Claims

~~1. A process of capturing Carbon Dioxide (CO_2) from flue gases, the process comprising the step of:~~

~~feeding a flue gas comprising CO_2 to at least one Rotary Packed Bed (RPB) absorber rotating circularly, wherein a solvent provided through an inner radius of the at least one RPB absorber moves towards an outer radius of the at least one RPB absorber, and wherein the solvent reacts with the flue gas in a counter-current flow.~~

1. A process of capturing Carbon Dioxide (CO_2) from flue gases, the process comprising the steps of:

(a) providing a carbon capture solvent;

(b) introducing the carbon capture solvent into a Rotary Packed Bed (RPB) absorber and a Rotary Packed Bed (RPB) stripper;

(c) applying steam to a reboiler;

(d) bringing the carbon capture solvent in the Rotary Packed Bed (RPB) stripper to a desired pressure;

(e) pumping the carbon capture solvent around the Rotary Packed Bed (RPB) absorber and the Rotary Packed Bed (RPB) stripper;

(f) introducing flue gas into the Rotary Packed Bed (RPB) absorber;

(g) monitoring production of Carbon Dioxide (CO_2) from the Rotary Packed Bed (RPB) stripper;

(h) starting a Rotary Packed Bed (RPB) O_2 eliminator; or, starting a conventional packed bed O_2 eliminator;

(i) stopping the flow of flue gas to the Rotary Packed Bed (RPB) absorber;

(j) monitoring production of Carbon Dioxide (CO_2) from the Rotary Packed Bed (RPB) stripper until Carbon Dioxide (CO_2) production has stopped;

(k) stopping supply of steam to the reboiler;

(l) stopping circulation of the carbon capture solvent;

(m) stopping rotation of the Rotary Packed Bed (RPB) stripper, absorber, and O_2 eliminator.

2. The process of claim 1, wherein the process further comprises the step of:

thermally regenerating the carbon capture solvent reacted with the CO_2 for re-utilizing the carbon capture solvent in the process.

3. The process of claim 1 ~~or claim 2~~, wherein the process further comprises the step of:

~~———~~passing the flue gas through one or both of a water wash and an acid wash to remove traces of the carbon capture solvent present in the flue gas; and step (m) further comprising stopping rotation of the water wash, the acid wash, or, when both are present, both.

4. The process of claim 3, ~~optionally,~~ wherein one or both of the water wash and the acid wash are conducted on separate Rotary Packed Beds (RPBs).

5~~4~~. The process of ~~any one of claims 1 to 3~~ claim 1, wherein a housing of ~~the RPB or~~ at least one of the RPBs is mounted on a rotatable disk.

6~~5~~. The process of ~~any one of claims 1 to 3~~ claim 1, wherein the step of ~~feeding a~~ introducing the flue gas comprising CO_2 to ~~at least one~~ the Rotary Packed Bed (RPB) absorber ~~rotating circularly~~ comprises feeding the flue gas to two, three, four, five or six Rotary Packed Bed (RPB) absorbers ~~rotating circularly~~.

7~~6~~. The process of claim ~~5~~ 6, wherein the two, three, four, five or six Rotary Packed Bed (RPB) absorbers ~~rotating circularly~~ are arranged in series on a common shaft.

8~~7~~. The process of ~~any one of claims 1 to 6~~ claim 1, wherein the carbon capture solvent reacts with the flue gas in a counter-current flow to remove CO_2 from the flue gas and form CO_2 rich solvent.

9~~8~~. The process of claim ~~7~~ 8, ~~further comprising the step of:~~

~~passing the CO_2 rich solvent to a stripper,~~ wherein the Rotary Packed Bed (RPB) stripper ~~acts to strip CO_2~~ produces a CO_2 lean solvent from the CO_2 rich solvent ~~forming CO_2 lean solvent~~.

10~~9~~. The process of claim ~~8~~ 9, wherein the RPB stripper is a stripper column, a stripper static column or ~~an~~ a RPB stripper.

11~~10~~. The process of ~~claim 8 or~~ claim 9, wherein the CO_2 lean solvent is re-introduced into the ~~at least one~~ Rotary Packed Bed (RPB) absorber ~~rotating circularly~~.

~~11. The process of any one of claims 1 to 10, further comprising the step of:~~

~~passing CO_2 rich solvent leaving the at least one Rotary Packed Bed (RPB) absorber to a Rotary Packed Bed (RPB) O_2 eliminator; or, a static packed bed O_2 eliminator; and eliminating dissolved O_2 from the solvent.~~

12. The process of claim ~~11~~ 1, wherein the ~~step of passing CO_2 rich solvent leaving the Rotary Packed Bed (RPB) absorber to a~~ Rotary Packed Bed (RPB) O_2 eliminator ~~; or, a static~~ or conventional packed bed O_2 eliminator ~~; and eliminating O_2 from the solvent~~ eliminates 90% or more of the O_2 present in the CO_2 rich solvent formed from the Rotary Packed Bed (RPB) absorber.

13. The process of ~~any one of claims 1 to 12~~ claim 1, wherein each Rotary Packed Bed (RPB) has the following dimensions:

radius: from 0.2m to 1.25m, or from 0.2m to 0.8m,

axial length: from 0.02m to 1.0m, or from 0.2m to 0.6m,

volume: from 0.04m^3 to 4.9m^3, or from 0.04m^3 to 0.6m^3.

~~14. A system for capturing Carbon Dioxide (CO_2) from flue gases, the system comprising:~~

~~at least one Rotary Packed Bed (RPB) absorber configured to rotate circularly, wherein when the RPB rotates circularly a solvent provided through an inner radius of the~~

~~at least one RPB absorber moves towards an outer radius of the at least one RPB absorber, and wherein the solvent reacts with flue gas in a counter-current flow to capture CO_2.~~

~~15. The system of claim 14, wherein the system further comprises:~~

~~components for thermally regenerating the solvent reacted with the CO_2 for re-utilizing the solvent in the process.~~

~~16. The system of claim 14 or claim 15, wherein the system further comprises:~~

~~one or both of a water wash and an acid wash, wherein passing the flue gas through one or both of the water wash and the acid wash removes traces of the solvent present in the flue gas.~~

~~17. The system of any one of claims 14 to 16, wherein a housing of the RPB is mounted on a rotatable disk.~~

~~18. The system of any one of claims 14 to 17, wherein the system comprises two, three, four, five or six Rotary Packed Bed (RPB) absorbers configured to rotate circularly.~~

~~19. The system of claim 18, wherein the two, three, four, five or six Rotary Packed Bed (RPB) absorbers configured to rotate circularly are arranged in series on a common shaft.~~

~~20. The system of any one of claims 14 to 19, wherein the solvent reacts with the flue gas in a counter-current flow to remove CO_2 from the flue gas and form CO_2 rich solvent.~~

~~21. The system of claim 20, further comprising:~~

~~a stripper, wherein the stripper is configured to strip CO_2 from the CO_2 rich solvent forming CO_2 lean solvent.~~

~~22. The system of claim 21, wherein the stripper is an RPB stripper.~~

~~23. The system of claim 21 or claim 22, wherein the system is configured to re-introduce the CO_2 lean solvent into the at least one Rotary Packed Bed (RPB) absorber rotating circularly.~~

~~24. The system of any one of claims 14 to 23, further comprising:~~

~~a Rotary Packed Bed (RPB) O_2 eliminator; or, a static packed bed O_2 eliminator for eliminating O_2 from CO_2 rich solvent, the Rotary Packed Bed (RPB) O_2 eliminator; or, the static packed bed O_2 eliminator; positioned to eliminate O_2 from CO_2 rich solvent leaving the at least one Rotary Packed Bed (RPB) absorber.~~

~~25. The system of claim 23, wherein the Rotary Packed Bed (RPB) O_2 eliminator; or, a static packed bed O_2 eliminator; is configured to eliminate 90% or more of the O_2 present in the CO_2 rich solvent.~~

~~26. The system of any one of claims 14 to 25, wherein each Rotary Packed Bed (RPB) has the following dimensions:~~

~~radius: from 0.2m to 1.25m, or from 0.2m to 0.8m,~~

~~axial length: from 0.02m to 1.0m, or from 0.2m to 0.6m,~~

~~volume: from 0.04m^3 to 4.9m^3, or from 0.04m^3 to 0.6m^3.~~

14~~27~~. The process of ~~any one of claims 1 to 13~~ claim 1, ~~or the system of any one of claims 14 to 26,~~ wherein the carbon capture solvent comprises at least one of:

a tertiary amine~~; and/or~~,

a sterically hindered amine~~; and/or~~,

a polyamine~~; and/or~~,

a carbonate buffer salt~~; and/or~~,

water ~~(optionally deionized water); optionally, water present from 10 wt% to 70 wt%~~, or

a combination thereof.

15~~28~~. The process~~, or the system,~~ of claim ~~27~~ 14, wherein the carbon capture solvent has a viscosity from 1 cp to 100 cp.

16. The process of claim 14, wherein the carbon capture solvent comprises at least one of:

a tertiary amine,

a sterically hindered amine,

a polyamine,

a carbonate buffer,

water, or

a combination thereof.

17~~29~~. The process~~, or the system, of claim 27 or claim 28~~ of claim 16, wherein ~~the solvent~~ at least one of:

~~is any solvent disclosed in US 2017/0274317 A1; and/or,~~

~~the solvent comprises:~~

(a) ~~a~~ the tertiary amine is ~~(for example,~~ N-methyl-diethanolamine, ~~and/or~~ 2-(diethylamino)ethanol~~)~~, ~~and/~~or a combination thereof;~~,~~

(b) ~~a~~ the sterically hindered amine is ~~(for example,~~ 2-amino-2-ethyl-1,3-propanediol, 2-amino-2-hydroxymethyl-1,3-propanediol, ~~and/or~~ 2-amino-2-methyl-1-propanol~~)~~, ~~and/~~or a combination thereof;~~,~~

(c) ~~a~~ the polyamine is ~~(for example,~~ 2-piperazine-1-ethylamine, ~~and/or~~ 1-(2-hydroxyethyl)piperazine~~)~~, ~~and/~~or a combination thereof;~~,~~

(d) ~~a~~ the carbonate buffer is ~~(for example,~~ potassium carbonate~~), and/or,~~;

(e) the water is ~~(for example,~~ deionised water~~)~~; or

(f) a combination thereof.

18~~30~~. The process~~, or the system,~~ of ~~any one of claims 27 to 29~~ claim 14, wherein the carbon capture solvent ~~comprises:~~ includes water, an amino hindered alcohol ~~(optionally,~~

~~amino-2-methyl-1-propanol),~~ and a polyamine ~~(optionally, amino ethyl piperazine) and water~~.

~~31. An arrangement of Rotary Packed Bed (RPB) absorbers comprising two, three, four, five or six RPB absorbers configured to rotate circularly, wherein the RPB absorbers are arranged in series on a common shaft.~~

~~32. A vacuum solvent reclamation system for removing Heat Stable Salts, degradation products and other contaminants from Carbon Dioxide (CO_2) capture solvents, the vacuum solvent reclamation system comprising:~~

~~a feed product exchanger configured to increase the temperature of Carbon Dioxide (CO_2) capture solvents;~~

~~a reboiler configured to further increase the temperature of Carbon Dioxide (CO_2) capture solvents emitted from the feed product exchanger such that the Heat Stable Salts, degradation products and other contaminants accumulate in the reboiler;~~

~~the feed product exchanger and the reboiler in fluid communication to permit batch or semi-batch removal of Heat Stable Salts, degradation products and other contaminants from the Carbon Dioxide (CO_2) capture solvents; and,~~

~~a condenser for decreasing the temperature of cleaned Carbon Dioxide (CO_2) capture solvents emitted from the feed product exchanger.~~

~~33. A vacuum solvent reclamation system for removing Heat Stable Salts, degradation products and other contaminants from Carbon Dioxide (CO_2) capture solvents, the vacuum solvent reclamation system comprising:~~

~~a reboiler configured to increase the temperature of Carbon Dioxide (CO_2) capture solvents such that the Heat Stable Salts, degradation products and other contaminants accumulate in the reboiler;~~

~~the reboiler configured to permit batch or semi-batch removal of Heat Stable Salts, degradation products and other contaminants from the Carbon Dioxide (CO_2) capture solvents; and,~~

a condenser for decreasing the temperature of cleaned Carbon Dioxide (CO_2) capture solvents emitted from the reboiler.

34. The vacuum solvent reclamation system of claim 32 or claim 33, wherein the vacuum solvent reclamation system is in fluid communication with the system of any one of claims 14 to 30.

35. A process of capturing Carbon Dioxide (CO_2) from flue gases, the process comprising the step of:

providing a carbon capture solvent;

introducing the carbon capture solvent into a Rotary Packed Bed (RPB) absorber and a Rotary Packed Bed (RPB) stripper; and, optionally, an O_2 eliminator;

applying steam to a reboiler;

bringing the carbon capture solvent in the Rotary Packed Bed (RPB) stripper to a desired pressure;

pumping the carbon capture solvent around the Rotary Packed Bed (RPB) absorber and the Rotary Packed Bed (RPB) stripper;

introducing flue gas into the Rotary Packed Bed (RPB) absorber;

monitoring production of Carbon Dioxide (CO_2) from the Rotary Packed Bed (RPB) stripper;

starting a Rotary Packed Bed (RPB) O_2 eliminator; or, starting a conventional packed bed O_2 eliminator;

stopping the flow of flue gas to the Rotary Packed Bed (RPB) absorber;

monitoring production of Carbon Dioxide (CO_2) from the Rotary Packed Bed (RPB) stripper until Carbon Dioxide (CO_2) production has stopped;

stopping supply of steam to the reboiler;

stopping circulation of the solvent;

stopping rotation of the Rotary Packed Bed (RPB) stripper, absorber, water wash, acid wash and O_2 eliminator.

36. A system substantially as set out in any one of figures 2, 3A, 3B or 4A, 4B or 8.

~~37. A process substantially as set out in figure 5.~~

~~38. Any novel feature or combination of features disclosed herein.~~

19. The process of claim 18, wherein the amino hindered alcohol is amino-2-methyl-1-propanol, the polyamine is amino ethyl piperazine, or a combination thereof.

20. The process of claim 14, wherein the water is present in the carbon capture solvent in an amount from 10 wt % to 70 wt. % of the carbon capture solvent.

21. The process of claim 1, wherein step (b) or step (h) further includes introducing the carbon capture solvent into an O_2 eliminator.