFE mesh.
98. The chemical delivery system of claim 69, wherein the carrier gas is a substantially dry carrier gas.
99. The chemical delivery system of claim 98, wherein the carrier gas is selected from the group consisting of nitrogen, argon, hydrogen, clean dry air, helium, ammonia, and any combination thereof.
100. The chemical delivery system of any one of claims 69-99, wherein the quantity of the process solution in the housing is about 30 to 1900 weight percent of the process solution/substrate complex.
101. The chemical delivery system of claim 100, wherein the quantity of the process solution in the device is about 30 to 800 weight percent of the process solution/substrate complex.

102. The chemical delivery system of claim 100, wherein the quantity of the process solution in the device is about 30 to 100 weight percent of the process solution/substrate complex.