From Industrial Residue to Supplementary Cementitious Material: Reactivity and Performance of Lignocellulosic Packaging By-Products

This master's thesis investigates the valorization of by-products from lignocellulosic packaging production as supplementary cementitious materials (SCMs) for the partial replacement of fossil-based fly ash. The study combines mineralogical, chemical, and environmental characterization techniques—such as X-ray diffraction (XRD) and X-ray fluorescence (XRF)—with reactivity assessment under alkaline and hydraulic conditions, including the R3 test and activity index measurements. Based on these analyses, functional blended cements and binder systems for non-structural applications should be developed.
The research aims to establish correlations between phase assemblage, amorphous content, and intrinsic reactivity in hydraulic environments, as well as to evaluate the effect of simple pretreatment routes, particularly mechanical activation, on SCM performance. The resulting binder systems are assessed with respect to relevant fresh-state properties (e.g., workability and setting behavior) and hardened-state properties (e.g., compressive strength development, water absorption, porosity, volume stability and shrinkage). In addition, microstructural characteristics and fundamental durability-related properties, including leaching behavior (on selected binders), are investigated to evaluate the long-term performance of the developed binders.

The specific objectives are as follows:

1. Mineralogical and chemical characterization and reactivity assessment of by-products
2. Evaluation of the properties and suitability of Mondi byproducts for functional blended binder formulations for non-structural building applications (mortars, floor screeds, ...)
3. Characterization of relevant binder properties in the fresh and hardened state.

Industrial partner:	Mondi AG, Marxergasse 4A, 1030 Vienna (www.mondigroup.com)
Research partner:	Graz University of Technology, Institute of Technology and Testing of Construction Materials & Institute of Applied Geosciences
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