Cement mortars manufactured with insulating material residues to reduce the use of sand in the construction industry

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REDUCE THE USE OF SAND

CONTEXTUALIZATION:

Currently the construction of buildings is one of the main pollution-generating activities in the European Union, so it is essential that the sector orients itself and evolves towards a circular economy model based on reuse, repair and recycling construction and demolition waste (CDW), and to use them as by-products, being able convert them in a highly viable option, as opposed to the current situation of landfilling (Figure 1).

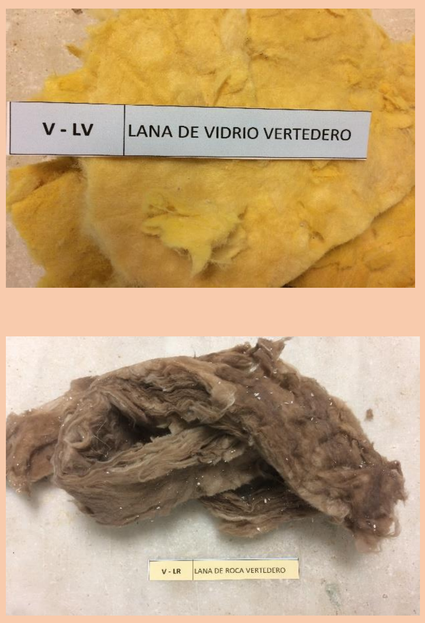


Fig.1 Residues stored in the Complex Treatment of Construction and Demolition Waste located in El Molar, Madrid, Spain.

RECYCLING MINERAL WOOL

The use of insulating materials is currently booming due to the increase of thermal and acoustic requirements marked by regulations about the construction of homes, which seek to contribute to energy savings and improve thermal comfort. This has caused an alarming growth of mineral wool waste as is the most used insulation in the European Union, so it is essential to recycle or reuse it is nonexistent today.

In addition, this waste will replace part of the aggregate of the mortar, a fundamental issue if we take into account that the extraction of sand worldwide has skyrocketed in the last 30 years, being the most demanded natural resource in the world after water, especially by the construction sector, that demands about 85% of sand This will also reduce the CWD generated by the construction industry.
In Spain the consumption of aggregates for construction has grown by 10.5% in 2017, up to 12 million tons, likewise the aggregates quarries produced 40.8 million tons of industrial aggregates for, among other uses, the manufacture of binders.

I.OBJETIVE

The approach to the study of this waste incorporated in a cement mortar matrix is considered a commitment to sustainable construction, which also prioritizes its reuse as 2008/98 / CE. opposed to its elimination as indicated in the current Waste Framework Directive

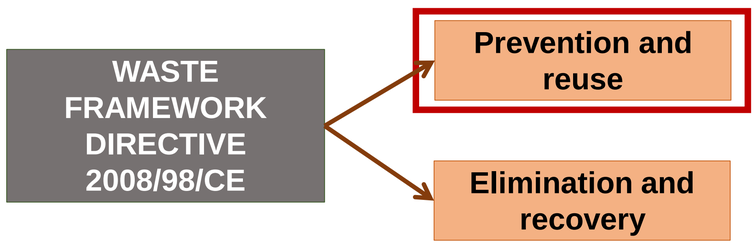
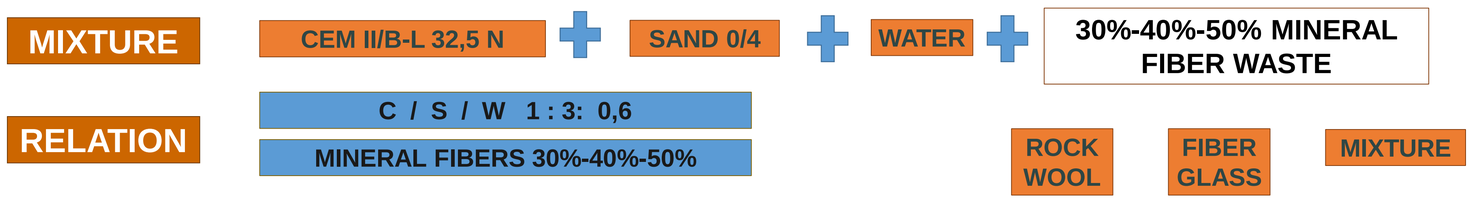


Fig. 2 Machine used for flexural and compressive strength tests.

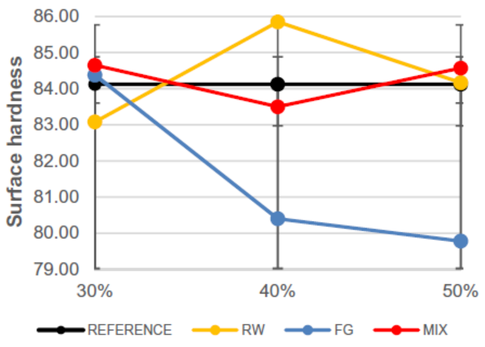


The Shore D surface hardness, flexural and compressive strength of the compound tests were carried out with additions of 30%, 40% and up to 50% of fiber waste.
Shore D surface hardness (UNE-EN 102042): a meter measuring the Shore D surface hardness was used on the two lateral longitudinal sides of the test pieces.
Flexural and compressive strength (UNE-EN 1015-11): the Autotest 200 work unit from Ibertest was used (Figure 2), and a load was applied at progressive and constant speed until the break, and the obtained value was recorded.

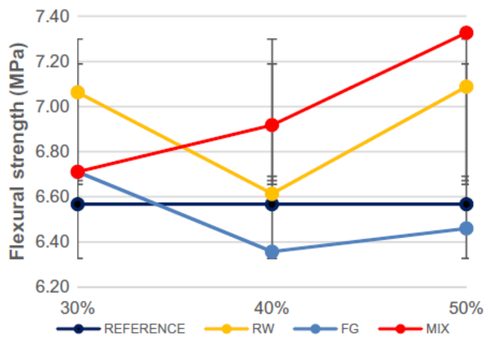
II. TESTS PERFORMED

III. RESULTS

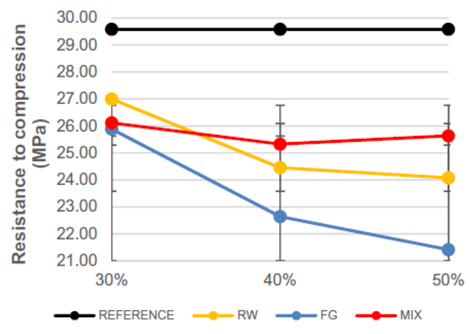
The addition of rock wool waste highly increase cement matrix hardness with the percentage of addition of 40% compared to 30%, again decreasing when 50% of addition is reached.



From the results obtained in the test it is observed that the flexural strength in general increases significantly by adding mineral fibre waste to the matrix, except for compounds with 40% and 50% glass fiber.



The values obtained in the test of resistance to compression are lower than the reference, but in all of the percentages exceeds by more than 13 MPa the established by standard UNE-EN 998-1 ‘‘Specifications of mortars for masonry”.



IV. CONCLUSIONS

The results of the tests performed show that even though the mechanical resistance decreases there is a good connection between the cementitious matrix and the residues, while also maintaining optimal durability properties, making it a sustainable and innovative alternative to the commercial fibers currently used by the company reinforcement of mortars.