CERIS Civil Engineering Research and Innovation for Sustainability

# Improving cracking performance of mortars with selected recycled fibres for non-structural uses

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## Summary

Cracking is considered one of the most common anomalies in rendering mortars, which implies a sudden reduction of the render's durability. The constituents, the mix design and the application conditions of the renders influence their behaviour in terms of cracking susceptibility. The tendency to crack is difficult to evaluate and avoid due to the several influencing factors. Generally, cracking resistance is the ability of the mortar to withstand the tensile stresses induced by restrained shrinkage or other causes. The deformations imposed on the cementitious composites are one of the main causes of cracking.

As the susceptibility of rendering to cracking is directly related to the deformability of the mortar, the incorporation of fibres can improve the performance of the coatings, since it increases their energy absorption and deformation capacity. Besides increasing the render's durability, in order to promote environmental gains, recycled fibres have been incorporated in rendering mortars. The addition of recycled fibres can ensure a lower consumption of natural resources and provide a proper disposal for the waste.

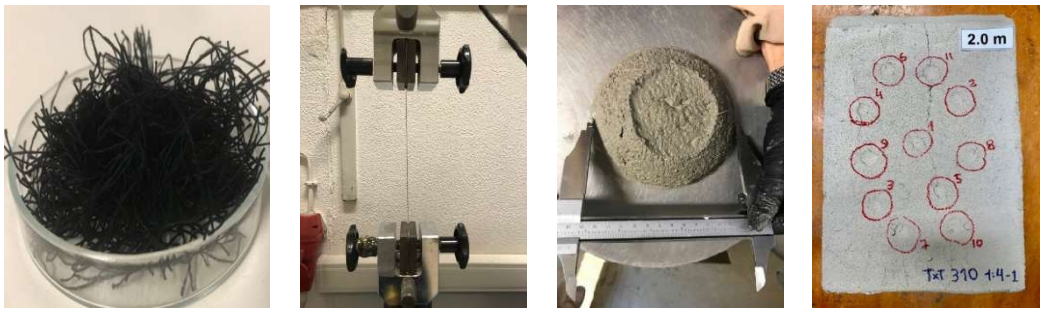
In this sense, the present study intends to contribute to the characterisation of mortars with different types of waste fibres, by identifying those that show better performance regarding cracking susceptibility, resistance to impact and durability, while maintaining adequate values of mechanical strength and water absorption. Seven waste fibres were selected, three natural fibres: wool fibres, coir fibres and flax fibres; and four synthetic fibres: textile fibres, acrylic fibres, plastic fibres and nylon fibres.

The technical and environmental performance was evaluated, in terms of fresh-state, mechanical, water behaviour and environmental impacts of each mortar composition. Furthermore, four waste fibres were selected for a deeper understanding of the mechanisms of susceptibility to cracking, impact resistance and durability. To reach this purpose, a methodology to evaluate the restrained shrinkage of the mortars was used based on the stresses induced and the interface with the substrate. The pattern of cracking was also evaluated through an impact test. An artificial accelerated ageing test was performed to analyse the mortars' durability.

With the results obtained in this thesis, it was possible to conclude that the waste fibres addition in rendering mortars contributed to improvements in terms of technical and environmental performance of the renders. Simultaneously, this solution provides a proper disposal of these wastes and avoids the use of raw materials for production of virgin fibres.

## Keywords

Rendering mortar, recycled fibres, cracking susceptibility, durability, sustainability.




*Recycled fibres waste incorporated in rendering mortars.*