

## 25

16. The assembly of claim 1, wherein the expandable material is in the form of a particle, fiber, block, sheet, web, or combinations thereof.

17. The assembly of claim 1, wherein the composite material is contained or associated with a porous support.

18. The assembly of claim 17, wherein the composite material and the support are associated with a housing that provides contact with the fluid.

19. The assembly of claim 18, wherein the composite material, the support, and the housing are further associated with a physical system which provides fluid contact.

20. The assembly of claim 19, wherein the physical system is flexible.

21. The assembly of claim 19, wherein the physical system includes cyclones and vortex generators.

22. The assembly of claim 1, wherein the agent that modifies the properties of said expandable material is selected from synthetic organic molecules, synthetic inorganic molecules, naturally occurring organic molecules, naturally occurring inorganic molecules, metals, semimetals, and combinations thereof.

23. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material is selected from acids, bases, oxidizing agents, reducing agents, precipitating agents, polymerization agents, flocculating agents, surfactants, salts, and combinations thereof.

24. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material is selected from amines, polyamines, quaternary amines, and combinations thereof.

25. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material is selected from medicinal agents, pharmaceutical agents, nutraceuticals, dietary supplements, and combinations thereof.

26. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material comprises an alcohol or a mixture of alcohols.

27. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material comprises an insoluble compound which is formed by the reaction with a fluid containing a soluble compound or element contained by the expandable material.

28. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material comprises an insoluble compound which is formed through irradiation, temperature change, or a combination thereof.

29. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material is selected from sequestering agents, chelating agents, and binders.

30. The assembly of claim 22, wherein the agent that modifies the properties of said expandable material comprises a precipitated compound selected from the group

## 26

consisting of phosphates, sulfates, sulfides, carbonates, chlorides, bromides, iodides, fluorides, oxides, hydroxides, silicates, cyanides, thiocyanates, arsenates, oxalates, chromates, manganates, and combinations thereof.

31. The assembly of claim 1, wherein the composite material contains a biological agent selected from synthetic biological molecules, naturally occurring biological molecules, microorganisms, and combinations thereof.

32. The assembly of claim 1, wherein the composite material contains a biological agent selected from both (i) a biological agent selected from the group consisting of synthetic biological molecules, naturally occurring biological molecules, microorganisms, and combinations thereof, and (ii) a chemical agent selected from the group consisting of synthetic organic molecules, synthetic inorganic molecules, naturally occurring organic molecules, naturally occurring inorganic molecules, metals, semimetals, and combinations thereof.

33. The assembly of claim 1, wherein the composite material is in contact with an electronic device selected from electrodes, heating elements, radiation sources, sensors, communicators, and combinations thereof.

34. The assembly of claim 1, wherein the composite material contains a media that supports a cellular function selected from respiration, metabolism, reproduction, defense, growth, and combinations thereof.

35. The assembly of claim 1, wherein the first chemical or biological agent is in a solid form, a liquid form, or a combination thereof.

36. The assembly of claim 1, wherein the first chemical or biological agent is biodegradable.

37. The assembly of claim 1 wherein the composite material is sized for individual use.

38. The assembly of claim 1 wherein the composite material can be sterilized.

39. The assembly of claim 1, wherein the composite material is useful as a particle filtration device.

40. The assembly of claim 1, wherein the composite material is in a form useful for processing aerosols.

41. The assembly of claim 1, wherein the composite material comprises a sponge or foam material.

42. The assembly of claim 1, wherein the first chemical or biological agent is in a gaseous form, alone or in combination with a solid or liquid form thereof.

43. The assembly of claim 1, wherein the fluid expandable material comprises a polyacrylic acid.

44. The assembly of claim 43, wherein the agent that modifies said expandable material comprises a hydrochloric acid solution.

45. The assembly of claim 43, wherein the first chemical agent comprises sodium chlorite.

\* \* \* \* \*