

UNIVERSITI TEKNOLOGI MARA

**EFFECTS OF PREBIOTICS ON THE GROWTH CAPABILITY  
OF *LACTOBACILLUS PLANTARUM* L5**

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## ABSTRACT

This study using Box-Behnken design under response surface methodology with 15 experiments to optimize growth factors of *Lactobacillus plantarum* L5 (*L. plantarum* L5) in de Man, Rogosa and Sharpe (MRS) carbohydrate-free medium supplemented with three different concentrations 0.5, 2.5, 4.5% (w/v) each of two prebiotics, namely corn starch and gum Arabic and a nonprebiotic, namely glucose in order to determine the effects of prebiotics on viability growth characteristics of *L. plantarum* L5. The cultivation of *L. plantarum* L5 toward corn starch and gum Arabic were done anaerobically at 1% inoculum in a temperature controlled incubator shaker (Lab-Line, USA) operated at 150 rpm for up to 24 h incubation in the shake flask. Based on cultivation of *L. plantarum* in MRS carbohydrate-free enriched with three substrates (corn starch, gum arabic and glucose) in difference concentrations (0.5, 2.5, 4.5% (w/v)) exhibited that there is a main significant effect toward the maximum measurement growth ( $OD_{620}$ ) and specific growth rates ( $\mu$ ) only on corn starch alone with  $p < 0.05$  and  $p > 0.05$  respectively based on ANOVA result and Pareto chart, while, the interaction effect in combination of substrates did not show any significant difference. In contrast with mean doubling time, there were no substrates showed significant result for the main and interaction effect. The optimum amount of substrates to achieve a predicted maximum  $OD_{620}$  of 1.4A, were found to be as follows: corn starch 0 % (w/v); gum Arabic 3.25 % (w/v); and glucose 5 % (w/v). Similar as  $OD_{620}$  value, in presence of both glucose (2.5% (w/v)) and gum Arabic (2.5% (w/v)) with absence of corn starch (0% (w/v)), *L. plantarum* L5 demonstrated the shortest mean doubling time (-5 minutes). However, *L. plantarum* L5 has the highest specific growth rates (0.75  $\mu$ ) with absence of corn starch (0% (w/v)) and gum Arabic (0% (w/v)) with presence of glucose (2.5% (w/v)). Thus, these results indicated that corn starch had significant effect when supplemented alone, however gum Arabic is more preferred prebiotic for the viability and growth of *L. plantarum* L5 than corn starch. Thus, gum Arabic could be a potential to be as a prebiotic for *L. plantarum* L5 for future synbiotic combination study.

# CHAPTER 1

## INTRODUCTION

### 1.1. Background of study

Recently there has been a substantial rise in study on the properties and verification potential health benefits involved with the application of probiotics and prebiotics. The primary clinical reports in the literature for the usage of synbiotic have been done for the reducing of serum cholesterol (Saad et al., 2013). The elimination of low density lipoprotein (LDL) cholesterol from the body is eligible because too high cholesterol will develop to ischemic heart disease (IHD) (Black, 1992). IHD is state that caused by reduced blood supply or increased myocardial oxygen demand, or both and becomes the leader of death causes for many of years until now (World Organization Health [WHO], 2011). Epidemiological researches have exhibited that strong inverse relationships between high density (HDL) cholesterol and coronary heart disease (CHD) (Clee et al., 2000). Actually, many studies have demonstrated that the coronary heart disease can be reduced up to 2 to 3 percent when 1 percent of serum cholesterol is reduced (Liong & Shah, 2005; Zhang et al., 2007).

Lately *in vitro* researches have verified that synbiotics were more effective than prebiotics or probiotics alone in regulating the gut microflora (Saulnier et al, 2008).