Enhancing CO2 Reduction and the Lifespan of Chloroplasts through Encapsulation

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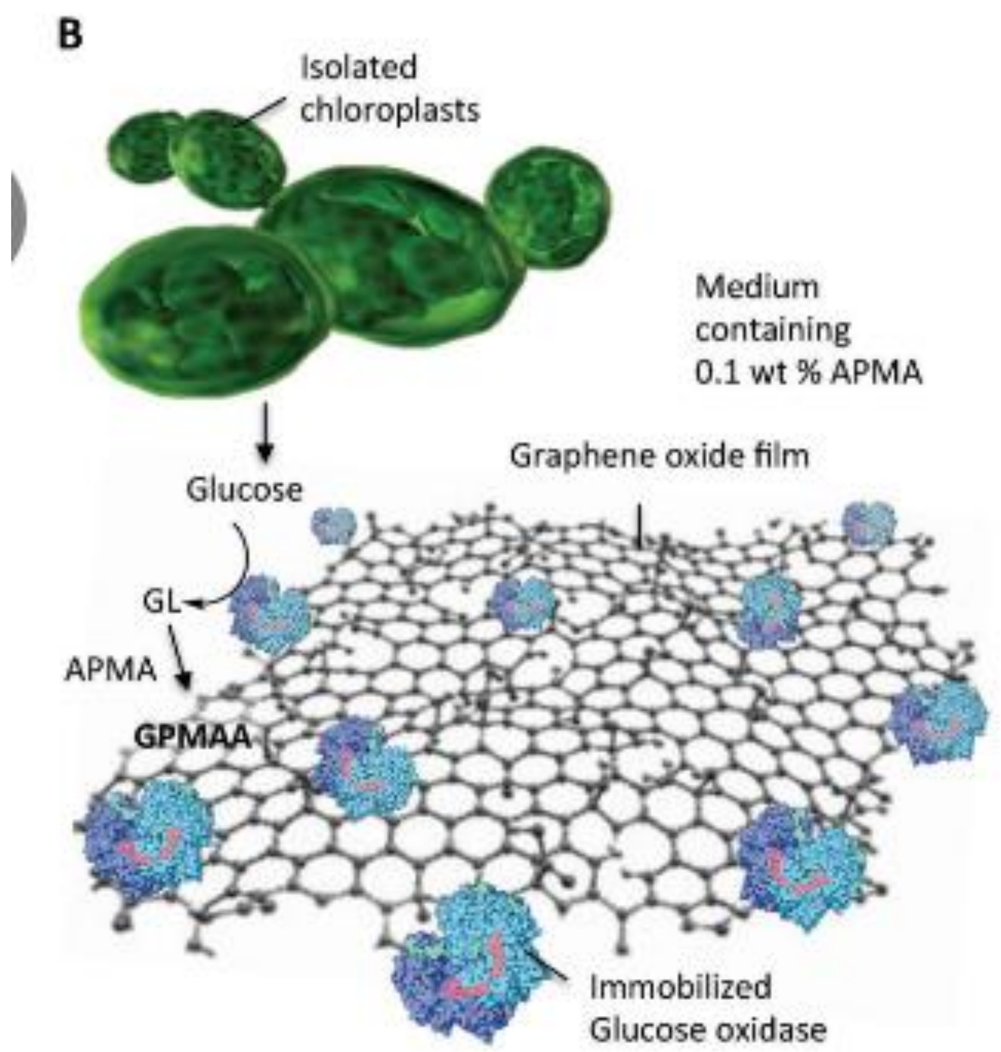
Research question:

With chloroplasts having a limited lifespan outside the plant cell, how can encapsulation techniques expand their lifespan while maintaining a high level of CO_2 reduction efficiency, particularly in environments unsuitable for traditional plant growth?

Abstract:

Our research team is investigating the use of encapsulation techniques to extend the lifespan of chloroplasts and optimize conditions for CO2 reduction. We will evaluate the performance of various encapsulation methods by comparing their efficiency in CO2 reduction and polymerization, particularly in environments unsuitable for traditional plant growth.



(Kwak et al., 2018)

Impact Statement:

To effectively harness chloroplasts outside of plant cells for CO2 reduction, encapsulation techniques are essential for facilitating and prolonging the polymerization process.

Obstacles Faced:

Since the experiment was adjusted to laboratory goals, new chemicals must be purchased and shipped to the lab, posing a logistical challenge that could impact the timeline and availability of necessary materials. Experiment was not able to begin in time, since chemicals were not in completely shipped in time.

Methods and Progress:

Gaining experience while creating a photocatalyst out of SnO2 and TiO2. The solutions were subjected to sonication and centrifugated. The characterization of the photocatalyst was with the DLS (Dynamic Light Scattering) for particle size distribution.
Chloroplast must be separated through a creation of a HEPES buffer solution that the leaves will be soaked in and then centrifugated. With the gathered Chloroplast, the Glucose export must be observed and then encapsulated with a Hydrogel. Thus the cells are then compared to the unencapsulated Chloroplast.

Acknowledgements:

The project came into develop after Dr. Parviz and her team proved the mathematical existence and probability to develop products that can go through the carbon dioxide process similar to chloroplast in plant cells. There are several teams that are taking part of the project to cover different aspects of the process from Carbon dioxide to Formaldehyde to Oxygen.

Kwak, S., Giraldo, J. P., Lew, T. T. S., Wong, M. H., Liu, P., Yang, Y. J., Koman, V. B., McGee, M. K., Olsen, B. D., & Strano, M. S. (2018). Polymethacrylamide and Carbon Composites that Grow, Strengthen, and Self-Repair using Ambient Carbon Dioxide Fixation. Advanced Materials, 30(46), 1804037. https://doi.org/10.1002/adma.201804037

Parviz, D., Lundberg, D. J., Kwak, S., Kim, H., & Strano, M. S. (2021). A mathematical analysis of carbon fixing materials that grow, reinforce, and self-heal from atmospheric carbon dioxide. Green Chemistry, 23(15), 5556–5570. https://doi.org/10.1039/d1gc00965f

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