

CLAIMS

What is claimed is:

1. A nasal composition comprising an agent that binds to one or more air pollutants, wherein the agent comprises one or more of nonporous silicon dioxide and porous silicon dioxide, for reducing the risks of exposure to air pollutants in a subject in need thereof.
2. The nasal composition of claim 1, wherein the air pollutants comprise one or more of gaseous components and particulate components.
3. The nasal composition of any one of claims 1 or 2, wherein the air pollutants comprise gaseous components comprising one or more of sulfur dioxide, carbon monoxide, nitrogen oxides, ozone, ammonia (NH₃), volatile organic compounds (VOC), and chlorofluorocarbons (CFCs).
4. The nasal composition of any one of claims 1 to 3, wherein the air pollutants comprise particulate components comprising one or more of solid particles and liquid particles.
5. The nasal composition of any one of claims 1 to 4, wherein the air pollutants comprise particulate components comprising one or more of fly ash, volcanic ash, soil particles, sea salt, dust, dessicated cellular debris, spores, pollen, bacteria, combustion products, hydrocarbons, and toxic metals.
6. The nasal composition of any one of claims 1 or 2, wherein the air pollutants comprise one or more of nitrogen oxides, carbon monoxide, sulphur oxides, sulfates, nitrates, ammonium, chloride, trace metals, carbon, ozone, chlorinated hydrocarbons, brominated hydrocarbons, polynuclear hydrocarbons, benzopyrene, aldehydes, peroxyacyl nitrates, butanedione soot, 1,3-butanediene, arsenic, and selenium.
7. The nasal composition of any one of claims 1 to 6, wherein the risks of exposure to air pollutants comprise health problems associated with one or more of the cardiovascular system, the respiratory system, the nervous system, and the reproductive system.

8. A nasal composition comprising an agent that binds to one or more air pollutants, wherein the agent comprises one or more of nonporous silicon dioxide and porous silicon dioxide, for reducing inflammation or the risks of inflammation in a subject in need thereof, or for reducing serum and/or BAL levels of one or more of IgE, TNF- α , LDH and MIP2.
9. The nasal composition of any one of claims 1 to 8, wherein the agent comprises colloidal silicon dioxide.
10. The nasal composition of any one of claims 1 to 8, wherein the agent comprises one or more of microporous silicon dioxide, mesoporous silicon dioxide, and macroporous silicon dioxide.
11. The nasal composition of any one of claims 1 to 10, wherein the composition further comprises one or more of (i) a lipophilic or partly lipophilic vehicle and (ii) a surfactant.
12. The nasal composition of claim 11, wherein the composition comprises a lipophilic or partly lipophilic vehicle comprising an oil or a mixture of oils, fatty acid esters, medium chain triglycerides, glycerol esters of fatty acids, polyethylene glycol, phospholipids, white soft paraffin, or combinations of two or more thereof.
13. The nasal composition of any one of claims 11 or 12, wherein the composition comprises an oil or mixture of oils comprising vegetable oil, castor oil, hydrogenated castor oil, soybean oil, sesame oil, peanut oil, or combinations of two or more thereof.
14. The nasal composition of any one of claims 11 or 12, wherein the composition comprises an oil or mixture of oils comprising castor oil.
15. The nasal composition of any one of claims 11 to 14, wherein the composition comprises fatty acid esters comprising ethyl oleate, oleyl oleate, isopropyl myristate, or combinations of two or more thereof.
16. The nasal composition of any one of claims 11 to 15, wherein the composition comprises a surfactant comprising apricot kernel oil PEG-6-esters, lecithin, fatty acid esters of polyvalent alcohols, fatty acid esters of sorbitanes, fatty acid esters of polyoxyethylenesorbitans, fatty acid esters of polyoxyethylene, fatty acid esters of sucrose, fatty acid esters of polyglycerol, oleoyl

polyoxylglycerides, oleoyl macrogolglycerides, sorbitol, glycerine, polyethylene glycol, macrogol glycerol fatty acid ester, or combinations of any two or more thereof.

17. The nasal composition of any one of claims 11 to 16, wherein the composition comprises a surfactant comprising apricot kernel oil PEG-6-ester.

18. The nasal composition of any one of claims 11 to 17, wherein the composition comprises one or more of castor oil and apricot kernel oil PEG-6-esters.

19. The nasal composition of any one of claims 11 to 18, wherein the composition consists essentially of colloidal silicon dioxide, castor oil, and apricot kernel oil PEG-6-esters.

20. A nasal composition comprising (i) an agent that binds to one or more air pollutants selected from a porous agent and a nonporous silicon dioxide, (ii) a lipophilic or partly lipophilic vehicle, and a (iii) surfactant, wherein the composition is adapted for nasal administration.

21. The nasal composition of claim 20, wherein the composition is in the form of a gel.

22. The nasal composition of any one of claims 20 or 21, wherein the porous agent is dispersed in an oil mixture.

23. The nasal composition of any one of claims 20 to 22, wherein the composition comprises one or more agents comprising a material selected from inorganic porous materials, organic-inorganic hybrids, organic polymers, and complexing agents.

24. The nasal composition of any one of claims 20 to 23, wherein the composition comprises an agent comprising an inorganic porous material selected from microporous silicon dioxide, mesoporous silicon dioxide, macroporous silicon dioxide, polyorganosiloxanes, pharmaceutical clays, silicon dioxide nanotubes, silicon dioxide gel, magnesium aluminosilicate, anhydrous calcium phosphate, and calcium carbonate.

25. The nasal composition of any one of claims 20 to 24, wherein the composition comprises an agent comprising colloidal silicon dioxide.

26. The nasal composition of claim 20, wherein the composition comprises an agent comprising an organic-inorganic hybrid that is a metal-organic framework.
27. The nasal composition of claim 20, wherein the composition comprises an agent comprising an organic polymer formed by a carbon-carbon coupling reaction, wherein the organic-inorganic hybrid comprises non-metallic elements.
28. The nasal composition of claim 20, wherein the composition comprises an agent comprising a complexing agent that is an adsorbent selected from β -cyclodextrin-based porous silicon dioxide, α -cyclodextrin-based porous silicon dioxide, hydroxypropyl- β -cyclodextrin-based porous silicon dioxide, and porous materials based on other adsorbents.
29. The nasal composition of any one of claims 20 to 28, wherein the agent is functionalized with thiol groups, amine groups, crown ethers, quaternary alkyl amines, alkyl chains, alkoxysilanes, fluorenylmethoxycarbonyl-modified organosilanes, hydrophobic groups, mercaptopropyl groups, aminopropyl groups, hydroxypropyl groups, phenyl groups, or combinations of two or more thereof.
30. The nasal composition of any one of claims 20 to 29, wherein the composition comprises an agent comprising pores that have a longest diameter in any dimension of less than 2 nm, from 2 nm to 50 nm, or larger than 50 nm.
31. The nasal composition of claim 20, wherein the nonporous silicon dioxide is colloidal silicon dioxide.
32. The nasal composition of claim 20, comprising:
- (a) from about 0.5% to about 50% w/w of a mesoporous silicon dioxide agent, based on the weight of the composition,
 - (b) from about 50% to about 98% w/w of castor oil, based on the weight of the composition, and
 - (c) from about 0.5% to about 20% w/w apricot kernel oil PEG-6-esters, based on the weight of the composition.

33. The nasal composition of claim 32, wherein the composition consists essentially of the mesoporous silicon dioxide agent, the castor oil, and the apricot kernel oil PEG-6-esters.
34. The nasal composition of claim 20, comprising:
an agent comprising nonporous silicon dioxide or porous silicon dioxide, a lipophilic or partly lipophilic vehicle, and a surfactant,
wherein the composition is adapted for nasal administration,
and wherein the composition binds to one or more air pollutants and/or provides a physical barrier between one or more air pollutants and internal nasal surfaces.
35. The nasal composition of any one of claims 20 to 34, for reducing the risks of exposure to air pollutants, or for reducing inflammation or reducing the risk of inflammation, or for reducing serum and/or BAL levels of one or more of IgE, TNF- α , LDH and MIP2.
36. Use of the nasal composition of any one of claims 20 to 34 in the manufacture of a medicament for reducing the risks of exposure to air pollutants, or for reducing inflammation or reducing the risk of inflammation, or for reducing serum and/or BAL levels of one or more of IgE, TNF- α , LDH and MIP2.
37. A method of making the nasal composition of any one of claims 20 to 34, wherein the method comprises mixing the agent, the lipophilic or partly lipophilic vehicle, and the surfactant.
38. The method of claim 37, wherein the method comprises:
(a) preparing a mixture comprising the lipophilic or partly lipophilic vehicle and the surfactant, and then
(b) adding the agent to the mixture.
39. A method of reducing the risks of exposure to air pollutants, reducing inflammation or reducing the risk of inflammation, or reducing serum or BAL levels of one or more of IgE, TNF- α , LDH, and MIP2, in a subject in need thereof, comprising nasally administering to a subject in need thereof a composition comprising one or more of nonporous silicon dioxide and porous silicon dioxide, or a nasal composition according to any one of claims 20-34.