Researchers find use of olivine in cement production could result in carbon negative concrete

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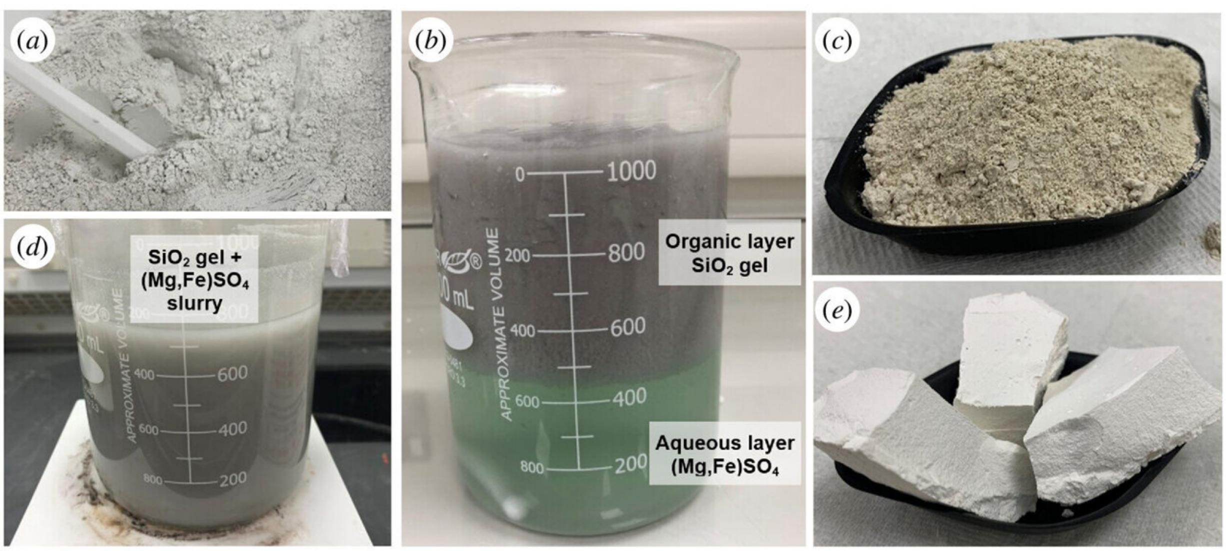

Photographs showing (a) raw as-received olivine, (d) dissolution of the olivine using H2SO4, (b) separation of silica gel from magnesium/iron sulfate using IPA, (c) APS and (e) HMC nesquehonite. Credit: *Royal Society Open Science* (2024). DOI: 10.1098/rsos.231645

A small team of materials scientists and environmental engineers at

Imperial College London has found that using olivine in cement could result in carbon-negative concrete. In their study, published in the journal *Royal Society Open Science*, the group conducted experiments with cement mixing that resulted in a way to produce it in a more climate-friendly manner.

Prior research has shown that cement-making is one of the major contributors to the release of CO_2, and it happens in two ways. The first is when fossil fuels are used to heat products used in the mix (clay, water and calcined lime) when creating cement. The second is when limestone is heated to produce clinker, a cement binder. In this new study, the research team found a replacement for clinker that does not result in CO_2 emissions.

The researchers found that adding products from olivine to cement mix instead of the clinker resulted in a cement that was not only more Earth-friendly, but also stronger and more durable. They note that olivine is an abundant mineral that contains silica and magnesium sulfate, which can be extracted and which also reacts with CO_2, resulting in sequestration.

In their work, the research team extracted silica and magnesium sulfate from olivine samples by dissolving them in sulfuric acid. They then bubbled CO_2 through a batch of the slurry that resulted, which in turn led to the formation of a mineral called nesquehonite during cooling and resulted in sequestration of the CO_2. The nesquehonite was then added to the cement mixture, along with some amount of clinker.

The researchers note that if the process were scaled up, the CO_2 used in the process could be pulled either directly from the air around the plant or by capturing the gas as it was emitted from fossil fuels as they are burned while heating the mixture. They state that depending on how much nesquehonite was added to the cement mixture, the process could be either carbon-neutral or carbon negative.

More information: Barney Shanks et al, Carbon capture and storage in low-carbon concrete using products derived from olivine, *Royal Society Open Science* (2024). DOI: 10.1098/rsos.231645

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