INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	Ph.D.

Thesis Title: Exploring potential genetic routes for enhancing lipid accumulation in microalgae for biofuel application

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Thesis Submitted to the Department/ Center	:	School of Energy Science and Engineering
Date of completion of Thesis Viva-Voce Exam	:	26/04/2022
Key words for description of Thesis Work	:	*Chlorella sorokiniana*; Genetic engineering; Microalgae; Lipid;

SHORT ABSTRACT

To harness the benefit of microalgal biotechnology for biofuel application, genetic manipulation of metabolic pathways is essential, requiring an efficient genetic transformation method. Besides, an efficient gene transfer system in microalgae would allow a way to understand cellular metabolism regulation by characterizing the genes involved through a reverse genetics approach. *A. tumefaciens*-mediated genetic transformation is a method of choice for ease in transformation and its ability to precisely integrate low copy number transgene into transcriptionally active genomic regions. However, in *C. sorokiniana*, the lack of a reliable and efficient Agrobacterium-mediated gene transfer method limits its potential uses in commercial scale utilization. We described an efficient *A. tumefaciens*-mediated genetic transformation in *C. sorokiniana*. For the first time in *C. sorokiniana*, it highlighted the reliable detection of stable transgene integration and expression in *C. sorokiniana*, which opens up limitless possibilities in biofuel production and other commercially valuable commodities. Further, as higher lipid biosynthesis and accumulation are essential to achieve sustainable production of biofuel in microalgae. The green microalgae *Chlorella sorokiniana* was genetically engineered with a rate-limiting enzyme of neutral lipid biosynthesis, diacylglycerol acyltransferase 1 from *Jatropha curcas* (*JcDGAT1*) and a transcription factor WRINKLED 1 from *Arabidopsis thaliana* known to involve in lipid biosynthesis in higher plants, to enhance the lipid content. The results offer a valuable strategy for enhancing oil production and might facilitate a platform strain with industrial potential. Our results suggest genetic means to increase neutral lipids and unsaturated fatty acids in *C. sorokiniana* for biofuel production. In conclusion, this research provides proof of concepts to make microalgae an economically viable source for biodiesel production. A similar technique may be helpful for the biosynthesis of certain high-value compounds in microalgae.