Effect of olive pomace fibre reinforcements on properties of alkali-activated cements based on blast furnace slag and biomass bottom ash

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Introduction

Cement industry

New materials research

Alkali-activated materials

Their manufacture

CO_2

Mechanical strength

Good results

Durability

Adding fibres

Improve mechanical properties

Types of fibres

Synthetic

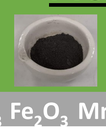
Natural

Wood fibres

Non-wood fibres

Manufacture of binders

Precursors



·Blast furnace slag
·Biomass bottom ash

XRF	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	SO_3	LOI
BBA	46.10	12.04	4.78	0.09	3.71	19.65	0.78	4.59	0.41	5.58
BSS	17.29	10.71	24.16	5.68	2.63	30.89	0.16	0.03	0.28	5.39

·Fibres

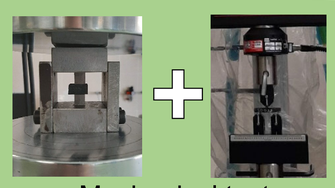
Activator

50% K_2SiO_3

+

50% KOH (8M)

Climatic chamber 20ºC-90%RH



Mechanical test at 1, 7, and 28 days

Fibre treatment

Si-0.5

% wt of fibres

UT	Untreatment
Si	10% Silicate
C	3% CaCl2
M	5% NaOH

Fibre treatments

Step 1

Prepare solution:
- 10% Silicate (Na_2SiO_3)
- 3% $CaCl_2$
- 5% NaOH

Step 2

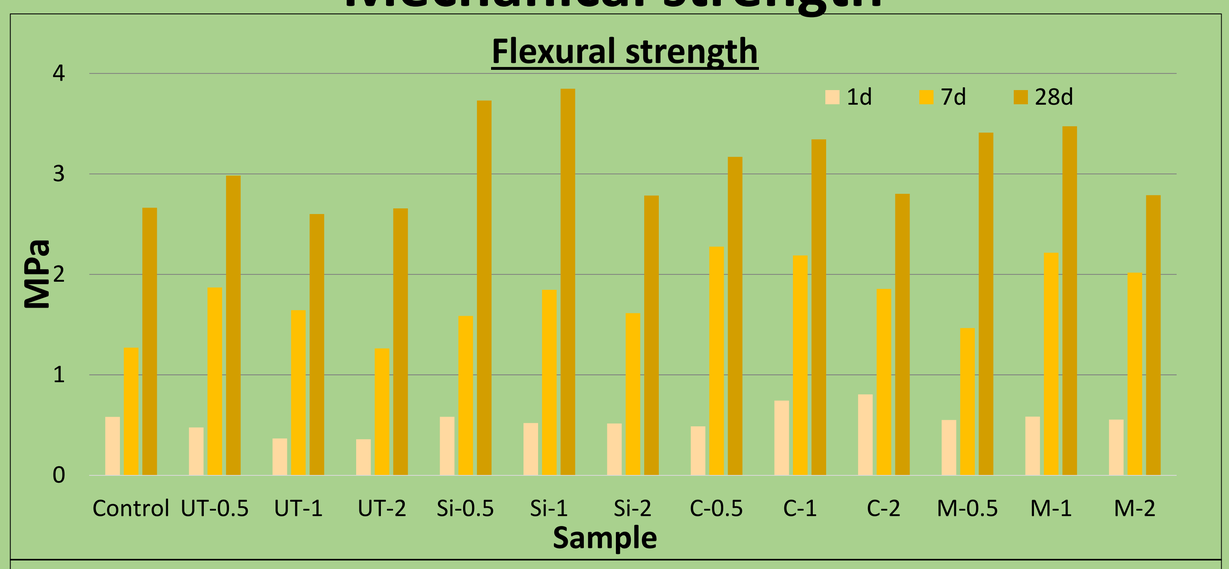
Inmerse fibres in solution:
- 60 min. stirring

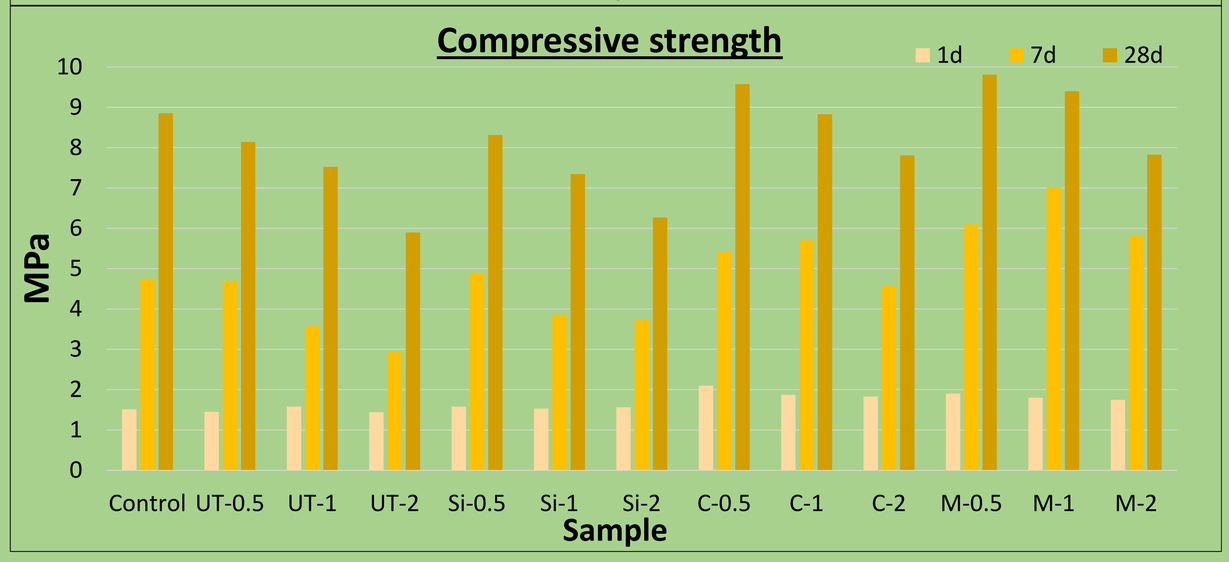
Step 3

Drain and dry fibres

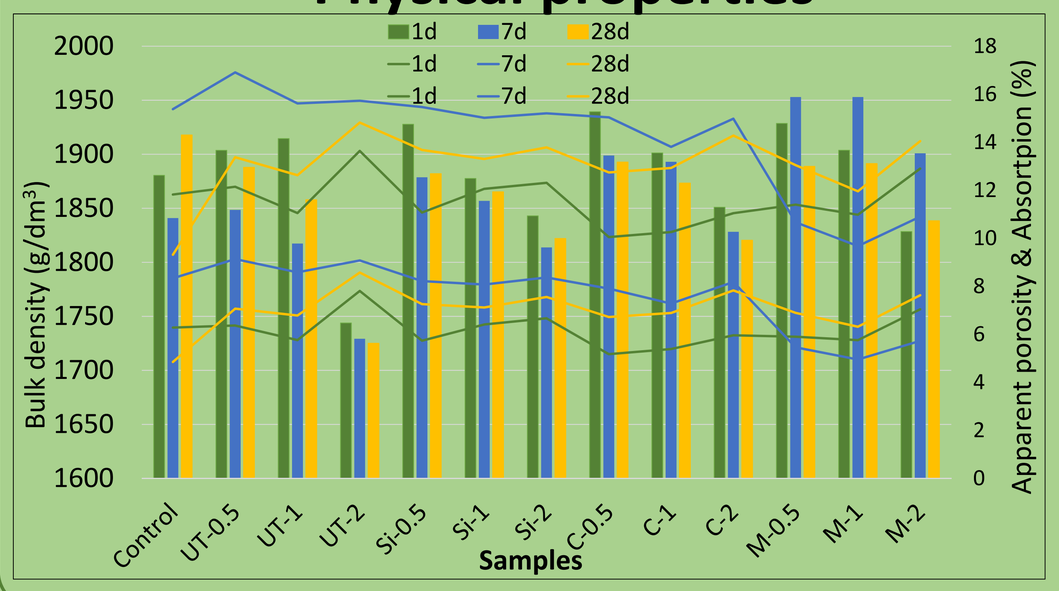
RESULTS

Mechanical strength

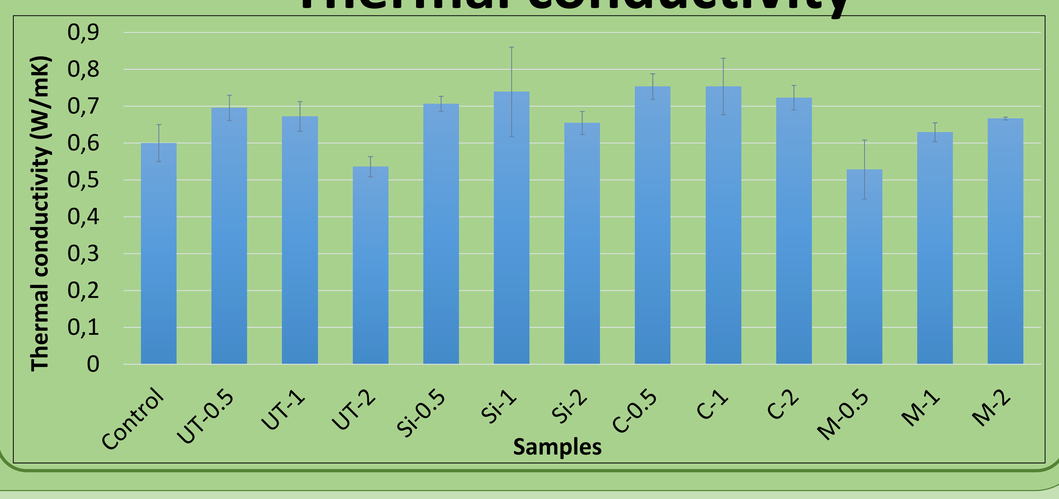




Physical properties



Thermal conductivity



Conclusions

- The optimal percentage for reinforcement was 1% wt, in terms of flexural strength.
- Best treatment for fibres were using a solution of 10% Na_2SiO_3 and a solution of 5% NaOH (mercerization). Improving values of control paste.
- Compressive strength decreased with the increased of fibres content. Although the decrease was consider it admissible.
- Thermal conductivity using fibres in the matrix of binders were similar to values of control paste.

Results indicate that fibres can be a reinforcement of binders manufactured from blast furnace slag and biomass bottom ash, when optimal treatment is used.

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