Mechanical-thermochemical process combination for the recycling of fine fractions from waste treatment plants – A journey into waste mineralogy

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Austria produces approximately 1.5 million tons of municipal solid waste annually. Additionally, about 500,000 tons of slags and ashes from thermal waste treatment plants are generated. There are an estimated 1.9 million tons of fine fractions, which includes one million tons of rubble from construction waste, per year, most of which are landfilled (BMK, 2021).

These fine fractions often contain high amounts of metal and mineral contents, however, they may also include pollutants (Viczek et al. 2021b, Vollprecht et al. 2020). This poses a challenge for recycling, as it is essential to avoid keeping mobile pollutants in the material cycle. Recycling fine fractions can immobilize contaminants, like heavy metals, in stable phases (Sarmiento et al. 2019).

The "MeteoR" project aims to close material cycles by reintegrating these fine fractions as resources and therefore to further develop the circular economy, reduce CO_2 emissions and increase the recycling quota in Austria. The following objectives are pursued:

1. Mineralogical and chemical characterization of fine fractions and mechanical processing.
2. Testing of different thermochemical treatment methods.
3. Investigation of the mineralogy and leachability of the slags resulting from the thermochemical treatment.
4. Removal/immobilization of contaminants in the fine fractions.
5. Life cycle assessment (LCA) of recycling routes and systemic evaluation of waste management.

An interdisciplinary consortium of universities and industrial partners (see Fig. 2) is dedicated to achieving the project's goals.

The first steps will be sampling selected waste streams, chemical and mineralogical analysis. The mineralogical analysis will consist of, but is not limited to, powder X-ray diffraction, X-ray fluorescence and electron probe microanalysis. Mechanical processing is then used to produce concentrates that are analyzed similarly to the sampled waste. These concentrates are then tested by the project partners for suitability for the various recycling routes. The project plan and the resulting dependencies are shown in Fig. 1

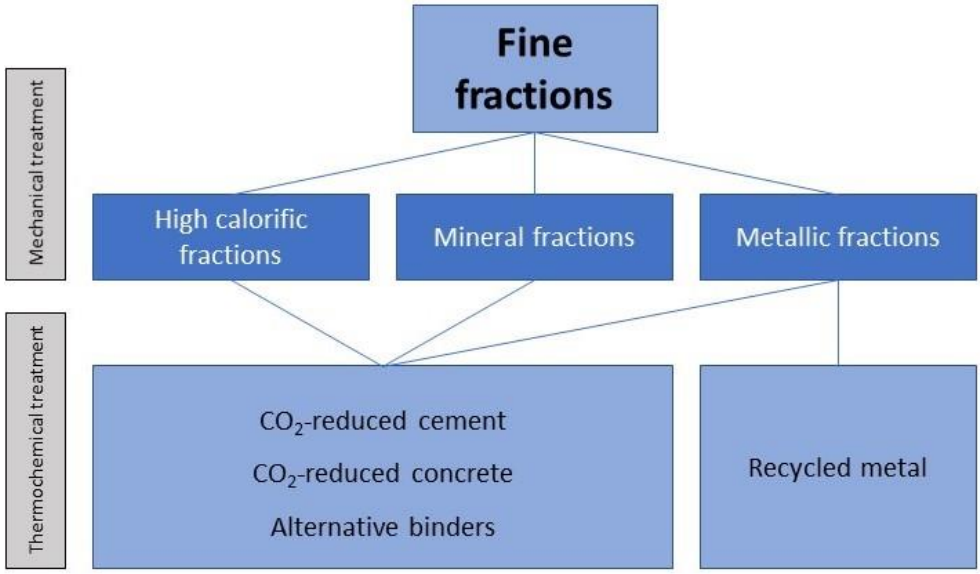

Figure 1. Scheme of the MeteoR project

By achieving the project goals, unused waste fractions containing raw materials can be utilized. Applying waste mineralogy methods, the mineral fractions can be characterized and optimized for reuse. The project enables more efficient use of resources and reintegrating waste into production chains and recycling cycles. This project is funded by the Austrian Research Promotion Agency (FFG, www.ffg.at), grant number 889863.

Figure 2. Logos of the consortium partners, funding agency and ministry of climate action, environment, energy, mobility innovation and technology in random order

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