CLAIMS

1. A solid adsorbent for capturing carbon dioxide (CO_2) from a gas stream comprising CO_2, the solid adsorbent comprising an amine covalently bonded to a polymer resin,

wherein the solid adsorbent has a CO_2 uptake capacity of greater than 7 wt. % at a temperature of 40 °C, and wherein the solid adsorbent has a CO_2 uptake capacity of less than 1.5 wt. % at a temperature of 100 °C, as measured when the gas stream further comprises a concentration of the CO_2 of 4 vol. %, by volume of the gas stream, and

wherein the amine is an alkyl diamine and wherein the alkyl diamine has a chain length and wherein the chain length of the alkyl diamine is covalently bonded to the resin for at least for 95% the same.

2. The solid adsorbent according to claim 1, wherein at least one of:

the polymer resin comprises a pore volume from .001 cm^3/g to .5 cm^3/g;

the polymer resin comprises a surface area from 1 m^2/g to 60 m^2/g;

the polymer resin comprises polystyrene;

the polymer resin comprises a porosity from 15 % to 60 %.

3. The solid adsorbent according to claim 1 or 2, where at least one of:

the solid adsorbent comprises a dry nitrogen content from 5 mol/kg to 10 mol/kg.

4. The solid adsorbent according to claim 1, wherein the amine comprises at least one of an ethylenediamine, a 1,3-diaminopropane, a 1,4-diaminobutane, a 1,5-diaminopentane, a 1,6-diaminohexane, a 1,7-diaminoheptane, a 1,8-diaminooctane, a 1,9-

diaminononane, a 1,10-diaminodecane, a 1,3-diaminopentane, a 1,2-diaminopropane, and combinations thereof.

5. A method for preparing a solid adsorbent for capturing carbon dioxide (CO_2) from a gas stream comprising CO_2, the method comprising:

combining an amine with a chloromethylated polymer resin to form the solid adsorbent,

wherein the solid adsorbent comprises a dry nitrogen content from 5 mol/kg to 10 mol/kg, wherein the solid adsorbent has a CO_2 uptake capacity of greater than 7 wt. % at a temperature of 40 °C, and wherein the solid adsorbent has a CO_2 uptake capacity of less than 1.5 wt. % at a temperature of 100 °C, as measured when the gas stream further comprises a concentration of the CO_2 of 4 vol. %, by volume of the gas stream, and

wherein the amine is an alkyl diamine and wherein the alkyl diamine has a chain length and wherein the chain length of the alkyl diamine is covalently bonded to the resin for at least for 95% the same.

6. Use of a polymer resin having an amine covalently bonded thereto, as a solid adsorbent for capturing carbon dioxide (CO_2) from a gas stream comprising CO_2, wherein the solid adsorbent has a CO_2 uptake capacity of greater than 7 wt. % at a temperature of 40 °C, and wherein the solid adsorbent has a CO_2 uptake capacity of less than 1.5 wt. % at a temperature of 100 °C, as measured when the gas stream further comprises a concentration of the CO_2 of 4 vol. %, by volume of the gas stream, and

wherein the amine is an alkyl diamine and wherein the alkyl diamine has a chain length and wherein the chain length of the alkyl diamine is covalently bonded to the resin for at least for 95% the same.