CO_2 assisted geo-polymerization: a win-win pragmatic approach for the synthesis of soda ash leading to reversal of climate clock

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Supplementary Information

(Scheme, S1)

The exact composition data, formulation and steps involved in the procedure have been presented below for the reproducibility of the experiments in research, to promote and reuse of new findings.

The raw fly ash used in our proof of concept experimentations and its compositions are as follows:

Sr.No.	Composition of fly ash	Class C Fly Ash	Class F Fly Ash
1.	Silicon Dioxide (SiO_2)	47-58%	50-65%
2.	Aluminum Oxide (Al_2O_3)	15-23%	20-30%
3.	Iron Oxide (Fe_2O_3)	5-8%	4-7%
4.	Calcium Oxide (CaO)	15-35%	1-8%
5.	Magnesium Oxide (MgO)	1-4%	0.5-4%
6.	Sulfur Trioxide (SO_3)	1-4%	<1.5%
7.	Loss on Ignition (LOI)	0.5-6%	0.5-5%
8.	Potassium Oxide (K_2O)	0.5-3%	0.5-2%
9.	Sodium Oxide (Na_2O)	0.1-2%	0.1-2%
10.	Titanium Dioxide (TiO_2)	1-2%	0.5-2%

The ratio of making fly ash paste specimens with variable ratio of ingredients:

Ingredients	Ash	sodium silicate	Carbonation duration	Relative humidity	Silica modulus (silica to alumina)	Sodium hydroxide	Plasticizing agent (glycerol)
Trial ratio CASP-1	85%	9%	8 hrs	40%	0.7	0%	4%
Trial ratio CASP-2	85%	9%	10 hrs	45%	0.9	0%	4%
Trial ratio CASP-3	85%	10%	12 hrs	55%	1.1	0%	4%
Trial ratio CASP-4	85%	12%	15 hrs	55%	1.3	0%	4%

Outcomes (percentage yield of the soda ash and mechanical parameters) for trials

Sample name	Percentage yield of soda ash	Strength of block synthesized and water absorption
Trial ratio CASP-1	24%	8 Mpa, 18%
Trial ratio CASP-2	27%	10 Mpa, 16%
Trial ratio CASP-3	31 %	14 Mpa, 13 %
Trial ratio CASP-4	33 %	16 Mpa, 12 %

The sample preparation steps are as follows:

Empty Mold

Making and filling of fly ash paste

Homogenize and compaction through vibration

Ready sample for keeping in carbonation chamber