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OIL BLEACHING EARTHS AS PRECURSOR OF GEOPOLYMERS FOR A CIRCULAR ECONOMY

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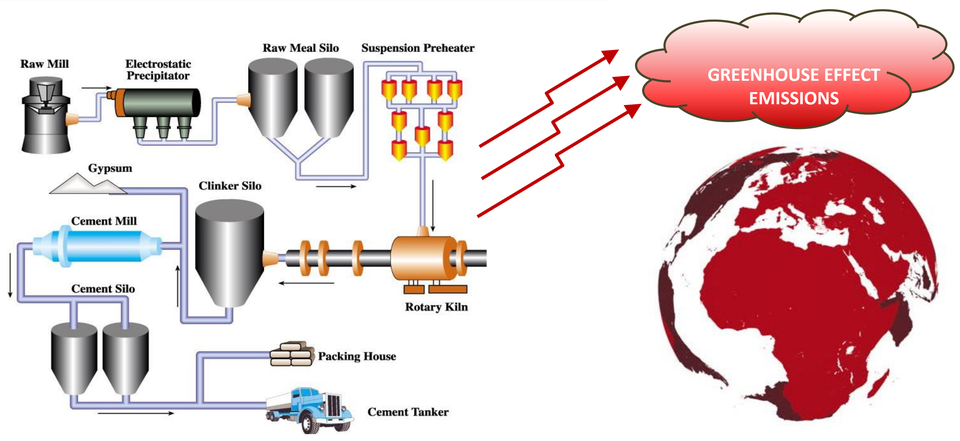
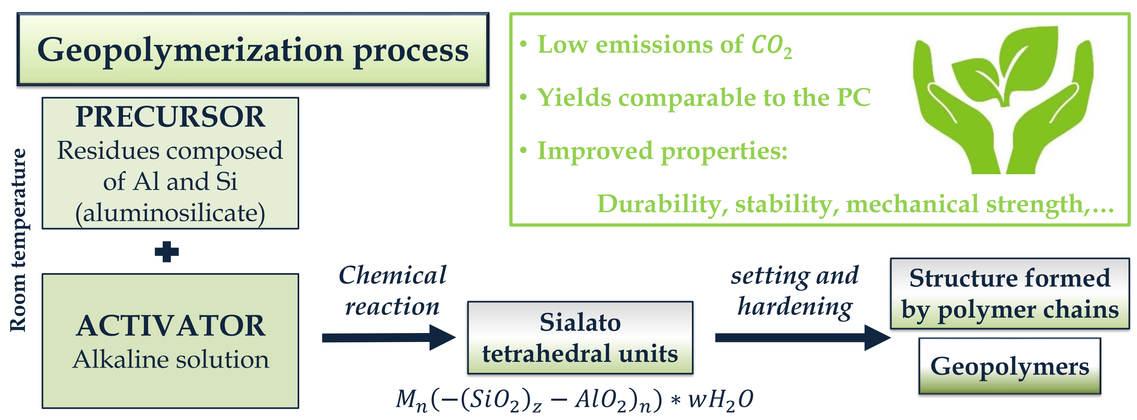
INTRODUCTION

Portland cement manufacture process



Geopolymerization process



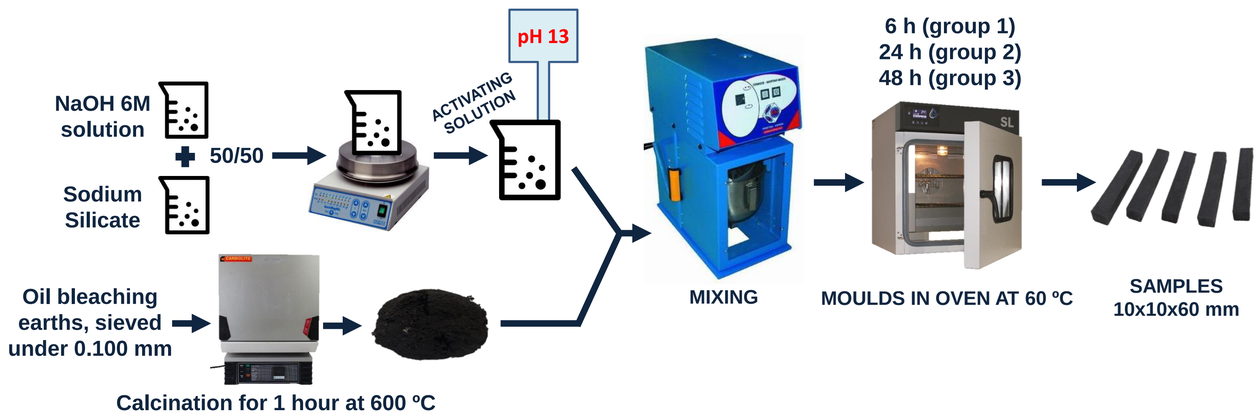
- Low emissions of CO_2
- Yields comparable to the PC
- Improved properties:

  Durability, stability, mechanical strength,...

OBJECTIVES

Oil bleaching earths at the end of their life cycle are important residues from the food industry produced in large quantities. The objective of this study is to find out if this waste could be considered as a proper source of aluminosilicate for the synthesis of geopolymers. Influence of the temperature of curing will be also studied.

SYNTHESIS OF GEOPOLYMERS

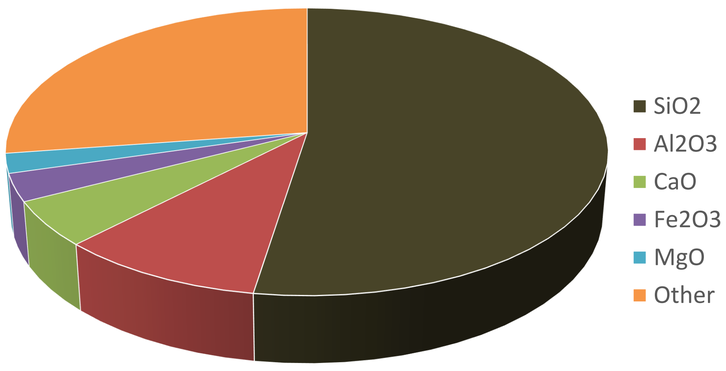


Alkali solution was prepared by mixing equal weights of caustic soda (6 M) and sodium silicate solution (29.2 wt % of SiO_2, 8.9 wt % of Na_2O and 61.9 wt % of H_2O). To carry out this study, three groups of representative samples of 10x10x60 mm were synthesized by adding the alkali solution to the previously conditioned material in a 1.4 relation. The mix was poured into moulds protected from evaporation by a plastic film cover. Samples were immediately put into oven at 60 ºC. Specimens were removed from the oven after a period of 6 h (group 1), 24 h (group 2) and 48 h (group 3). From that moment, samples remained at ambient temperature until age of tests. All samples were removed from the moulds at the age of 48 h.

RESULTS AND DISCUSSION

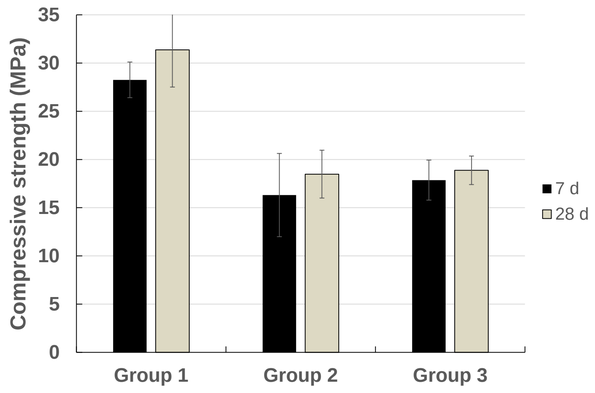
WASTE COMPOSITION

The waste, after calcination at 600 ºC, is composed of SiO_2 (52.5 wt %), Al_2O_3 (9.8 wt %), CaO 5.1 wt %), Fe_2O_3 (3.1 wt %) and MgO (2.2 wt %). It is presumable to consider this waste as a proper source of aluminosilicate for the synthesis of geopolymers.



COMPRESSIVE STRENGTH

Compressive strength was determined at 7 and 28 days. Best results were obtained for group 1 samples: 28.3 and 31.4 MPa at 7 and 28 days respectively. Groups 2 and 3 presented similar results of 16.3 and 18.5 MPa (group 2) and 17.9 and 18.9 MPa (group 3).



CONCLUSIONS

In view of the results of the tests performed, duration of the period of thermal treatment influences significantly on the compressive strength.

According to the results obtained, geopolymers from oil bleaching earths could be used as construction materials. All three groups had a compressive strength greater than the minimum required standard value (>10 MPa) for building materials used for structural purposes as bricks. In addition, group 1 samples even meet the requirement as structural concrete (> 20 MPa).

Recycling this residue to manufacture construction products seems to be possible which represents important environmental benefits to bring us closer to the circular economy.

ACKNOWLEDGMENTS

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