Analyzing and Applying Biological Charcoal for High-Concentration Carbon Dioxide Storage

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Biological Charcoal, or Biochar, is one of the most promising tools recently found for effective carbon capture and sequestration. Biochar is capable of binding to CO2 through a process called physisorption, which loosely connects CO2 to biochar's surface. Typical applications of Biochar utilize it as the final receptor for CO2, however prior testing has shown that it can only absorb a relatively small quantity of CO2, albeit at a fast rate. This project aimed to remedy this discrepancy by applying biochar not as a final receptor, but as an incredibly efficient intermediary. Facilitating this application, the hypothesis stated that if saturated Biochar were placed in an isolated environment, high-concentration CO2 could be extracted with constant efficiency. To do so, this project required a two-fold goal: determining methods of on-demand carbon detachment, and applying these methods to establish high-concentration CO2 storage. After varied experimentation, heating Biochar to above 90C was found to be the key to complete, on-demand CO2 removal. Cyclic heating tests were conducted 6 times, revealing Biochar to be almost 99% efficient at reabsorbing CO2. To apply this knowledge, a modified Boyle's law Apparatus was used to isolate and extract the pure CO2. This proved to be highly successful, filling a 16g CO2 cartridge from a vacuum to 1 atm in just 3 cycles of 20ml of biochar. Overall, this project highlights the viability of a novel form of carbon sequestration, which plays to Biochar's strengths and could be crucial in modernizing and accelerating the fight against climate change.

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