Use of Alternative Waste Materials for a Sustainable Economy in the Construction Sector

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Abstract

Recycling industrial waste offers a valuable and sustainable solution to reduce the consumption of non-renewable raw materials in the cement industry. Within the CIRCOMP Project funded by the Italian Ministry of the Environment and Energy Security for the development of technologies for the prevention, recovery, recycling and treatment of waste, this study shows the results of the analysis of the properties of building materials containing industrial by-products consisting of an inorganic siliceous matrix and an organic acrylic binder currently not served by an adequate management chain and therefore destined for disposal. From an environmental perspective carried out through LCA analysis, the introduction of composite material into aggregate and fibers and its use in concrete showed a reduction of approximately three percentage points in the Climate Change category. The mechanical testing showed that replacing 20% of natural aggregates (by volume) with recycled ones caused a slight reduction in compressive strength whereas fracture energy increases by more than 30%. These results, together with the reduction in density, make this sustainable concrete not only suitable for the most common on-site applications but also particularly suitable for special purposes, such as in seismic-resistant building systems. We are currently evaluating how the technological process fits in with current legislation, and the required authorization procedures.