

CLAIMS:

What is claimed is:

1. A process for delivering controlled quantities of ammonia to multiple ammonia-consuming devices, the process comprising:

(I) supplying a vaporization medium from a centralized vaporization medium subsystem;

(II) providing a separate ammonia vaporizer for each of the ammonia-consuming devices;

(III) supplying a separate stream of vaporization medium from the centralized vaporization medium subsystem to each of the ammonia vaporizers;

(IV) supplying an ammonia supply stream comprising a controlled quantity of ammonia to each of the ammonia vaporizers;

(V) obtaining a vaporized ammonia stream from each of the ammonia vaporizers; and

(VI) supplying one of the vaporized ammonia stream to one of the ammonia-consuming devices.

2. The process of claim 1, wherein:

in step (III), the stream of vaporization medium comprises air, steam, or a mixture thereof.

3. The process of claims 1 or 2, wherein the stream of vaporization medium has a temperature in a range from 150 to 400 °C and an absolute pressure in a range from 138 to 1482 kPa.

4. The process of any of the preceding claims, wherein:

the centralized vaporization medium subsystem comprises (i) at least one air blower and/or at least one regulator connected to a compressed air source and (ii) at least one heater, and step (III) comprises:

(III.1) obtaining an air stream from the air blower and/or the regulator;

(III.2) heating the air stream at the heater to obtain a source stream of heated air; and

(III.3) supplying a separate stream of heated air divided from the source stream heated air as the separate stream of vaporization medium to each of the ammonia vaporizers.

5. The process of claim 4, wherein the centralized vaporization medium subsystem further comprises (i) at least two air blowers in which at least one is a backup air blower and at least two heaters in which at least one is a backup heater; and/or (ii) at least two regulators connected to the compressed air source in which at least one is a backup regulator.

6. The process of any of claims 1 to 4, wherein:

the vaporization medium comprises steam, and step (III) comprises:

(III.1) supplying a stream of high-pressure steam or super-high-pressure steam; and

(III.2) passing the stream of high-pressure steam or super-high-pressure steam through a regulator to reduce the temperature and/or pressure of the stream of high-pressure steam to obtain a source stream of steam; and

(III.3) supplying a separate stream of steam divided from the source stream of steam as the separate stream of vaporization medium to each ammonia vaporizer.

7. The process of any of the preceding claims, wherein:

in step (IV), the ammonia supply stream comprises liquid pure ammonia or an aqueous ammonia solution, and optionally nitrogen.

8. The process of claim 7, wherein the ammonia supply stream comprises an aqueous ammonia solution having an ammonia concentration in a range from 10 wt% to 29 wt%, based on the total weight of ammonia and water therein.

9. The process of claim 7 or claim 8, wherein the ammonia supply stream is supplied into the ammonia vaporizer through an atomizer.

10. The process of any of claims 7 to 9, wherein step (IV) comprises:

(IV.1) supplying a liquid stream comprising ammonia; and

(IV.2) supplying a nitrogen gas stream into the liquid stream to obtain the ammonia supply stream.

11. The process of any of the preceding claims, wherein:

Each of the ammonia-consuming devices comprises a selective catalytic reduction ("SCR") catalyst bed for reducing NO_x in a NO_x-containing gas stream passing through the SCR catalyst bed; and

at least a portion of the vaporized ammonia stream is supplied to the NO_x-containing gas stream upstream of the SCR catalyst bed.

12. The process of claim 11, wherein the NO_x-containing gas stream is produced by burning of fuel in a furnace.

13. The process of claim 12 wherein the furnace is a boiler furnace or a hydrocarbon steam-cracking furnace.

14. The process of any of claims 11 to 13, further comprising:

providing at least one sensor capable of sensing the concentration of NO_x in the NO_x-containing gas stream upstream and/or downstream of the SCR catalyst bed; and

controlling the quantity of ammonia in the ammonia supply stream in step (IV) according to the NO_x concentration sensed by the at least one sensor.

15. The process of any of claims 11 to 14, further comprising:

operating at least one of the ammonia-consuming devices in different modes producing the NO_x-containing stream with different NO_x concentrations; and

supplying different quantities of ammonia to the NO_x-containing stream in different modes to abate the NO_x to predetermined levels.

16. A system comprising:

(A) a centralized vaporization medium subsystem;

(B) multiple ammonia-consuming devices;

(C) a separate ammonia vaporizer for each of the ammonia-consuming devices adapted for (i) receiving a separate stream of the vaporization medium from the centralized vaporization medium subsystem, (ii) receiving an ammonia supply stream from an ammonia source, and (iii) supplying a vaporized ammonia stream to one of the ammonia-consuming device; and

(D) an ammonia-delivery subsystem comprising a pump for delivering a controlled quantity of ammonia from the ammonia supply stream to each ammonia vaporizer.

17. The system of claim 16, wherein the centralized vaporization medium subsystem comprises at least one air blower and/or a regulator connected to a compressed air source adapted for supplying an air stream and at least one heater adapted for heating the air stream to obtain a source stream of a vaporization medium, and the separate stream of the vaporization medium for each of the ammonia-consuming devices is obtained from the source stream of the vaporization medium.

18. The system of claim 16 or claim 17, wherein the centralized vaporization medium subsystem comprises (i) at least two air blowers in which at least one is a backup air blower and/or at least two regulator in which at least one is a backup regulator; and (ii) at least two heaters in which at least one is a backup heater.

19. The system of claim 16, wherein:
the centralized vaporization medium subsystem comprises at least one regulator adapted for reducing the temperature and/or pressure of a stream of high-pressure steam or super-high-pressure steam to obtain a source stream of steam, and the separate stream of the vaporization medium for each of the ammonia-consuming devices is obtained from the source stream of steam.

20. The system of claim 19, wherein the centralized vaporization medium subsystem comprises at least two regulators in which at least one is a backup regulator.

21. The system of any of the preceding claims 16 to 20, wherein:
the ammonia-delivery system further comprises a conduit for supplying nitrogen gas into the ammonia supply stream and/or an atomizer at the inlet to the ammonia vaporizer.

22. The system of any of the preceding claims 16 to 21, wherein:
each of the ammonia-consuming devices comprises a selective catalytic reduction (“SCR”) catalyst bed for reducing NO_x in a NO_x-containing gas stream passing through the SCR catalyst bed; and
the fluid communication between the ammonia vaporizer and the ammonia-consuming device is set up in a manner such that at least a portion of the vaporized ammonia stream is supplied to the NO_x-containing gas stream upstream of the SCR catalyst bed.

23. The system of claim 22, wherein each of the ammonia-consuming devices is a furnace producing the NO_x-containing gas stream.

24. The system of claim 23, wherein the furnace is a boiler furnace or a hydrocarbon steam-cracking furnace capable of operating in different modes.

25. The system of any of the preceding claims 16 to 24, further comprising:

at least one sensor capable of sensing the concentration of NO_x in the NO_x-containing gas stream upstream and/or downstream of the SCR catalyst bed; and

at least one actuator in the ammonia delivery subsystem adapted for controlling the quantity of ammonia supplied to the ammonia vaporizer according to the concentration of NO_x sensed by the at least one sensor.