Preliminary Study on Methyl Jasmonate Nanoemulsion for Paddy Growth Modulation

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Abstract: Methyl jasmonate (MeJA), are phytohormone that crucial in plant signaling responses to biotic and abiotic stresses. The emulsion nanofertilizer containing 20% (v/v) of MeJA diluted in soybean oil was developed to improve tillers elongation, consequently, increase the yield using the ternary phase diagram (TPD) approach. Each tube with formulation at 90% water with different percentage of oil and surfactant (HLB 8-15) were ultra-sonicated. A few formulations in HLB 14 shows a droplet size below than 100 nm with polydispersity index value in a range of 0.06 to 0.107 will be further studied on their stability and performance as paddy nanofertilizer.

***Keywords*:** Methyl jasmonate, nanoemulsion, nanofertilizer, colloidal system, hidrofilic lipofilic balance

INTRODUCTION

Proper management in fertilization is essential for increasing production of rice to meet the demand. Jasmonates are phytohormone involved in several vegetative growth and developmentprocesses, such as the increase of fruit size and mass and the development of the root system [1].The study objective is to develop emulsion nanofertilizer containing a plant hormone (MeJa) using TPD and high energy emulsification approach to increase the rice production.

MATERIALS AND METHODS

MeJA, sorbitan monooleate (Span 80) and polyoxyethylene sorbitan monooleate (Tween 80) were purchased from Sigma (USA). Soybean oil was purchased from hypermarket in Malaysia.Soybean oil is popular as an oil phase in colloidal system among other selected oils [2,3]. This study targeting an oil in water (o/w) nanoemulsion formulation, the screening of the hidrofilic lipofilic balance (HLB) value from 8 and above were performed. Tween 80 (HLB 15) and Span 80(HLB 4.3) were blend together as surfactant mixture (Smix) with different percentage ratio according to Rodrigues et al. [4]. Aqueous titration method was used for the construction of the TPD which involves stepwise addition of water to each weight ratio of oil and surfactants, and then mixing the components with the help of vortex mixer at 25 °C [5]. The TPD was constructed using CHEMIX School version 10.0. Each tube with the last formulation at 90% water (aqueous

phase) with different percentage of soybean oil and Smix were proceed for high energy emulsification process using ultrasonicator at 125 kHz, 100% amplitude for 3 minutes. The droplet (particle) size and PDI were determine using Zetasizer (Brookhaven Instruments, USA).

RESULTS AND DISCUSSION

For an example TPD for HLB 14 was shown below in figure 1a. The blue area in TPD has represented one phase of microemulsion formulation with creamy, clear or cloudy and gel like structure. The pink area has represented one phase of formulation with different range of surfactant (0 – 10.0%), oil (0 – 10.0%) and water (90%) after performing ultrasonication.

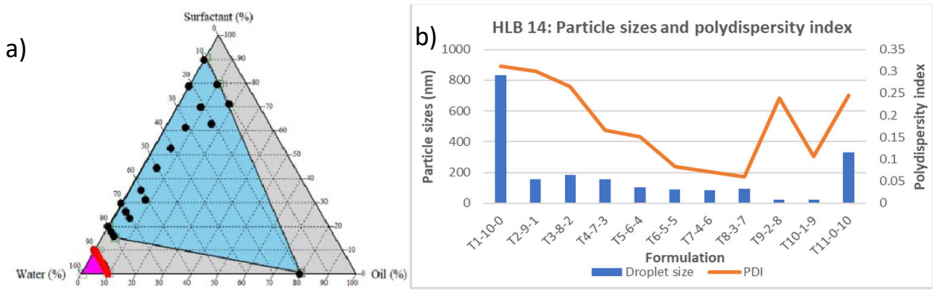

Fig. 1. a) TPD of emulsion nanofertilizer **b)** Graph on droplet sizes and PDI of HLB 14

Physicochemical characteristic of emulsion nanofertilizer such as particles sizes and PDI value were ploted in the graph at figire 1b. A few formulations in HLB 14 shows a droplet size below than 100 nm with PDI value in a range 0.06-0.107 will be a potential formulation to be further studied on their stability and performance as nano fertilizer to increase rice production.

CONCLUSIONS

Emulsion nanofertilizer containing MeJA was developed and the potential formulations at HLB 14 will be explored further on their stability and its application as paddy nanofertilizer.

ACKNOWLEDGMENTS

This project was financed by RMK-12 Development Project Fund (PRB-502), MARDI, Selangor

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