Conversion of Atmospheric CO2 into Value-Added Material Via Chloroplast-Assisted Polymerization Pathways

Katherine Malloy, Chemical Engineering
Mentor: Dorsa Parviz, Assistant Professor
Ira A. Fulton School of Engineering

QR CODE

Research Question:
How does pairing carbon fixing capability of plants with synthetic polymerization pathways allow for sustainable chemical and materials production?

Issues Faced:
In the lab, issues of chloroplast isolation were present. Shown aside, the chloroplasts would not fully separate from the spinach leaf, while in tact. The chloroplast isolation should be partnered with small white dots, visibly showing the isolated chloroplasts. The Figure 1 is the initial centrifuge, and Figure 2 is the final centrifuge results.

Figure 1: Chloroplast isolation post initial centrifugation.

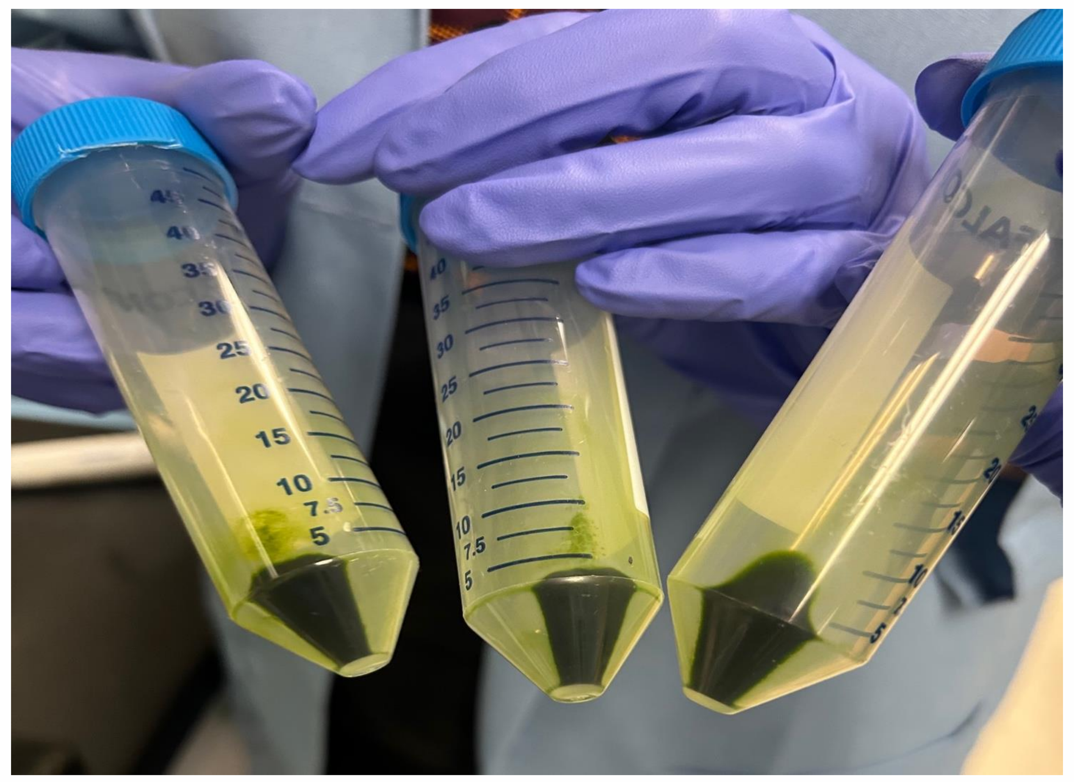

Figure 2: Chloroplast isolation post final centrifugation.

Research Methods:

1. Literature review is completed to study the nutrients necessary to keep chloroplasts alive outside of the plant cell
2. Initial testing of chloroplast isolation tested and mastered
3. Testing of polyvinyl alcohol (PVA) hydrogels, and carbon nanotubes for the extension of chloroplast lifespan
4. Once stage 3 is mastered, literature review on glucose polymerization pathways is completed
5. Glucose from the chloroplasts will be converted during polymerization pathways

Protocol:

1. Measure 30 g of Spinach leaves, wash, and cut
2. Dilute Chloroplast Isolation Buffer (CIB) 5x with DI water
3. Prepare 0.1% Bovine Serum Albumin (BSA) solution using the 1x CIB
4. Blend and filter spinach and solution mix
5. Centrifuge twice
6. Use Percoll Layer to separate chloroplasts from liquid

References and Acknowledgements:
Chloroplast Isolation Kit - Sigma Aldrich
A big thanks to Sigma Aldrich, as well as those at MIT who have completed this research prior.