Reducing carbon emissions using waste marble powder

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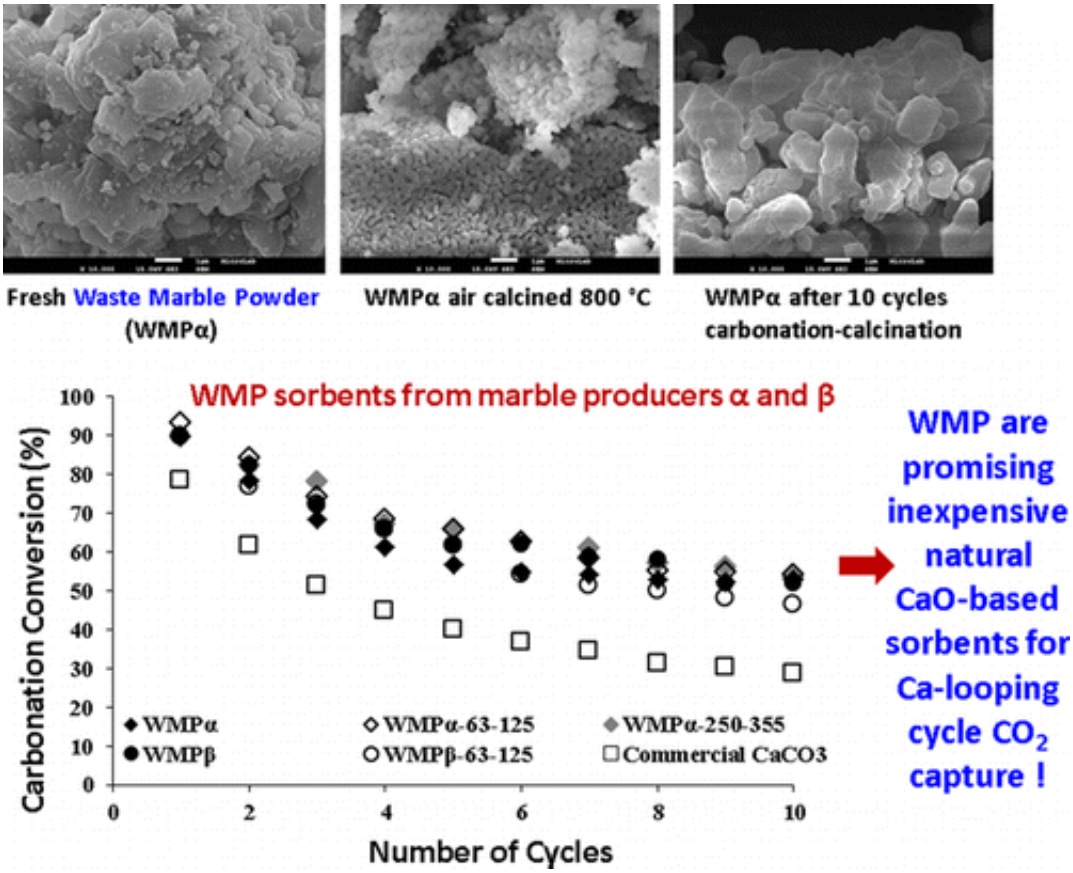

Credit: American Chemical Society

The ongoing fraud investigation into the nearly $7 billion Mississippi clean coal plant has sparked debate on whether carbon capture is a viable technology. But to lesser fanfare, other industrial efforts to keep carbon

dioxide out of the atmosphere are moving forward successfully. Now scientists report in ACS' journal *Industrial & Engineering Chemistry Research* a new approach to accomplishing this while also cleaning up waste from the marble industry.

Many countries including the U.S. are pursuing carbon capture as part of their strategy to reduce global emissions of carbon dioxide (CO2), a major greenhouse gas. One of the most promising technologies to do this is called calcium looping. The process scrubs CO2 from flue gases by using calcium-oxide-based sorbents. But current sorbents—natural or synthetic—are either expensive or lose their effectiveness over many cycles. So scientists are investigating alternate materials, including industrial byproducts. If successful, this route could help clean up both carbon emissions and waste at the same time. Carla I.C. Pinheiro and colleagues wanted to test this strategy using the powder waste created in large amounts by cutting and polishing marble, a popular stone for such uses as countertops and flooring.

In lab-scale testing, the researchers found that waste marble powder performed better than a current commercial calcium-carbonate sorbent as a material for capturing CO2. The marble powder initially showed about 90 percent of carbonation conversion compared to 78 percent by the commercial sorbent. And over 10 cycles of reuse, the powder sorbent's reactivity declined by about 36 to 44 percent while the commercial material's performance dropped by 50 percent.

More information: Carla I. C. Pinheiro et al. Waste Marble Powders as Promising Inexpensive Natural CaO-Based Sorbents for Post-Combustion COCapture, *Industrial & Engineering Chemistry Research* (2016). DOI: 10.1021/acs.iecr.5b04574

Abstract

There are currently no studies in the literature on the use of natural waste

marble powder (WMP) resources as inexpensive sorbents for looping cycle CO2 capture. The high volume of marble production is associated with considerable amounts of WMP generated as byproduct during cutting and polishing procedures, which negatively impacts the surrounding environment. The main goal and innovative idea addressed in this study consists of investigating if solid wastes WMP from marble producer sources can be used as possible inexpensive and effective solid materials to be used as precursors of CaO-based sorbents in Ca-looping cycle CO2 post-combustion capture process. The cyclic carbonation–calcination reactions were experimentally studied in a laboratory-scale fixed-bed reactor unit for 10 and 20 cycles. The innovative and interesting results obtained show that Portuguese WMP represents a category of promising natural inexpensive solid sorbents to be used as effective CaO-based sorbents for looping cycle CO2 post-combustion capture, because of their increased CO2 carrying capacity and better cyclic stability with lower sorbent deactivation with the number of cycles, when compared with commercial CaCO3 reference sorbent precursor and with other natural and synthetic CaO-based sorbents, and other CaO-solid-based materials from industrial and natural wastes recovery, reported in the literature. The WMP resources have potential to be an economically attractive option thus contributing to reduce the cost of the Ca-looping cycle CO2 capture process, as well as to minimize the adverse environmental impacts of the high volume of WMP generated in the marble producers.

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