UNIVERSITI TEKNOLOGI MARA

OPTIMIZATION OF *Lactobacillus plantarum* NBRC3070 EMULSION MATRICES (EMULSIFIER CONCENTRATIONS AND HOMOGENIZATION SPEED) FOR INTESTINAL DELIVERY SYSTEM USING RESPONSE SURFACE METHODOLOGY APPROACH (RSM)

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Viability of probiotics is a crucial for eliciting health benefits towards the hosts upon consumption. Encapsulating probiotics method involve emulsion using oil and water base could be an effective method in maintaining the probiotics viability. However, to date, studies regarding on encapsulation of probiotics in emulsions still remain scarce. The objective of this study were : 1) to optimize the emulsifying matrices (concentration of PGPR, (polyglycerol polyricinoleate) (v/v)%, OSA, (octenyl succinic anhydride) starch (w/v)% and homogenizing speed (rpm)) through single emulsion (W/O) and double emulsion (W/O/W) for obtaining better *L. plantarum* NBRC 3070 viability and stable emulsion using Response Surface Methodology (RSM), 2) to study the survivability of emulsified *L. plantarum* NBRC 3070 (ATCC 8014) in simulated gastric juice (SGJ) and simulated intestinal fluid (SIF). Parameters used in this study were different concentrations of emulsion matrices: PGPR ranging 4 % to 8 % (w/v), OSA ranging 2% to 6 % (w/v) and homogenizing speed ranging from 4000-6000 rpm for single emulsion and 7500 – 11500 rpm for double emulsion. Two responses for optimization were *L. plantarum* NBRC 3070 probiotic yield (log_{10} CFU/ml) and creaming extend (%). Based on the findings, it can be suggested that the optimized matrices for single emulsion in water-in-oil (W/O) which were concentration of PGPR at 6.22% (v/v) and homogenization speed at 5424 rpm were able to encapsulate *L. plantarum* NBRC 3070 efficiently. For double emulsion (W/O/W), the optimized concentration of PGPR and OSA were at 4% (v/v) and 5.48 % (w/v) respectively whereas the optimized homogenization speed at 10614.89 rpm. Upon verification of both single and double optimization model, experimental data of *L. plantarum* NBRC 3070 probiotic yield (log_{10} CFU/ml) and creaming extend (%) remained close to predicted data with low error for all the responses and with no significant difference ($p<0.05$). Encapsulated *L. plantarum* NBRC 3070 in double emulsion (W/O/W) were able to survive the exposure of SGJ, maintaining viability of 7.402 log_{10} CFU/ml whereas the free-living cells or non-encapsulated *L. plantarum* NBC 3070 in double emulsion failed to maintain its viability above 6.00 Log_{10} CFU/ml after SGJ exposure. This proved that encapsulated *L. plantarum* NBRC 3070 were able to survive low pH of 2.5 and presence of pepsin which mimics the condition of the stomach. When exposed to SIF, encapsulated *L. plantarum* NBRC 3070 showed better viability which is 8.04 log_{10} CFU/ml compared to the viability of non-encapsulated *L. plantarum* NBRC 3070 which is 7.605 log_{10} CFU/ml. The viability of encapsulated *L. plantarum* NBRC 3070 in double emulsion (W/O/W) was higher compared to free-living cells of *L. plantarum* NBRC 3070 after being exposed to gastrointestinal and this justified the usage of double emulsion. In conclusion, the results indicated that the microencapsulation of probiotics in double emulsion is suitable and effective for maintaining probiotics viability.

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