Enhancing Carbon Sequestration of Sedum Acre by Integrating Silica-Composited Biochar: A Novel and Sustainable Bioremediation Approach to Mitigate Climate Change

Eldeeb, Ahmed (School: Spruce Creek High School)
Eldeeb, Salsabeel (School: Spruce Creek High School)

Biofuels are critical in combating the global climate crisis while providing increasing energy security. However, the current application of biofuels solely emphasizes the utilization of Bio-oil and Syngas. This project proposes a soil amendment composed of the carbon-rich product (Biochar) derived from pyrolysis with the addition of silica nanoparticles to aid carbon sequestration. Sedum Acre was the model vegetation tested due to its abundance around the world and its medical significance. The Sichar (synergistic fusion of biochar and silica) was created through equal proportions of both materials. Three concentrations of the novel Sichar (60g, 120g, 240g) were tested on the Sedum Acre for a two-month period. Bi-weekly assessments were in place to maintain a controlled environment: air quality, pH, and watering. Monthly, a carbon dioxide respirometer (infrared cell sensing) was utilized to measure fluctuations in carbon dioxide readings (ppm). The average increase in carbon content by Sichar compared to Biochar, two months after application, is approximately 1296 ppm (p-value < 0.004). Through the utilization of Matplotlib, we concluded that Sichar is 140% more efficient in sequestering carbon than Biochar: underscoring its capabilities in enhancing soil carbon storage. Referencing the promising results, we developed a model of tangible Sichar pods that are compacted through natural curing and sustainably packaged. This study illustrates a sustainable approach to advancing sustainable farming practices and an alternative catalyst for biofuel. This research serves as an inexpensive means to reduce greenhouse gasses and boost crop yields: supporting the mitigation efforts to combat climate change and food insecurity.

Awards Won: