

Cement as a climate killer: Using industrial waste to produce carbon neutral alternatives

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A pozzolan quarry in Guatemala where large quantities of volcanic ash are added to cements in order to reduce CO₂ emissions. Credit: Herbert Pöllmann/MLU

Producing cement takes a heavy toll on our climate: Around eight per cent of annual global carbon dioxide emissions can be attributed to this process. However, the demand for cement continues to rise. A team of geoscientists from Martin Luther University Halle-Wittenberg (MLU) has found a way to produce more environmentally friendly and sustainable alternatives. In the journal *Construction and Building Materials* they describe how industrial residues can be used to produce high-quality, climate-friendly materials.

The basic raw material for [cement](#) is limestone, which is converted to cement clinker in large furnaces. The environmental impact of this process is disastrous: "Around one tonne of carbon dioxide is released during cement production for every tonne of limestone. The majority of this is emitted by the limestone itself," says Professor Herbert Pöllmann, a geoscientist at MLU. Replacing the limestone in cement production would result in an enormous savings potential, adds the researcher. However, the material produced would need to have the same beneficial properties as traditional cement.

In their search for alternative raw materials, the researchers from Halle came across two types of industrial waste: Residual materials from the production of kaolin and aluminium. "I don't really like the term [industrial waste](#). It is actually industrial residues that can still be used very effectively, for example to produce alternative forms of cement," says Pöllmann. For the new study, his team tested different mixing ratios and analysed the physical properties of the newly produced cements. The study showed that the two industrial residues can be used to produce cements that have the same properties as conventional mixtures.



A pozzolan quarry in Guatemala. Credit: Herbert Pöllmann/MLU



Raw materials for the production of eco-friendly cement. Credit: Sabrina Galluccio/MLU

The advantage of the two residual materials that the mineralogists at MLU investigated is that they contain no carbon dioxide which could be released during further processing. "And you can use them to produce large quantities of cement that has great properties," explains Pöllmann. In the new study, he and his team also describe in detail the mixing ratios and production steps of the more environmentally friendly cements. According to the researcher, producers could either switch completely to the more climate-friendly [materials](#) or produce cement mixtures that use a lower ratio of [limestone](#) and are therefore also more climate-friendly.

However, the process does have its limits: "There aren't enough

industrial residues to cover the global demand for cement," says Pöllmann. Therefore, his team is also looking for suitable natural products such as [volcanic ash](#) or various mineral resources that have not yet been used industrially and that do not release carbon dioxide as well, for example various types of clay.

More information: Sabrina Galluccio et al, Maximization of the reuse of industrial residues for the production of eco-friendly CSA-belite clinker, *Construction and Building Materials* (2019). [DOI: 10.1016/j.conbuildmat.2019.02.148](#)

Provided by Martin-Luther-Universität Halle-Wittenberg

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