SATU Presidents' Forum
of Southeast and South Asia and Taiwan Universities
台灣與東南亞暨南亞大學校長論壇

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2016 SATU Joint Research Scheme Program

Host Application Form

Date: _2016___ / __4__ / _18___ (year /month/day)

1. Host University

University of Malaya

2. Host Unit

Institute of Biological Sciences

3. Joint Research Project Title

Proteins recovery technique from Microalgae

4. Principal Investigator

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6. Project Details

Project Description	**Problem statements** • The rigid thick cell walls hinder the liberation of proteins from microalgae.

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- The attempt to recovery proteins from microalgae at low cost remains challenging.
- Limited studies are documented on exploring the cost-effective and practical method to break the cell wall and extract proteins from microalgae.

Questions

- Which appropriate cell disruption method is suitable for industrial use to facilitate proteins release?
- Which solvent is the best for use in cell disruption process at large scale?
- Is the cell disruption method applicable for wide range of microalgae?
- Is it possible to integrate the cell disruption and proteins extraction method into one single step?
- What is the optimum condition for proteins release and extraction from microalgae?

Research objectives

- To study a simple and cost-effective disruption method for maximum proteins release from microalgae.
- To compare the efficiency of different types of disruption treatment.
- To develop an efficient and rapid integrated cell disruption and protein extraction system.
- To maximize the extraction of proteins from microalgae under optimum condition.

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- To study the disruption and extraction efficiency of microalgal proteins using recycling materials from ATPS.
- To study the possibility of applying the integrated method to large scale.

Literature research

Fishmeal is the principle source of dietary protein in commercial fish feeds formulation (Roy and Pal, 2014). It contains high-quality of proteins with adequate balance of amino acid profile and high digestibility (Ayadi et al., 2012; Dersjant-li, 2002). The aquaculture consumption of fishmeal is forecasted to be increased continually (Norambuena et al., 2015; Taelman et al., 2015). However, the increasing demands for protein source has caused the cost of fishmeal to be increased significantly (Roy and Pal, 2014; Sirakov et al., 2015) and could impede the sustainability of aquaculture sector (Kiron et al., 2012). Hence, it is crucial to look for new replacements of proteins sources for aquaculture industry that could supply comparable nutritional value at competitive cost (Sirakov et al., 2015).

In recent years, the other alternative protein sources to replace fishmeal relies mainly on the soybean crops (Bhosale et al., 2010; Dersjant-li, 2002; Taelman et al., 2015). Unfortunately, fish are unable to absorb much of the protein from crop-plant derived protein sources in aquaculture feed due to the low digestibility of protein (Li et al., 2009). The existence of anti-nutritional factors and deficiency in certain essential amino acids also cause significant changes in the nutritional quality of the fish produced (Stankovic et al., 2011; Watanabe, 2002). Because of these limitations, soybean is not considered as an ideal fishmeal replacer for cultured fish.

Microalgal proteins emerge as the most promising alternative to

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conventional proteins sources such as fishmeal and soybean in aquaculture industry (Roy and Pal, 2014). This is mainly due to their high protein content (Blackburn and Volkman, 2012; López Barreiro et al., 2013) and nutritional quality (Norambuena et al., 2015). Microalgae able to synthesise all types of essential amino acids which is mostly equivalent or even better with that of other higher plant (Spolaore et al., 2006). Their amino acid composition does not significantly affected by changes in environmental conditions (Blackburn and Volkman, 2012). Additionally, the farming of microalgae is cost-effective than conventional crops due to numerous attractive characteristics: high photosynthetic efficiency (López Barreiro et al., 2013), high growth rate, short harvesting cycle (Cheah et al., 2014; Chen et al., 2013; Taher et al., 2014), high disease resistance ability and high biomass density (Roy and Pal, 2014). Cultivation of microalgae is unaffected by seasonal variations (Duong et al., 2015). Microalgae can be cultured in non-arable land (Ferreira et al., 2013) and thus are not competitive to conventional crops. On top of that, these tiny microorganisms can reduce greenhouse gas emissions by their higher photosynthetic efficiency (Cheah et al., 2014; Tan et al., 2015). All these characteristics makes the mass production of proteins from microalgae attractive and economically feasible (Roy et al., 2014; Shekh et al., 2016; Vanthoor-Koopmans et al., 2013).

However, one of the main difficulties faced in the mass production of proteins commercially is the low recovery of proteins due to the presence of multiple layers of thick cell wall (González-Fernández et al., 2012; Günerken et al., 2015). Also, limited studies on extracting the proteins from microalgae have been reported. The development of simple, rapid and cost-effective cell disruption method and

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proteins extraction techniques is therefore very important to recover proteins from microalgae at industrial scale (Safi et al., 2015).

Research methods

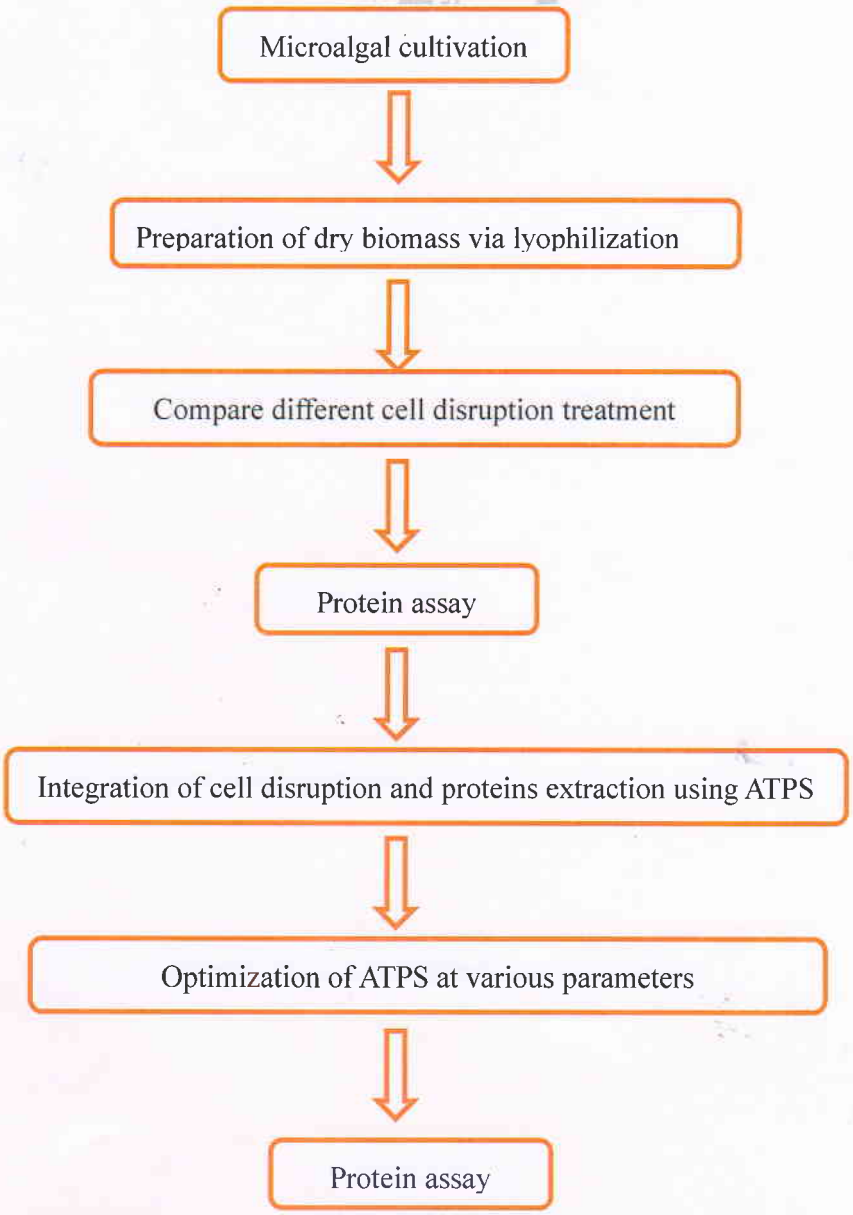

Fig. 1 Flow chart of project methodology

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7. **Acknowledgement** (Signed by the President or SATU representative to show recognition)

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Date: 2016 / 4 / 18 **(yyyy/mm/dd)**

Please email satu@email.ncku.edu.tw before 2016.4. 29(Fri.) for application with the subject line: < 2016 SATU JRS host application –School Name>. Thank you.