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# Influence of wet and drying cycles on behaviour of cement composites reinforced cellulose pulps

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**Abstract** – This work focuses on the durability study of cellulose-cement reinforced composites, where fibrecements reinforced by short and long cellulosic pulp fibres were submitted to up to 40 wet and drying cycles in which a maximum 50°C is applied together with forced air flow. Two different mineral admixtures such as carbonate filler and silica fume (SF) as partial Portland cement substitute were employed. Besides the physical and mechanical parameters established for the composites during the cycles, it was also investigated how the cycles affected the drying shrinkage and the absorption-desorption curves of the composites.

In spite of the full scale production of cellulosic-pulp reinforcing cement sheets for more than 30 years, questions regarding the durability aspects of this material are still not fully answered. The main deterioration mechanisms as well as some approaches for improvements in composites' durability have being reported during the last decades leading to a fundamental knowledge on the influence of weathering on the structure and properties of these materials. In this context, different proposals for accelerated ageing tests have being applied for durability studies, but still without a consensus on the correct setup of these tests [1].

This work focuses on the durability study of cellulose-cement reinforced composites, where fibrecements reinforced by short and long fibres and mineral admixtures such as carbonate filler and silica fume (SF) as partial Portland cement substitute were employed. Three composites formulations were studied, where two of them used long fibres as reinforcement. Silica fume was incorporated in one of the long fibre formulation with 5% in mass as cement substitute. The composites were produced using the vacuum-dewatering and compaction based on modified Hatschek process and submitted to up to 40 accelerated wet and drying weathering cycles. In the drying cycle it was employed a 50ºC temperature in an oven with forced air flow circulation. In the saturation cycle the composites specimens were submerged in the same temperature water. The effects of the cycles were evaluated based on the results of mechanical, physical parameters and on the interfacial adhesion strength model. Also, the influence of the cycles on the drying shrinkage and on the composites' water absorption-desorption were evaluated.

The results showed that, in a general manner, the long fibre composites had a similar behaviour as the short fibre's in the mechanical parameters evaluated through the accelerated weathering cycles. In all of composites' formulations it was observed a increasing in the stiffness, probably due to the matrix carbonation. The SF addition minimized a little the effects of the cycles, postponing the fibres degradation. The composites with SF were the only ones to present a decreasing in water absorption and apparent porosity after 40 accelerated cycles. The water absorption-desorption tests provided some backgrounds to improve the knowledge of the degradation mechanisms based on the composites' physical parameters, where the main strategies to improve durability are related to the composites' porous net refinement. It could be concluded that a matrix pore refinement have happened, due to the more difficult water transportation through the material during the wetting-drying accelerated weathering cycles. The results presented by the drying shrinkage tests provided important data to support future researches about drying shrinkage in cellulose-cement composites, especially considering correlation between the accelerated cycles with natural weathering.

## References

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