Scientists use sunlight and modified sawdust to reversibly capture carbon dioxide

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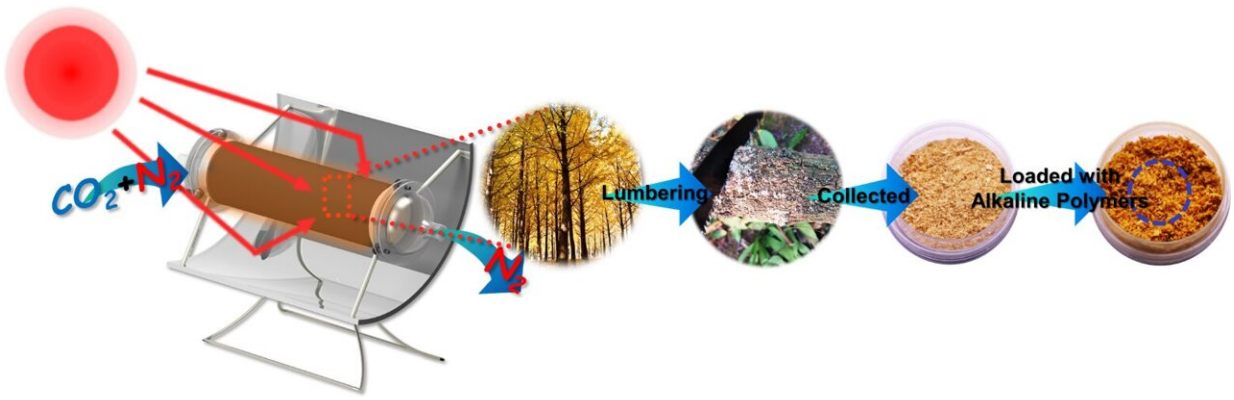

How the sunlight-controlled CO2 separation installation works. Credit: Shiming Zhang, Renmin University of China.

According to the World Meteorological Organization, greenhouse gas concentrations have reached a record high. In the case of carbon dioxide (CO_2),the growth in 2020 exceeded the average for the last decade; despite a 5.6% drop in fossil fuel CO_2 emissions driven by COVID-19 restrictions. This continued rise in CO_2 concentration is directly linked to our massive consumption of fossil fuels.

In a study published in the journal *Green Energy & Environment*, a group of researchers from Renmin University of China propose a new method to capture CO_2 using sunlight as the energy source and modified sawdust

as the CO_2 absorbent. In addition to capturing CO_2, their method also avoids using the fossil fuels that would create additional CO_2. Importantly, the absorption method they have developed is reversible, so the captured CO_2 can be used to generate other products, such as methanol, ethanol and methane.

Corresponding author Yapei Wang, a professor in the university's Department of Chemistry, explains that "while a large number of high-performing CO_2 absorbents have been developed in recent decades, people rarely pay attention to the carbon emitted by the adsorbent during its preparation. Moreover, typical industrial CO_2 capture systems show high-energy consumption during the absorber regeneration process.

"To solve these issues, we focused on a solution that not only fabricates low-energy consumption CO_2 absorbents, it also uses sunlight as the single energy input to regenerate those absorbents."

The research team found that sawdust impregnated with an aqueous solution of amine-based polymer was an easy-to-obtain CO_2 absorbent with two important advantages: it doesn't require complicated synthesis, and it can capture CO_2 and be regenerated by proper heating. In addition, a reflector and sunlight absorption layer was used to fabricate the sunlight harvesting systems, heating up the modified sawdust for CO_2 capture.

According to Shiming Zhang, a Ph.D. student who took part in the study, "we were inspired by solar water heaters. Using sunlight as an energy input minimizes the need for traditional energy and is more environmentally-friendly." Postgraduate Qianhao Pan, who also participated in the research, adds that they "believe less is more, sometimes a simple preparation process can lead to an effective solution that protects the environment."

More information: Shiming Zhang et al, Sunlight-controlled CO_2 separation resulting from a biomass-based CO_2 absorber, *Green Energy & Environment* (2021). DOI: 10.1016/j.gee.2021.09.001