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Nanosecond Electric Pulses for Lipid Extraction from Microalgae

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The continued increase in overall energy demand and the desire to mitigate environmental hazards of emissions continues to motivate alternative energy source development. Initial studies focused on developing plant biofuels; however, this approach is expensive and used foodstuffs, raising food costs. Microalgae provide an alternative source of liquid fuels that is not involved in the food supply. The most common lipid extraction method, Bligh & Dyer [1], is costly and toxic. Treating microalgae with electric pulses (EPs) permeabilizes the cell membranes which can lyse the cells to increase the extraction efficiency of safer, greener biofuels [2]. Thus, EPs can intensify biological effects to provide a safer and less expensive renewable solution than the Bligh & Dyer method. In this study, we assess the impact of using nanosecond duration EPs with different numbers of pulses and electric fields on lipid extraction. We compare these results to extraction using conventional electroporation pulses with the same energy [2] and to extraction without EPs [3]. The implications of these results on lipid extraction and ideas for future parametric studies of EP parameters will be discussed.

[1] E. G. Bligh and W. J. Dyer, "A rapid method of total lipid extraction and purification,"Can. J. Biochem. Phys., vol. 37, no. 8, pp. 911-917, 1959.

[2] C. Joannes, C. S. Sipaut, J. Dayou, S. M. Yasir, and R. F. Mansa, "The potential of using pulsed electric field (PEF) technology as the cell disruption method to extract lipid from microalgae for biodiesel production," Int. J. Renew. Energy Res., vol. 5, pp. 598-621, 2015.

[3] J. O'Grady and J. A. Morgan, "Heterotrophic growth and lipid production of Chlorella protothecoides on glycerol,"Bioprocess. Biosyst. Eng., vol. 34, pp. 121-125, 2011.

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