New process could capture carbon dioxide equivalent to forest the size of Germany

March 13 2023

Credit: CC0 Public Domain

New research suggests that around 0.5% of global carbon emissions could be captured during the normal crushing process of rocks commonly used in construction, by crushing them in CO_2 gas.

The paper, published in *Nature Sustainability*, says that almost no additional energy would be required to trap the CO_2. The amount of 0.5% of global emissions would be the equivalent to planting a forest of mature trees the size of Germany.

The materials and construction industry accounts for 11% of global carbon emissions. More than 50 billion tons of rock is crushed worldwide every year and current crushing processes—standard in construction and mining—do not capture CO_2. Previous work has explored trapping carbon into single minerals by the same method, but the research at the University of Strathclyde shows this is unstable and dissolves out of the mineral when placed in water.

The paper documents how a larger proportion of carbon dioxide can be trapped in a stable, insoluble form in rocks composed of multiple different minerals by grinding it in CO_2 gas. The resulting rock powders can then be stored and used in the environment for construction and other purposes.

The calculation of 0.5% was made for Norway, as an example, because the country publishes annual data on the volume of hard rock aggregate produced for their construction industry, and their annual national CO_2 emissions are also documented.

Principal investigator Professor Rebecca Lunn, from the Department of Civil & Environmental Engineering, said, "The hope is that the sector could reduce the emissions by adapting the current setups to trap carbon from polluting gas streams such as those from cement manufacture or gas-fired power stations.

"The global estimate is based on the assumption that Norway's construction industry is reasonably typical. Some countries such as Australia and South Africa will actually produce far more, as they have large mining industries and will look to crush and sell the waste rock, while others may be less. If the technology were adopted worldwide in aggregate production, it could potentially capture 0.5% of global CO_2 emissions—175 million tons of carbon dioxide annually. Future research can pin this down, as well as optimize the process to trap more carbon."

Co-investigator Dr. Mark Stillings added, "Now we know that CO_2 trapping in most hard rock can be done in a lab, we need to optimize the process and push the limits of how much can be trapped through the crushing technique. We then need to understand how this process can be scaled up from the lab to industry, where it can reduce global CO_2 emissions.

"If this process was applied, the CO_2 footprint associated with building houses and public infrastructure could be greatly reduced, helping to meet global objectives to combat climate change."

As part of the Paris agreement, countries around the world agreed to pursue efforts to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this, countries must reduce their greenhouse gas emissions to net zero by around 2050.

Professor Lunn added, "There are many industries for which there is currently no low carbon solution and this research will allow direct gas capture of CO_2 [...] to decarbonize industries, where a solution is not going to exist by 2050. In the future, we hope that the rock used in concrete to construct high rise buildings and other infrastructure such as roads, bridges and coastal defenses will have undergone this process and trapped CO_2, which would otherwise have been released into the atmosphere and contributed to global temperature rise."

Dr. Lucy Martin, EPSRC's Deputy Director for Cross Council

Programmes said, "This breakthrough research from the University of Strathclyde [...] is truly revelatory. It points to a new process for the construction industry that could significantly reduce global carbon emissions and help us meet our net zero goals."

More information: Mark Stillings et al, Mechanochemical processing of silicate rocks to trap CO2, *Nature Sustainability* (2023). DOI: 10.1038/s41893-023-01083-y

Provided by University of Strathclyde, Glasgow

Citation: New process could capture carbon dioxide equivalent to forest the size of Germany (2023, March 13) retrieved 4 June 2023 from https://techxplore.com/news/2023-03-capture-carbon-dioxide-equivalent-forest.html