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Study of Oil Extraction from Microalgae by Pulsed Power as a Renewable Source of Green Energy

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Biofuel production as a sustainable source of green energy is considered as promising complements to petroleum in order to prevent environmental problems such as global warming. In this regard, microalgae can be one of the best options since other plant resources may be used for human consumption, using them for producing biofuel may cause an increase in their price. However, there are several challenges to extract oil from microalgae, e.g., high energy consumption, chemical solvents, and algae culture destruction; which should be addressed by new approaches. This study suggests two pulsed power based physical methods for hydrocarbon extraction from microalgae: nanosecond pulse electric fields (nsPEF) and underwater shock waves. Botryococcus braunii with high hydrocarbon production potential was used as microalga model. For nanosecond pulse electric fields (nsPEF) experiments, 20 to 65 kV/cm electric fields with 80 ns pulse duration, with different pulse repetition frequencies and pulse numbers were applied. Underwater shock waves experiments were conducted by applying 500 to 1000 shock waves, generated by nanosecond pulse electric discharge in water. Fluorescence microscopic observation and image and chemical assessments were performed for analysing the samples, understanding the extraction mechanisms, and comparing the outcomes. According to the results, both pulsed power approaches can be used as high-efficiency physical methods for extracting oil from Botryococcus braunii.

Keywords: Biofuel, Microalgae, Botryococcus braunii, Oil extraction, Pulsed power

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