Liquids have commonly been used as a filter medium to remove chemicals from gas streams that are bubbled through liquid. However, handling of liquid filtration media is complicated, heavy and can lead to spills. Filtration using liquid media often leads to solids and sludge which are difficult to remove. Filtration equipment using liquid filtration media is also typically not very flexible in how it can be arranged or connected, without risking spilling. Furthermore, spent liquid media is often a hazardous substance which needs special care and increase costs to handle and dispose of.

EP 1102620B1 describes an air filter system where a sorbent filter is made in a pleat web pack design. US 20130292001 describes an air purification system, specifically for a gas mask filter cartridge and a method to fill a sorbent inlet. US 4559066 describes a filter cartridge where a sorbent bed receives the gas stream and gas flow radially outward from the sorbent bed, it is a low capacity system with a pleat pack filter on an outer surface of the system, and with a permanent cartridge. US 2728409 describes a method of filtering gases with a vaned, radially directed gas inlet contained in a canister.

However, there is still a need for a design that effectively removes noxious substances from fugitive emissions streams that is portable, reusable, simple to install, flexible in its installation arrangement, can vary in capacity of filtration needs and can be safely hauled to and from an industrial site.

SUMMARY

A filtering device is provided for filtering pollutants from a gas stream. The device comprises a cartridge comprising an inner perforated passage, an outer perforated jacket, one or more non-perforated ends and a sorbent bed contained between the inner passage and the outer jacket; and an outer shell containing said cartridge and having a first port in fluid communication with said inner perforated passage and a second port in fluid communication with said outer perforated jacket. A flowpath of the gas stream into any one of the first port or the second port, through said sorbent bed and out of the other of the first port or the second port is a bidirectional flowpath having an axial direction and a radical direction.

CLAIMS

1. A filtering device for filtering pollutants from a gas stream, said device comprising:

a. a cartridge comprising an inner perforated passage, an outer perforated jacket, one or more non-perforated ends and a sorbent bed contained between the inner passage and the outer jacket; and

b. an outer shell containing said cartridge and having a first port in fluid communication with said inner perforated passage and a second port in fluid communication with said outer perforated jacket;

wherein a flowpath of the gas stream into any one of the first port or the second port, through said sorbent bed and out of the other of the first port or the second port is a bidirectional flowpath having an axial direction and a radical direction.

2. The filtering device of claim 1, wherein the cartridge is removably instertable within the outer shell.

3. The filtering device of claim 2, further comprising an annular space between the outer perforated jacket of the cartridge and the outer shell, and also between at least one non-perforated end of said cartridge and the outer shell.

4. The filtering device of claim 3, wherein the outer shell comprises a sidewall, a first end wall and second opposite end wall, and wherein said first port is formed in the first end wall of the outer shell and the second port is formed in any one of the sidewall and the second opposite end wall of the outer shell.

5. The filtering device of claim 4, wherein the at least one non-perforated ends of the cartridge prevent direct fluid communication between the inner perforated passage of the cartridge and the second port.

6. The filtering device of claim 5, wherein the bidirectional flowpath of the gas stream includes a first axial direction and a second radial direction.

7. The filtering device of claim 5, wherein the bidirectional flowpath of the gas stream includes a first radial direction and a second axial direction.

8. The filtering device of claim 5, wherein the flowpath of the gas stream takes a bend having an angle of from 45 degrees to 135 degrees.

9. The filtering device of claim 5, wherein the flowpath of the gas stream takes a bend having an angle of 90 degrees.

10. The filtering device of claim 5, further comprising a non-perforated collar covering a portion of the inner perforated passage adjacent the first port.

11. The filtering device of claim 10, further comprising a non-perforated sleeve extending into a portion of a length of the inner perforated passage, and having a diameter smaller than a diameter of the inner perforated sleeve to thereby define an annular channel therebetween.

12. The filtering device of the claim 11, wherein the annular space is created by inclusion of one or more spacers arranged between the outer perforated jacket and at least one non-perforated end of the cartridge, and the outer shell.

13. The filtering device of claim 12, wherein said one or more spacers are selected from the group consisting of spacer tabs, spacer rings, a frame and rails arranged on the outer perforated jacket and at least one non-perforated end of the cartridge.

14. The filtering device of claim 13, wherein a volume defined by said annular space is sized based on the flow rate of the gas stream.

15. The filtering device of claim 14, wherein the outer shell is made from a material selected from the group consisting of steel, stainless steel, fiberglass and polymeric materials.

16. The filtering device of claim 15, wherein the sorbent media is regeneratable.

17. The filtering device of claim 15, wherein the sorbent media is selected from the group consisting of activated carbon, extruded carbon, treated bitumen based extruded carbon, zeolites, granulated iron oxides and impregnated activated carbons.

18. The filtering device of claim 1, wherein said device is mountable in an orientation selected from vertically and horizontally.

19. The filtering device of claim 1, wherein the device is connectable to one or more further devices in parallel and to a manifold of the gas stream.

20. The filtering device of claim 1, wherein the device is connectable to one or more further devices in series.

21. The filtering device of claim 20, wherein a sorbent media of the sorbent beds of the one or more further devices in series are the same or different as the sorbent media in the device.

22. The filtering device of claim 1, further comprising one or more gas detection means at one or both of the first port and the second port.

23. The filtering device of claim 1, further comprising a temperature monitoring system installed within the device.

24. The filtering device of claim 1, further comprising one or more pressure sensors on one or both of the first and second ports to monitor pressure drop through the device.

25. A method for filtering pollutants from a gas stream, said method comprising the steps of:

a. allowing the gas stream to flow into a filtering device in a first direction, said device comprising a cartridge having a sorbent bed contained therein;
b. directing the gas stream to bend in a second direction differing from the first direction as it enters the sorbent bed; and
c. allowing the gas stream to pass through the sorbent bed and to exit the device.

26. The method of claim 25, wherein the first direction of the gas stream is an axial direction and the second direction is a radial direction.

27. The method of claim 25, wherein the first direction of the gas stream is a radial direction and the second direction is an axial direction.

28. The method of claim 25, wherein the difference between the first direction and the second direction is an angle of from 45 degrees to 135 degrees.

29. The method of claim 25, wherein the difference between the first direction and the second direction is an angle of 90 degrees.

30. The method of claim 25, further comprising the steps of removing the cartridge from the filtering device when the sorbet bed is spent and regenerating a sorbent media in the sorbent bed.

31. The method of claim 25, further comprising the steps of connecting the device to one or more further devices in parallel and connecting the one or more devices in parallel to a manifold of the gas stream.

32. The method of claim 25, further comprising the steps of connecting the device to one or more further devices in series.

33. The method of claim 36, wherein a sorbent media of the sorbent beds of the one or more further devices in series are the same or different as the sorbent media in the device.

34. The filtering device of claim 1, wherein the device comprises one or more cartridges in series in a single shell.