

Doughmi Khaoula 1*, Baba Khadija 1

Civil Engineering and Environment Laboratory (LGCE), Mohammadia Engineering School, Mohammed V University, Rabat, Morocco1

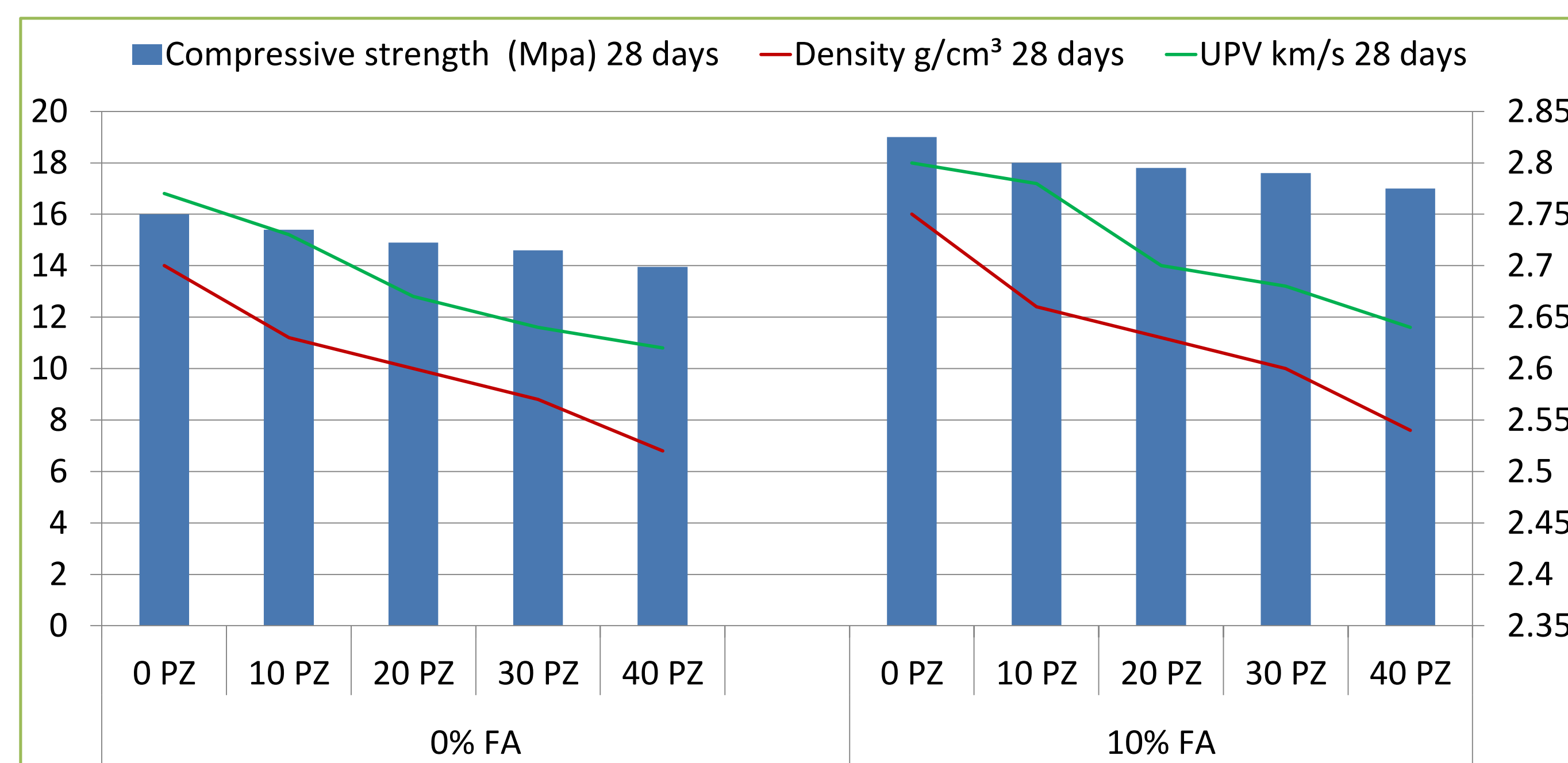
Introduction : Cement continues to be one of the most extensively used material, however, its production is responsible for approximately 6-8% of the world's CO₂ emissions. Developing ways to reduce the carbon footprint of materials without increasing their cost is quite challenging; hence, the number of studies trying to solve this problem is increasing to make the cement industry more sustainable.

In parallel, the thermal insulation of buildings has attracted a lot of interest as it has become evident that the greatest energy savings can be achieved by using proper thermal insulation for the building. Natural pozzolan (PZ) is an abundant volcanic area, not energy intensively extracted like cement and fly ash (FA) is an industrial byproduct of the combustion of pulverized coal in thermal power plants. Both have been used as a powder to substitute cement.

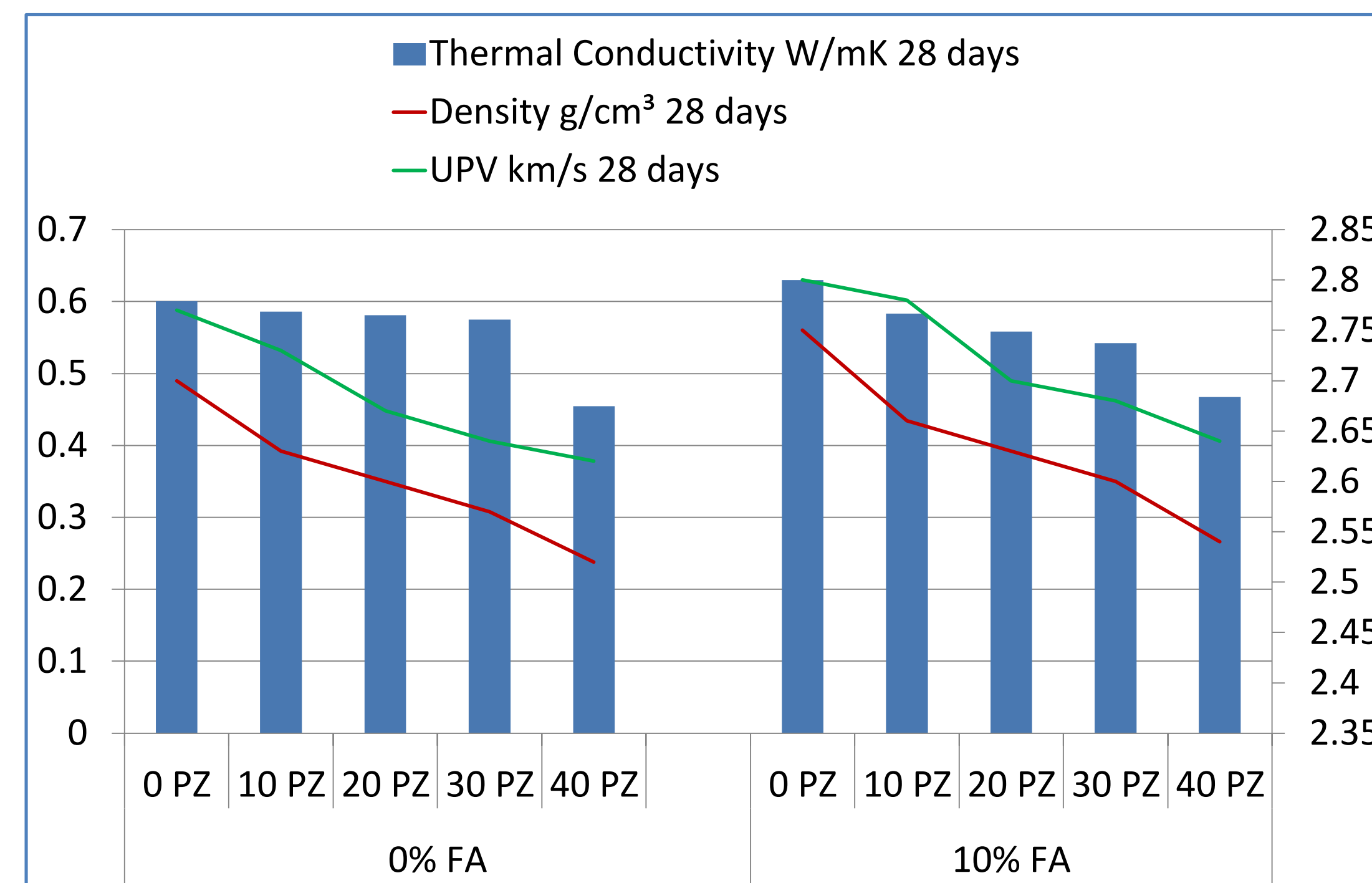
The main objectives of this research are reducing cement usage, valorizing wastes, and utilizing abandoned natural resources to reduce environmental pollution.

Materials and methods : Ten mixtures were synthesized, in accordance to NF EN 196-1, using different proportions of natural pozzolan (0-40%) and a constant fly ash amount (10%) as a partial replacement for cement. (40x40x160 mm) specimens were tested for compression performed at 28 days, following the NF EN 196-1, in a compression testing machine by loading the prismatic specimens with a force until rupture. (40x80x120 mm) samples were tested for thermal conductivity determined after 7 and 28 days with a TPS 1500 hot disc analyser according to ISO 22007-2.

Results and discussion :

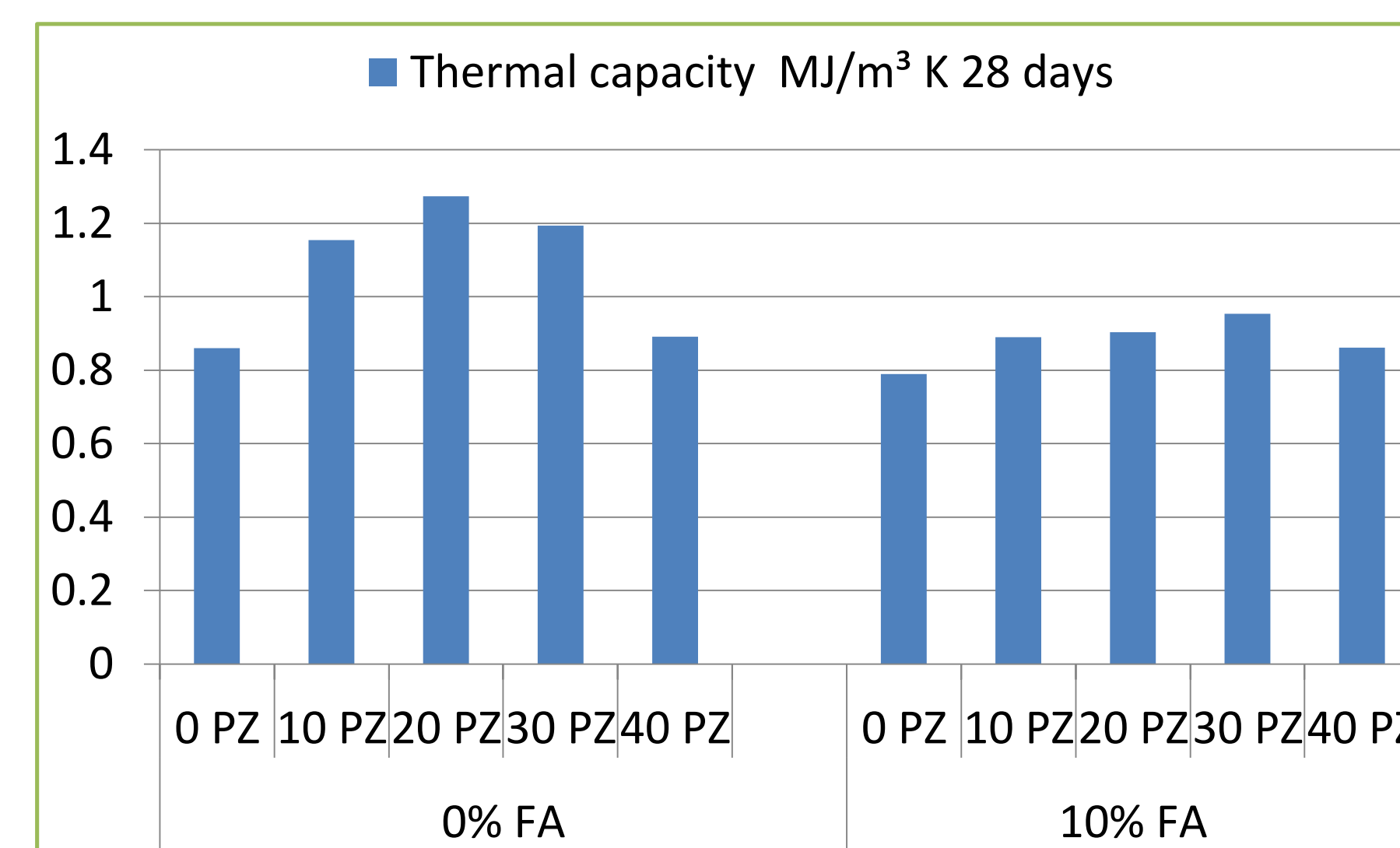


Correlation between density, UPV values and compressive strength at 28 days



Correlation between density, UPV values and thermal conductivity at 28 days

- As the natural pozzolan concentration increases, the thermal conductivity decreased. This reduction can be due to natural pozzolan's lower thermal conductivity compared to cement mortar's higher thermal conductivity .
- Thermal conductivity was correlated with density and UPV.



Thermal Capacity of mortars at 28 days

- The heat capacity of all mixture is higher than the control mix.
- The heat storage capacity of mortars containing cement mixed with PZ & FA are improved.

- As the pozzolan content increases in the mixtures, the cement will automatically decreases, consequently hydration products decrease (notably Ca(OH)₂), therefore a decrease amount of C-S-H will result.
- By adding FA, the compressive strength increase, this can be explain by the creation of CSH gel by the pozzolanic process, which integrates the pores and increases the strength.
- There is a link between compressive strength, density and UPV value explained by the close relationship between density and UPV values and the voids created by PZ and FA.

Conclusion : In certain proportions, natural pozzolan and fly ash can be used to create environmentally acceptable building materials and isolant. This strategy controls the uncontrolled disposal of fly ash waste and offers the possibility to use unused natural resources to produce more durable materials.