Claims

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, 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, wherein one or both of the water wash and the acid wash are conducted on separate Rotary Packed Beds (RPBs).

5. The process of claim 1, wherein a housing of at least one of the RPBs is mounted on a rotatable disk.

6. The process of claim 1, wherein the step of introducing the flue gas comprising CO_2 to the Rotary Packed Bed (RPB) absorber comprises feeding the flue gas to two, three, four, five or six Rotary Packed Bed (RPB) absorbers.

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

8. The process of 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. The process of claim 8, wherein the Rotary Packed Bed (RPB) stripper produces a CO_2 lean solvent from the CO_2 rich solvent.

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

11. The process of claim 9, wherein the CO_2 lean solvent is re-introduced into the Rotary Packed Bed (RPB) absorber.

12. The process of claim 1, wherein the Rotary Packed Bed (RPB) O_2 eliminator or conventional packed bed O_2 eliminator 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 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. The process of claim 1, wherein the carbon capture solvent comprises at least one of:

a tertiary amine,

a sterically hindered amine,

a polyamine,

a carbonate buffer salt,

water, or

a combination thereof.

15. The process of claim 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. The process of claim 16, wherein at least one of:

(a) the tertiary amine is N-methyl-diethanolamine, 2-(diethylamino)ethanol, or a combination thereof;

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

(c) the polyamine is 2-piperazine-1-ethylamine, 1-(2-hydroxyethyl)piperazine, or a combination thereof;

(d) the carbonate buffer is potassium carbonate;

(e) the water is deionised water; or

(f) a combination thereof.

18. The process of claim 14, wherein the carbon capture solvent includes water, an amino hindered alcohol and a polyamine.

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.