Aluminum, Batteries, and Carbon

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Aluminum-ion batteries, with a stainless steel mesh cathode, aluminum (Al) anode, and salt(NaCl) water electrolyte has the ability to sequester CO_2 around it, generating aluminum oxalate as a byproduct. It can also be recharged up to 7,500 times without capacity loss, about 750% more than that of the standard lithium-ion battery(Tarantola, 2016). However, the battery sequesters CO_2 very slowly. I wondered, if I changed the cathode and the electrolyte, would the battery sequester CO_2 more efficiently? I selected two different metals (copper (Cu) and stainless steel) and a powder (carbon (C)) to act as potential cathodes, along with three different salt solutions (NaCl, $CaCl_2$, and NH_4Cl) to act as electrolytes. The anode remained as aluminum. To test CO_2 absorption rate, I built all nine battery variants, and placed them, along with a control (no battery), into separate air-tight containers. CO_2 was pumped into the chambers, and CO_2 levels were monitored for 24 hours, after which batteries were shifted to a different container, and the experiment was repeated four more times. Data collected showed that chambers that contained batteries had, on average, a faster rate of CO_2-level decline. Batteries with a copper or carbon cathode and NaCl water electrolyte sequestered CO_2 at a significantly higher rate than an average CO_2-level rate of decline (control). Batteries with a stainless steel cathode and NaCl electrolyte also sequestered CO_2, but not by a significant margin from the control. Data collection on the other electrolytes is uncompleted, but preliminary data shows a similar trend to this data. In conclusion, this experiment determined that aluminum-ion batteries with copper or carbon cathodes sequester CO_2 efficiently, and batteries with stainless steel do not.