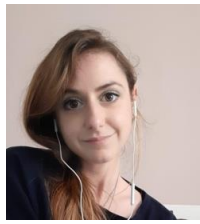

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Novel sustainable polymer-based Phase Change Materials (PCMs) for mortars based on different binders for the energy efficiency located in different climatic regions

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The buildings sector is one of the main contributors to the use and consumption of fossil fuel energy and, consequently, to the CO_2 emissions. This evidence is more widespread in industrialized countries where energy is used for heating and cooling purposes. This trend is not destined to change since climate change affects temperatures making them hotter in summer and colder in winter. A solution to this issue is represented by Phase Change Materials (PCMs) that can absorb, store and release energy according to their physical state that changes with the environmental temperature. In this work, a novel eco-sustainable PCM has been developed through the form-stable method. Through this method, it was possible to create a composite material consisting of a natural matrix (i.e., a very porous stone obtained from processing waste) and an eco-friendly polymer-based PCM, i.e., Poly-Ethylene Glycol (PEG). This composite material has been used to replace mortar aggregates. A complete characterization was performed on the new PCM assessing its thermal stability and thermal efficiency. Mortar formulations based on different binders (i.e., hydraulic lime, and cement) were, then, produced including the composite material as aggregate. The study of the mortar's properties, in their fresh and hardened states, allowed to identify those with suitable mechanical properties. These latter were then subjected to a further investigation to assess their thermal behavior in response to different climatic loads. Encouraging results were achieved that allowed to establish the effectiveness of the novel PCM in thermo-regulating an indoor environment.

Keywords: Phase Change Material (PCM); Poly-Ethylene Glycol (PEG); Mortars; Circular Economy (CE); Energy efficiency.