The combined effect of bottom ashes and cellulose fibers on fired clay bricks

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Abstract
The paper and pulp industry (PPI) is permanently searching for new ways of managing its residues due to the increasing pressure of new environmental concerns and policies adopted worldwide. In addition, the manufacturing of construction materials such as fired clay bricks (FCBs) is also facing the transformation of its traditional market, which is asking for new materials with a lower environmental footprint but equal or even better technological properties. In considering the large mass flows related to both the PPI and FCB industries, several researchers have pointed out the feasibility of replacing clay by residues produced by PPI. However, these approaches have always considered the replacement of a single residue rather than the addition of several new ones. Conversely, by using both residues at once, the overall FCB performance is improved and the feasibility of this circular economy approach is eased. For instance, the addition of woody fibres increases thermal resistance but reduces mechanical strength. Conversely, the addition of ashes produced by PPI improved the mechanical strength by reducing the thermal resistance due to the increasing content of fluxing agents which improve the fired clay matrix structure. For this reason, this paper explores the technological properties achieved by replacing clay with both ashes and fibres provided by PPI in an integrated approach. By following industrial procedures, the so made fired clay bricks (with 20% of ash and 5% of fibres) meet the standard and show approx. 20% less thermal conductivity, with the same thermal capacity and a density reduction of more than 15%.

Author keywords
Ash; Brick; Cellulose; Circular economy; Paper