



جامعة الإمارات العربية المتحدة
United Arab Emirates University

**The College of Graduate Studies and the College of Engineering Cordially
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Master Thesis Defense

Entitled

VISUALIZATION AND QUANTIFICATION OF LIPID AND PROTEIN IN SINGLE MICROALGAL CELL

by

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Abstract:

Microalgae have the potential to be used as a main source of renewable energy in the future due to their lipid contents. Microalgae are comprised of several components including carbohydrates, lipids and protein. This lipid and protein composition needs to be quantified so the amount of usable energy can be measured. Therefore, the main objective of this thesis is to develop an image processing technique for the quantification of lipid and protein contents in single microalgal cell. This image processing technique has made lipid quantification an easier process as compared to previous methods used to quantify lipid content. The technique is based on staining microalgal cells with several dyes for the visualization of the lipid and protein content in a microalgal cell. The quantification is then carried out by applying image processing methods. To enhance the lipid accumulation and simultaneously reduce the protein, these microalgal cells are put under stress conditions such as nitrogen starvation. The nitrogen starvation stress condition results in alteration of the lipid and protein content inside the cells. This will significantly influence the ex vivo optimization of microalgal growth conditions for enhanced oil productivity. The image processing-based approach is then used to analyze the time course of lipid accumulation and protein reduction patterns inside the corresponding-stained microalgal cells. There are many different types of strains of microalgae. In this study, Nannochloropsis microalgal strain was used and cultivated in a nitrogen deficient medium. The intracellular Nannochloropsis cell content was estimated by mathematically evaluating the lipid and protein volume inside the corresponding-stained cell. This mathematical evaluation was made possible with the image processing technique that has been developed in this thesis. This image processing approach allows the quick characterization of microalgal cells. It also takes precedence over any techniques or methods that have been developed in the past to quantify lipid content of microalgal cells. This will be explored further in the following thesis.

Keywords: Lipid, Microalgal cell, Protein, Quantification, Visualization.