CLAIMS

What is claimed is:

1. An air filtration system, comprising:

a photocatalytic reactor including a photocatalyst composition and a lamp configured to irradiate the photocatalyst composition, the photocatalyst composition configured to decompose one or more volatile organic compounds in air passing through the photocatalytic reactor into one or more products;

a first air filter disposed upstream of the photocatalytic reactor to filter the air prior to the photocatalytic reactor, the first air filter configured to filter one or more compounds from the air; and

a second air filter disposed downstream of the photocatalytic reactor, the second air filter configured to filter at least one of the one or more products from the air passing through the second air filter.

2. The air filtration system of claim 1, further comprising:

an inlet and an outlet, the air flowing from the inlet to the outlet through the first air filter, the photocatalytic reactor, and the second air filter in that order.

3. The air filtration system of claim 1, wherein the one or more compounds filtered by the first air filter include one or more of:

an inorganic compound that deactivates the photocatalyst composition and

a silicon compound that deactivates the photocatalyst composition.

4. The air filtration system of claim 1, further comprising:

a third air filter disposed to filter the air flowing from the photocatalytic reactor, the third air filter being a particulate filter configured to filter solid particulates from the air.

5. The air filtration system of claim 4, further comprising:

a fourth air filter disposed to filter the air flowing from the second air filter, the fourth air filter being a particulate filter configured to filter solid particulates discharged from the second air filter, wherein

the third air filter is disposed to filter air flowing from the photocatalytic reactor to the second air filter, the third air filter configured to filter solid particulates of the photocatalyst composition discharged from the photocatalytic reactor.

6. The air filtration system of claim 1, further comprising:

a housing containing the first air filter, the photocatalytic reactor, and the second air filter, the housing forming a flow path that directs the air through the first air filter, the fluidized bed of the photocatalytic reactor, and the second air filter in that order.

7. The air filtration system of claim 1, wherein the one or more volatile compounds include isopropyl alcohol, the photocatalyst composition configured to decompose the isopropyl alcohol.

8. The air filtration system of claim 1, wherein the photocatalytic reactor includes an agitable bed of the photocatalyst composition.

9. An air filtration system, comprising:

a photocatalytic reactor including an agitable bed of a photocatalyst composition and a lamp configured to irradiate the photocatalyst composition, the photocatalytic reactor configured to agitate the agitable bed of the photocatalyst composition, the photocatalyst composition configured to decompose one or more volatile organic compounds in air passing through the photocatalytic reactor into one or more products; and

a first air filter disposed upstream of the photocatalytic reactor to filter the air prior to passing through the photocatalytic reactor, the first air filter configured to filter one or more compounds from the air.

10. The air filtration system of claim 9, wherein

the agitable bed is a fluidized bed, or

the agitable bed is a fixed bed, and the photocatalytic reactor includes a means of mechanically agitating the fixed bed of the photocatalyst composition.

11. The air filtration system of claim 9, further comprising:

a second air filter disposed downstream of the photocatalytic reactor, the second air filter being a particulate air filter configured to filter particles of the photocatalyst composition discharged from agitable bed from the air.

12. The air filtration system of claim 11, further comprising:

a third air filter disposed to filter the air flowing from the second air filter, the third air filter configured to filter at least one of the one or more products from the air passing through the third air filter.

13. The air filtration system of claim 12, further comprising:

an inlet and an outlet, the air flowing from the inlet to the outlet through the first air filter and the photocatalytic reactor in that order.

14. The air filtration system of claim 9, wherein the one or more compounds filtered by the first air filter include one or more of:

an inorganic compound that deactivates the photocatalyst composition, and

a silicon compound that deactivates the photocatalyst composition.

15. The air filtration system of claim 9, further comprising:

a housing containing the photocatalytic reactor and the first air filter, the housing forming a flow path that directs the air through the first air filter and the agitable bed of the photocatalytic reactor in that order.

16. The air filtration system of claim 9, wherein the one or more volatile compounds include isopropyl alcohol, the photocatalyst composition configured to decompose the isopropyl alcohol.

17. A method of filtering air in an air filtration system, comprising:

passing air through a photocatalytic reactor that includes a photocatalyst composition and a lamp, which includes:

irradiating, with the lamp, the photocatalyst composition, and

decomposing, with the photocatalyst composition, one or more volatile organic compounds in the air into one or more products; and

passing the air through a first filter prior to the passing of the air through the photocatalytic reactor, wherein the passing of the air through the first filter includes filtering one or more deactivating compounds from the air that deactivate the photocatalyst composition,

wherein

the method includes passing the air through a second air filter that includes filtering at least one of the one or more products from the air, and/or

the passing of the air through the photocatalytic reactor includes passing the air through an agitable bed of the photocatalyst composition.

18. The method of claim 17, comprising:

the passing of the air through the second air filter.

19. The method of claim 17, wherein the passing of the air through the photocatalytic reactor includes the passing of the air through the agitable bed of the photocatalyst composition.

20. The method of claim 19, further comprising:

passing the air through a particulate filter to filter solid particulates of the photocatalyst composition discharged from the agitable bed, the agitable bed being a fluidized bed of the photocatalyst composition.