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Nanosecond and Microsecond Pulsed Electric Field Treatment of Microalga *Chlorella protothecoides* for Increased Lipid Extraction

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Extraction of lipids from microalgae is a major barrier to the industrial production of lipid-derived biodiesel, motivating efforts to implement treatment strategies to replace or supplement solvent extraction. Pulsed electric field (PEF) treatment has shown promise in weakening the cell membrane to facilitate greater lipid yield by subsequent solvent extraction. Previous studies have assessed microsecond duration pulses with fields between 10 and 60 kV/cm [1].

This study assesses the impact of pulse duration on PEF facilitated lipid extraction for nanosecond electric pulses. In particular, we assess the impact of total energy delivered by fixing the pulse duration (60 ns) and electric field (60 kV/cm) and applying 10, 50, 100, 200, and 300 pulses. Lipid extraction increased significantly compared to the unpulsed control by 14.6%, 16.8%, and 19.2% following 10, 50, and 100 pulses, respectively. However, applying 300 pulses resulted in a statistically significant 9.4% decrease compared to control, suggesting a peak efficiency in PEF enhanced lipid extraction. The implications of these results will be discussed and compared to ongoing experiments at 100 microseconds and 5 kV/cm with the same energy delivered.

1. C. Joannes, C. S. Sipaut, J. Dayou, S. M. Yasir, and R.F. Mansa, "Review paper on cell membrane electroporation of microalgae using electric field treatment method for microalgae lipid extraction," *Mater. Sci. Eng.* vol. 78, no. 012034, 2015.

Authors: GEISSLER, Caleb (Purdue University); MULLIGAN, Mary (Purdue University); RAY, Shaunak (Purdue University); ZMOLA, Zane (Purdue University); MORGAN, John (Purdue University); GARNER, Allen (Purdue University)

Presenter: GEISSLER, Caleb (Purdue University)

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