Recovery of construction and demolition waste as raw materials of alkaline activated materials

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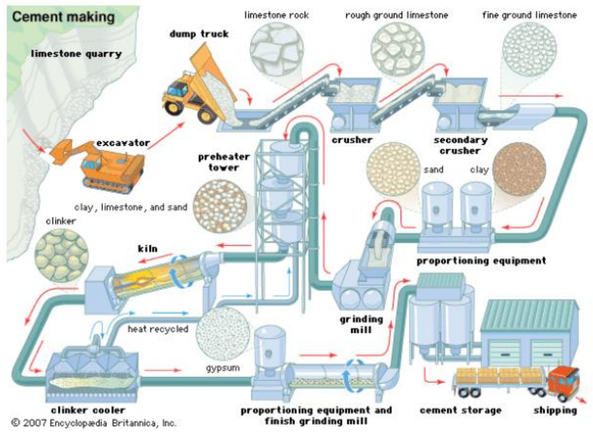
INTRODUCCTION

Portland Cement Production



Industrial waste

Environmental problems

- 5-8% of global CO_2 emissions
- Extraction of raw materials

Environmental problems

- Enormous amount of waste accumulates in landfills
- No chance of being reused

Another option?

Alkaline activation cements or Geopolymer

Are inorganic aluminosilicates with an amorphous, three-dimensional structure

Resulting from

REACTION OF GEOPOLYMERIZATION

Chemical reaction with low T[a]

PRECURSOR

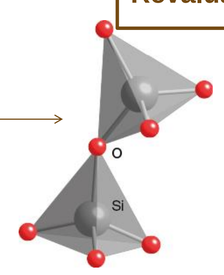
Material composed of Al and Si

ACTIVATOR

Alkaline solution

Other use or application?

Revaluation



- Low emissions of CO_2
- Cementitious properties comparable to Portland cement
- Excellent properties such as chemical, thermal and mechanical resistance, good durability

OBJETIVES

This study has two objectives: to find an alternative to Portland cement (PC) that is more sustainable both energetically and environmentally, and the recovery of waste that allows the saving of raw materials, reduces the consumption of fossil fuels, reduces greenhouse gas emissions and provide a sustainable solution to the problem of waste

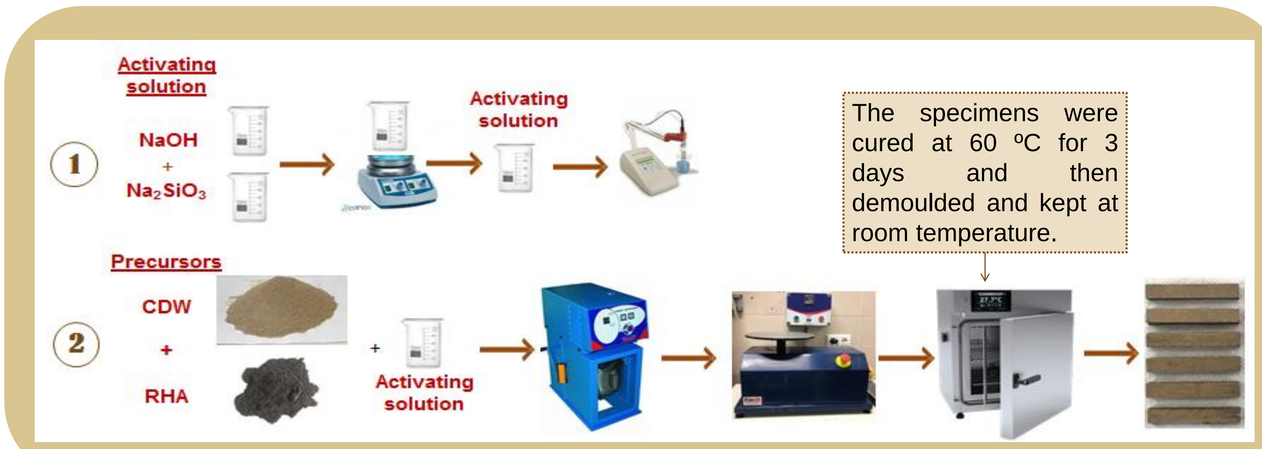
SYNTHESIS OF GEOPOLYMERS

First, geopolymers were prepared with 100% by weight of CDW, and then the amount of CDW was decreased to 60%, the remaining 40% being RHA.

As sources of aluminosilicates (precursors) have been used: rice husk ash (RHA) and construction and demolition residues (CDW).

As activator, a solution of 8M NaOH and Na_2SiO_3 have been used. The percentage of Na_2SiO_3 in the activating solution varied from 25%, 50% and 75%, with the NaOH concentration being 8 M

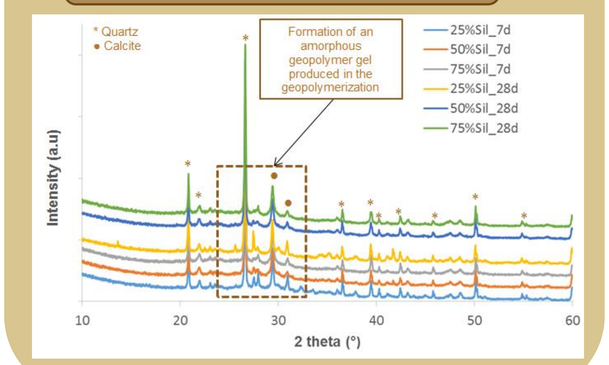
Mix	RCD (g)	RHA (g)	H_2O (g)	NaOH (g)	M (mol/L)	Na_2SiO_3 (g)	Relation L/S	Molar Ratio Si/Al	Molar Ratio Na/Si	Ms	pH
80%RCD_40%RHA	150	100	49.14	16.05	8	195.56	1.043	9.01	0,37	1,99	12
80%RCD_40%RHA	150	100	98.28	32.09	8	130.38	1.043	7.96	0.51	1,09	12
80%RCD_40%RHA	150	100	147.42	48.14	8	65.19	1.043	6.90	0.69	0.46	12



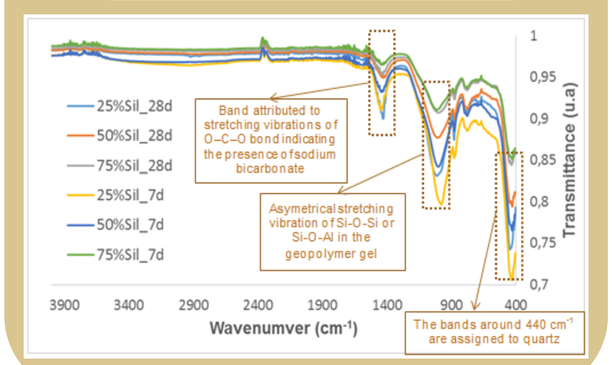
The specimens were cured at 60 ºC for 3 days and then demoulded and kept at room temperature.

RESULTS AND DISCUSSION

DRX



FTIR

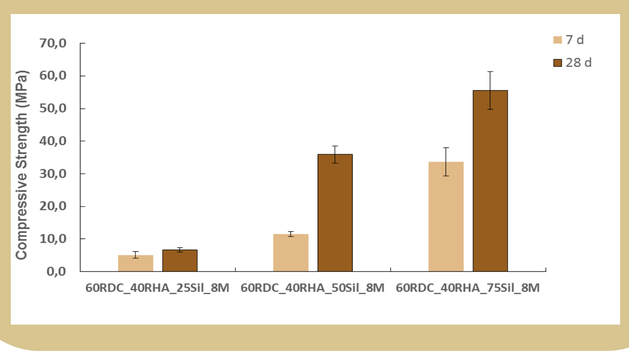


XRF

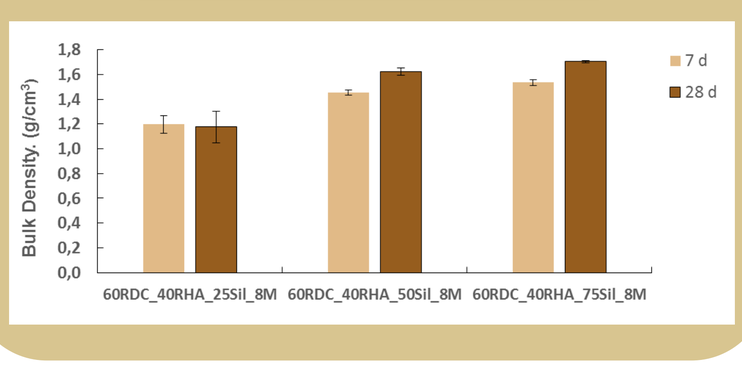
Chemical Composition	SiO_2	Al_2O_3	Fe_2O_3	Na_2O	MgO	CaO	K_2O	SO_3	LOI
RCD (%)	55.1	5.76	2.45	0.758	2.24	17.27	1.39	0.426	13.65

Chemical Composition	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	SO_3	LOI
RHA (%)	79.6	0.19	0.27	0.04	0.68	0.852	0.09	2.11	0.01	1.68	0.12	17.37

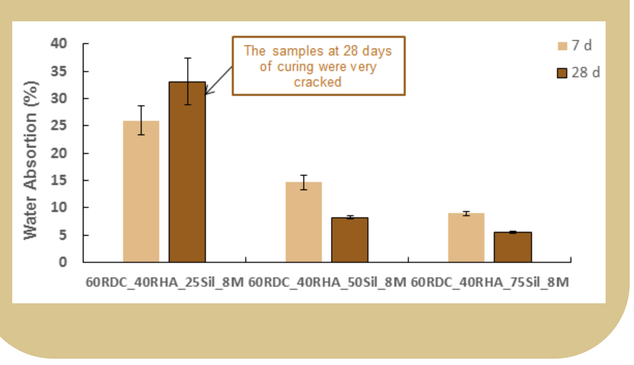
COMPRESSIVE STRENGTH



BULK DENSITY



WATER ABSORPTION



The compressive strength results indicate that it is necessary to use high concentrations of silicate to activate the CDW, reaching compressive strengths 19.06 MPa after 7 days of curing. The addition of 40 wt% of RHA using the same silicate/NaOH ratio produced an increase in compressive strength to 33.6 MPa, when 75 wt% of silicate is used, increasing to 55.5 MPa after 28 days of curing

ACKNOWLEDGMENTS

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

The work was financially supported by Junta de Andalucía. Ministry of Economy, Knowledge, companies and Universities. Through Knowledge Transfer Activities: "GEO4BUILD: geopolymers and by-products for a circular economy in the construction field"

CONCLUSIONS

The results obtained in this research provide an alternative way to the use of Portland cement and the reuse of construction and demolition waste through the production of alkaline-activated materials. This is a sustainable option for the recovery of construction and demolition waste (CDW), entering into what is known as the circular economy.