

CLAMS:

1. A cyclic process for separating CO₂ from a gas stream, which process comprises: dehumidifying the gas stream to remove substantial quantities of water therefrom; contacting the dehumidified gas stream with an absorbent system comprising a non-aqueous aprotic solvent, an amine CO₂ sorbent, having a first pK_a and a non-nucleophilic base having a second pK_a higher than the first pK_a at least 3 units higher than that of the amine at a temperature above 50°C to sorb CO₂, wherein the contacting of the absorbent system with the dehumidified gas stream results in formation of a stabilized mixed carbamate in which the CO₂ forms a carbamate by reaction with the amine sorbent and in which a protonated form of the non-nucleophilic base forms a stabilizing counterion for the carbamate; and treating the absorbent system containing the sorbed CO₂ under conditions sufficient to cause desorption of at least a portion of the CO₂.

2. The process of claim 1, wherein the amine sorbent comprises ~~one or more of the following: a primary amine, and/or a secondary amine, or mixture thereof; a primary and/or secondary aliphatic, cycloaliphatic, or aromatic amine, or mixture thereof; and a polyamine having both primary and secondary amine groups, having both secondary and tertiary amine groups, or having each of primary, secondary, and tertiary amine groups~~

3. The process of claim 1, wherein the amine sorbent comprises a primary or secondary aliphatic, cycloaliphatic, or aromatic amine, or mixture thereof.

~~3.4.~~ The process of claim ~~2~~ 3, wherein the aliphatic amine comprises a primary amine selected from: the amine comprises monoethanolamine, 2-amino-2-methyl-1-propanol, 2-(2-aminoethylamino)ethanol, 2-amino-2-hydroxymethyl-1,3-propanediol, diglycolamine, 2-ethoxyethylamine, 2-*n*-propoxyethylamine, 1,5-diamino-3-oxapentane, 3-aminopropionitrile, aminoacetonitrile, or hydroxyethylenediamine; ~~comprises piperidine, piperazine, diethanolamine, diisopropanolamine, 1,5-bis(methylamino)-3-oxapentane, bis(2-methoxyethyl)amine, bis(2-ethoxyethyl)amine;~~

~~ethoxyethanol tertiarybutylamine, or 3,3'-iminodipropionitrile; comprises aniline; and has a pK_a not greater than 11.5, for example not greater than 10 or not greater than 9.~~

5. The process of claim 3, wherein the amine comprises a secondary amine selected from piperidine, piperazine, diethanolamine, diisopropanolamine, 1,5-bis(methylamino)-3-oxapentane, bis(2-methoxyethyl)amine, bis(2-ethoxyethyl)amine, ethoxyethanol tertiarybutylamine, or 3,3'-iminodipropionitrile.

6. The process of claim 3, wherein the aliphatic amine comprises aniline.

4.7. The process of ~~any one of the previous claims~~ claim 1, wherein the non-nucleophilic base:— comprises an amine, an imine, an amidine, a guanidine, or a biguanide; ~~has a pK_a of at least 8.5, for example at least 9, at least 10, or at least 13; has a pK_a of at least 3 units higher, for example at least 7 units higher, than that of the amine.~~

8. The process of claim 7, wherein the non-nucleophilic base has a pK_a of at least 8.5.

9. The process of claim 8, wherein the non-nucleophilic base has a pK_a of at least 9.

10. The process of claim 9, wherein the non-nucleophilic base has a pK_a of at least 10.

11. The process of claim 10, wherein the non-nucleophilic base has a pK_a of at least 13.

12. The process of claim 1, wherein the amine has a pK_a not greater than 11.5.

13. The process of claim 8, wherein the amine has a pK_a not greater than 11.5.

14. The process of claim 12, wherein the amine has a pK_a not greater than 10.

15. The process of claim 14, wherein the amine has a pK_a not greater than 9.

16. The process of claim 1, wherein the non-nucleophilic base has a pK_a of at least 7 units higher than that of the amine.

~~5-17.~~ The process of ~~any one of the previous claims~~ claim 1, wherein the dehumidified gas stream is contacted with the absorbent at a temperature of at least 70°C, ~~for example at least 90°C~~, but not more than 100°C.

18. The process of claim 17, wherein the dehumidified gas stream is contacted with the absorbent at a temperature of at least 90°C but not more than 100°C.

~~6-19.~~ The process of ~~any one of the previous claims~~ claim 1, wherein the CO₂ is desorbed from the absorbent containing the sorbed CO₂ at a temperature of at least about 100°C, ~~for example from 100 to 120°C~~, to cause desorption of at least a portion of the sorbed CO₂.

20. The process of claim 15, wherein the CO₂ is desorbed from the absorbent containing the sorbed CO₂ at a temperature from 100 to 120°C.

~~7-21.~~ The process of ~~any one of the previous claims~~ claim 1, wherein the amine and the non-nucleophilic base are dissolved in a polar, aprotic solvent having a boiling point of at least 65°C.

~~8-22.~~ The process of ~~any one of the previous claims~~ claim 1, wherein ~~only the amine, only or the non-nucleophilic base, or both are~~ is integrated onto a porous support.

23. The process of claim 1, wherein the amine and the non-nucleophilic base are integrated onto a porous support.

9,24. The process of claim 8 22, wherein the porous support is comprised of a material selected from carbon, alumina, silica, silica-alumina, magnesia, zeolites, and solid porous polymers.

25. The process of claim 23, wherein the porous support is comprised of a material selected from carbon, alumina, silica, silica-alumina, magnesia, zeolites, and solid porous polymers.

26. The process of claim 1, wherein the amine comprises a polyamine having both primary and secondary amine groups, having both secondary and tertiary amine groups, or having each of primary, secondary, and tertiary amine groups.

27. The process of claim 21, wherein the non-aqueous polar aprotic solvent is selected from the group consisting of toluene, acetonitrile, dimethylformamide, dimethylsulfoxide, tetrahydrofuran, methyl ethyl ketone, ethyl acetate, amyl acetate, 1,2-orthodichlorobenzene, and combinations thereof.