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MORTEROS DE RELLENO PARA RESTAURACIÓN DE PATRIMONIO CULTURAL, CON BASE CAL CON ADICIÓN PUZOLÁNICA Y DIVERSOS ADITIVOS

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Los morteros de relleno o inyección, especialmente destinados a reparación de cavidades y defectos de albañilería, deben fluir adecuadamente en estado fresco y combinar resistencia y durabilidad. Para conseguir algunas de estas características pueden utilizarse aditivos químicos: superplastificantes, para mejorar la fluidez; adiciones puzolánicas, para conseguir resistencias adecuadas en ambientes con limitado acceso de CO_2 y una mejora de la durabilidad; e hidrofugantes, de manera que, sin perjudicar la permeabilidad de estos materiales al vapor de agua, se evite la penetración de agua por capilaridad mejorando la durabilidad.

Sin embargo, en la mayor parte de los casos, toda la información disponible se circunscribe al efecto de un único aditivo, sin contemplar el posible efecto conjunto o incluso sinérgico de las combinaciones más interesantes de dos o más aditivos y/o adiciones puzolánicas. El estudio de las sinergias entre estos componentes ofrece posibilidades muy interesantes de avance científico-técnico. Precisamente este es el objetivo del trabajo: diseño de nuevos morteros de inyección de cal que puedan ser utilizados para la restauración del Patrimonio Edificado mediante combinación adecuada de aditivos superplastificantes (éteres de policarboxilato, condensados de naftaleno-formaldehído, sulfonato de melamina y ácido poliacrílico), hidrofugante (oleato sódico) y adiciones minerales puzolánicas (microsílice y metacaolín).

Grouts for restoration of cultural heritage with lime base, pozzolanic addition and various additives

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INTRODUCTION

Grouts or injection mortars, especially destined to repair cavities and masonry defects, must flow properly in a fresh state and combine strength and durability [1-4]. However, in most cases, all available information is limited to the effect of a single additive, without considering the possible synergistic effects of the most interesting combinations of two or more additives and/or pozzolanic additions [3,4]. Only recently has published some work that raises the combination of a pozzolanic addition with some superplasticizer additives, with very good and encouraging results. The simultaneous combinations of two or more additives and/or additions in lime mortars have not been previously investigated by the scientific community and the study of these synergies offers very interesting possibilities of scientific-technical advance.

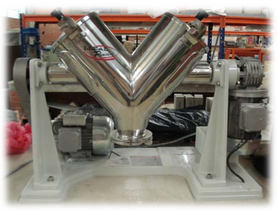
OBJECTIVE

The objective of this work is to determine the behavior and compatibility in lime mortars of various combinations of additives and pozzolanic mineral additions, in order to optimize the mixtures and thus obtain new mortars that serve for the restoration of the Architectural Heritage.

MATERIAL AND METHODS

The proportions of lime mortars were: 25% slacked and bagged lime, In Addition, when necessary, the following components were added with respect to lime 20% mineral pozzolanic additive (Metakaolin or Microsilica), 0.5% hydrofugal (sodium oleate, provided by ADI-CENTER) and two superplasticizer doses 0.5% and 1% PCE1, BASF's Melflux commercial product; melamine sulfonate, BASF's Melment F10; polynaphthalene sulfonate, marketed as Conplast SP340 Fa of FOSROC International and polyacrylic acid, of Sigma-Aldrich.

MIX



CURING

FRESH ASSAYS

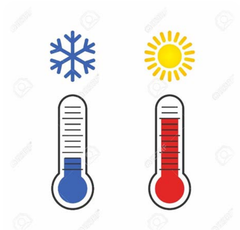
DENSITY

FLUIDITY

SETTING TIME

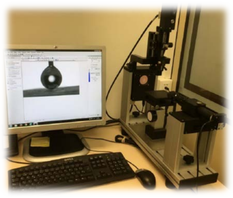
HARD ASSAYS

COMPRESSIVE STRENGTH



FREEZING-THAWING

MIP



CONTACT ANGLE

DATA ANALYSIS AND CONCLUSIONS

RESULTS

FRESH ASSAYS

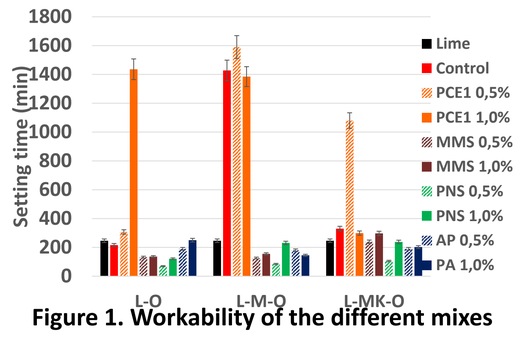


Figure 1. Workability of the different mixes

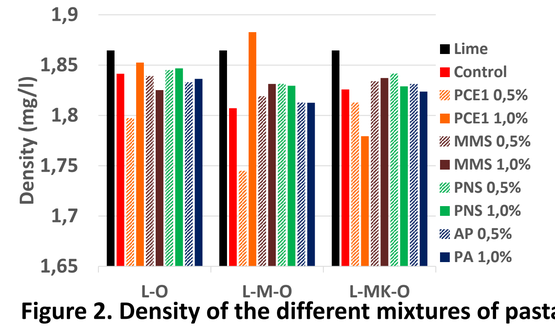


Figure 2. Density of the different mixtures of pasta

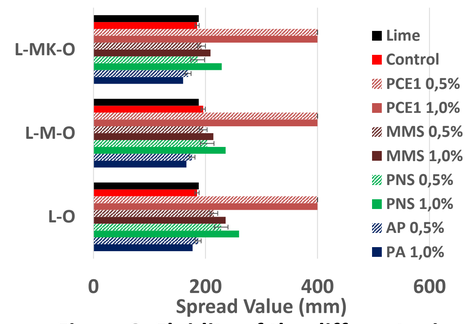


Figure 3. Fluidity of the different mixes

HARD ASSAYS

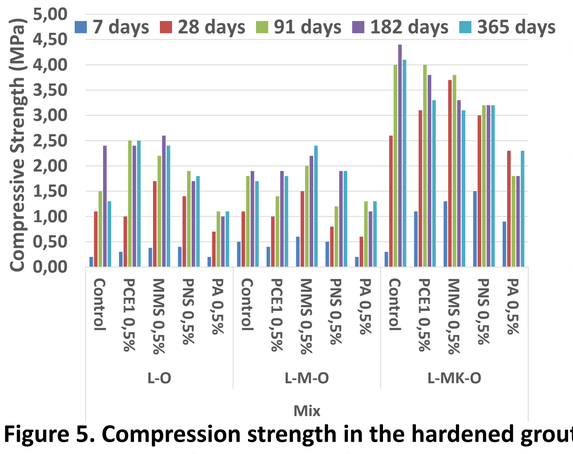


Figure 5. Compression strength in the hardened grouts with 0.5% Superplasticizer

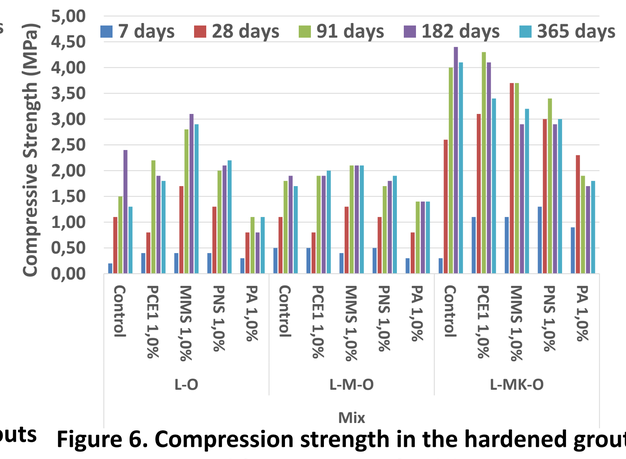


Figure 6. Compression strength in the hardened grouts with 1,0% Superplasticizer

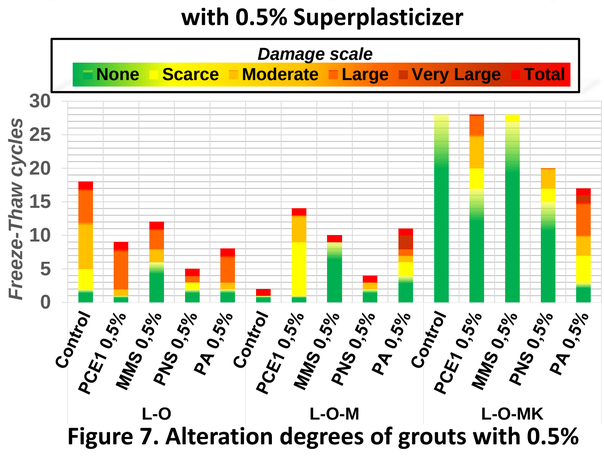


Figure 7. Alteration degrees of grouts with 0.5% Superplasticizer after freeze-thaw cycles.

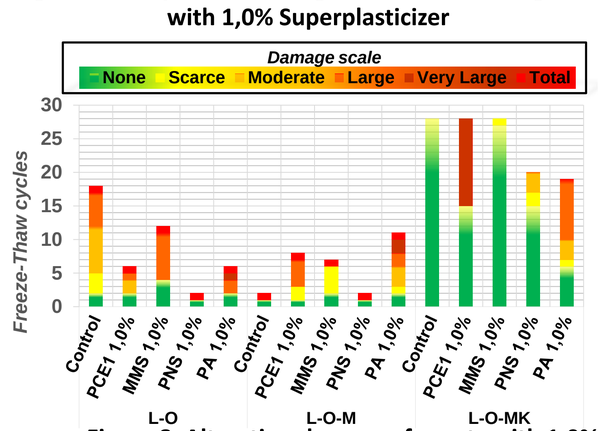


Figure 8. Alteration degrees of grouts with 1,0% Superplasticizer after freeze-thaw cycles.

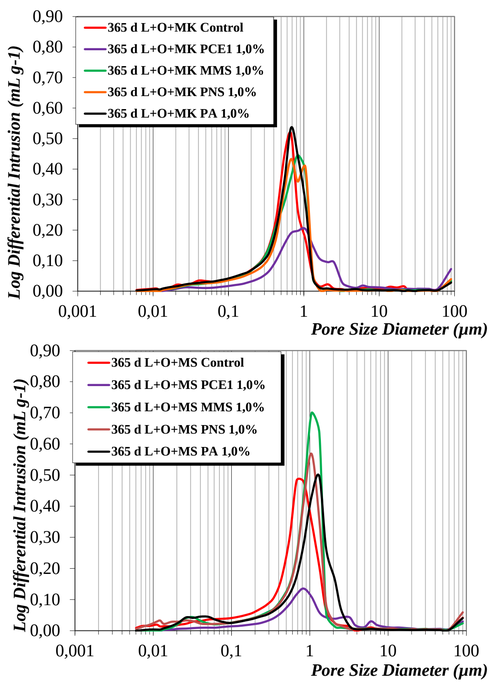


Figure 9. Pore size distributions of different pasta samples after 365 days of curing.

Table 1: Contact angle Measurement Results

GROUT	CONTACT ANGLE	Complete absorption of the water drop and disappearance in a short time interval
L-O	75.0	No
L-M-O	59.2	No
L-MK-O	28.8	Yes
L-O-PCE1	66.8	No
L-O-MMS	53.5	No
L-O-PNS	29.4	Yes
L-O-PA	58.2	No
L-M-O-PCE1	95.1	No
L-M-O-MMS	30.2	Yes
L-M-OPNS	29.6	Yes
L-M-O-AP	13.7	Yes
L-MK-O-PCE1	123.6	No
L-MK-O-MMS	30.4	Yes
L-MK-O-PNS	40.1	Yes
L-MK-O-AP	11.9	Yes

ACKNOWLEDGMENTS

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CONCLUSION

1. Through this study with a scientific and a technical point of view was able to determine the behavior and the compatibility existing in lime mortars with various combinations of additives and mineral additions.
2. The results are favorable if want to use some of these mixtures in the restoration of Architectural Heritage, resulting as the best grout the combination of lime-oleato-metacaolín-PCE1 that improves the properties of an ordinary lime mortar for this use.

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