

**UNIVERSITI TEKNOLOGI MARA**

***“LACTOBACILLUS PLANTARUM L5 production:  
A statistical approach”***

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## ABSTRACT

The survival characteristic of *Lactobacillus plantarum* in the harsh environment of human gastrointestinal (GI) tract has been manipulated to make it as one of the safest probiotic to be commercialized. According to the market report, the global probiotic products market was estimated at USD 58,700.3 million in 2013 and is expected to reach USD 96,046.8 million by 2020 due to unexpected success in health benefit and extreme competition from developers and suppliers (Chaudhari, 2015). However, the production of probiotics in large-scale using traditional method requires high cost, high energy and time consuming. So, the implementation of design of experiment (DoE) in the bioprocess of *L. plantarum* to speed up and increase its productivity is significantly necessary. The objective of this research is to identify the main and interaction effects of two variables (temperature, and agitation speed) on bio-mass production of *L. plantarum* L5 strain. The experiment was designed using  $2^2$  factorial methods and was duplicated twice. The main effect of incubation agitation speed on *L. plantarum* L5 not significant ( $F(1,4) = 0.141$ ,  $p = 0.727$ ), but the main effect of temperature on *L. plantarum* L5 growth was significant such that cultivation of *L. plantarum* L5 at high speed produced maximal OD than cultivation of *L. plantarum* L5 at low speed ( $F(1,4) = 15.08$ ,  $p = 0.018$ ). There were significant interaction effects between temperature and agitation speed,  $p < 0.05$  on maximum OD and specific growth rate. Results obtained from present study indicate that there is interaction effect of temperature and agitation speed on the maximum optical density (OD) and specific growth rate of L5. Implementation of design of experiment (DoE) has potential alternative method to estimate the effects of variables on the productivity of *Lactobacillus plantarum* L5.

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of research

*Lactobacillus plantarum* (*L. plantarum*) is a very versatile bacterium that has the ability to adapt various environmental conditions and can ferment much different type of sugars and carbohydrates. The survival characteristic of *L. plantarum* in the harsh environment of human gastrointestinal (GI) tract has been manipulated to make it as one of the safest probiotic to be commercialized. The benefits of recombinant *L. plantarum* in limiting the colonization of pathogenic bacteria, restoring the homeostasis in the GI tract, stimulating potent antibodies as well as potential vehicles for vaccines has been attract many researchers to explore more about this bacterium (de Vries, Vaughan, Kleerebezem, & de Vos, 2006).

Dr. Richard Fedorak, MD in his study shows that 95% of symptomatic patients with inflammatory bowel disease (IBD) portray great improvement with *L. plantarum* therapy as compared to 15% of patients with placebo treatment (Ouwehand et al., 2003) and increase remission rates in patients with active ulcerative colitis (UC), Crohn's disease and pouchitis (Shen, Zuo, & Mao, 2014). According to the market report, the