CLAIMS

1. A method for producing purified SiO_2, the method comprising the following steps:

a) providing an aqueous solution containing Na_2CO_3 and mixing it with an oxide or hydroxide of an alkaline earth metal to produce an aqueous solution containing NaOH and a precipitated carbonate of an alkaline earth metal;

b) adding acid-pretreated crude SiO_2, containing more than 50 wt% of SiO_2, to the aqueous solution of step a) and scavenging NaOH from the aqueous solution to form an aqueous Na_2SiO_3 solution at a temperature of 100 °C or lower;

c) filtering the aqueous Na_2SiO_3 solution to remove the precipitated carbonate of an alkaline earth metal;

d) partitioning the aqueous Na_2SiO_3 solution into at least two portions, wherein a mixture comprising a first portion of the purified SiO_2 alongside $NaHCO_3$ solution is produced by adding gaseous CO_2 to a first portion of the aqueous Na_2SiO_3 solution; and

e) filtering the mixture from d) to separate and obtain the purified SiO_2 and the $NaHCO_3$ solution, wherein the $NaHCO_3$ solution is added to a further portion of the aqueous Na_2SiO_3 solution from step d) to precipitate an additional portion of the purified SiO_2.

2. The method of claim 1, wherein the Na_2CO_3 is present in the aqueous solution in a concentration higher than about 10 wt%.

3. The method of claim 1 or 2, wherein the oxide or hydroxide of an alkaline earth metal is an oxide or hydroxide of calcium or magnesium.

4. The method of claim 3, wherein the oxide or hydroxide of calcium or magnesium is an oxide or hydroxide of calcium.

5. The method of any of claims 1 to 4, step a) subsequently comprising

a)i) filtering the aqueous solution obtained from step a) to remove the precipitated carbonate of an alkaline earth metal before addition of the acid-pretreated crude SiO_2.

6. The method of any of claims 1 to 5, wherein the acid-pretreated crude SiO_2 contains more than about 60 wt% of SiO_2.

7. The method of any of claims 1 to 6, wherein the concentration of the NaOH in the aqueous solution of step b) is kept below about 5 wt%.

8. The method of any of claims 1 to 7, wherein step b) is carried out at a temperature of about 90 °C or lower.

9. The method of any of claims 1 to 8, wherein step b) is carried out at a pressure of between 1 bar to 5 bar.

10. The method of any of claims 1 to 9, wherein step c) is carried out at a lower temperature than the temperature in step b).

11. The method of any of claims 1 to 10, wherein the precipitated carbonate of an alkaline earth metal, which is removed in step c) or optionally in step a)i), is decomposed into an oxide or hydroxide of an alkaline earth metal and recycled in step a).

12. The method of any of claims 1 to 11, wherein the pH of the aqueous Na_2SiO_3 solution prior to the addition of gaseous CO_2 is at 9 to 14.

13. The method of any of claims 1 to 12, wherein the addition of gaseous CO_2 in step d) lowers the pH of the aqueous Na_2SiO_3 solution to 6 to 10.

14. The method of any of claims 1 to 13, step e) subsequently comprising
e)i) precipitating the additional portion of the purified SiO_2 to further produce Na_2CO_3.

15. The method of claim 14, wherein the Na_2CO_3 of step e)i) is recycled in step a).

16. The method of claim 15, wherein the Na_2CO_3 of step e)i) is present in an aqueous solution for recycling in step a).

17. The method of any of the claims 1 to 16, further comprising

f) decomposing the precipitated carbonate of an alkaline earth metal into an oxide or hydroxide of the alkaline earth metal and purified CO_2.

18. The method of claim 17, wherein the reaction in step f) involves purifying the precipitated carbonate of an alkaline earth metal by reacting it with diluted CO_2 to give an aqueous solution of a bicarbonate of an alkaline earth metal and decomposing the bicarbonate of an alkaline earth metal to give a purified carbonate of an alkaline earth metal.