UNIVERSITI TEKNOLOGI MARA

POLYMERIZATION OF LACTIDE TO POLY (LACTIC ACID): EFFECT OF INITIATOR

NAQIBAH BINTI ABDUL MALEK

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ABSTRACT

Plastics are one of the material that responsible for countless aspects of the modern life we enjoy today. It improves our lives due to its flexibility and adaptability that enable them to provide solutions in such a complex world we live in. As the world's population continue to increase, so does the amount of plastics waste produced by people that could surely lead to massive environmental pollution. To overcome this arising problem, there is a strong need to replace the non-biodegradable plastics with the biodegradable one. Poly (Lactic Acid) (PLA) is one of the most promising and popular material of biopolymer in the production of biodegradable plastics. The aim of this study were to produce PLA by polymerization of lactide through ring-opening polymerization (ROP) method by using stannous octoate, $Sn(Oct)_2$ as catalyst and to investigate the effect of initiator towards the characteristics of the PLA produced by using UV-Visible Spectrophotometer (UV-Vis) and Fourier Transform Infrared Spectroscopy (FTIR). The experiment was conducted at constant temperature of 120°C for 3 hours in bioreactor by using different types of initiator (1-dodecanol, 1-octanol and methanol). The result obtained from UV-Vis shows that the concentration of PLA increase as the reaction time increase for reaction initiated by methanol and 1-octanol but decrease half-way for 1-dodecanol. The spectrum obtained from FTIR shows that all of the three types of initiator have successfully revealed all the functional group contained in PLA. In overall, methanol is the most effective initiator in polymerization of lactide.

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CHAPTER 1
INTRODUCTION

1.1 RESEARCH BACKGROUND

Poly (Lactic Acid) (PLA) is a polymer that can be derived from renewable resources such as cassava roots, corn starch and sugarcane. Nowadays, PLA is an essential polymer that has been widely used in many areas such as medical equipment and food packaging.

The issue on non-biodegradable plastic waste disposal has been on rise due to its massive bad impact to environment such as contamination. Hence, extensive study has been done on how to solve the arising problem and it has come the time to replace the non- biodegradable plastics with products that can be degradable and environmentally safe (He et al., 2013). Thus, PLA is the most suitable polymer to use in the production of plastics as it has excellent characteristics in biocompatibility and biological degradation. The ability of biodegradable plastics to naturally decompose into safe by-products with the presence of microorganisms will surely help to resolve the environmental pollution such as contamination of soil. Besides its environmental friendly properties, study shows that fresh products and perishable foodstuffs placed in biodegradable plastic could remain fresh for a longer time (Van Den Oever et al., 2017). As such, the demand on PLA from plastic production industry has been drastically increased. In 2010, PLA has been the second highest volume of demand for the production of plastics and the demand keep on increasing year by year. Hence, this study is to do a research on the synthesizing of PLA by polymerization of lactide and the presence of PLA produced will be analysed by using UV-Visible Spectrophotometer (UV-Vis) and Fourier Transform Infrared Spectroscopy (FTIR).

PLA production can be synthesized in various method such as Direct Polycondensation (DP) and Ring-Opening Polymerization (ROP). In this study, the production of PLA through ROP has been our interest since it has many advantages over the other method as it requires low reaction time and it does not involve difficult operation such as vacuum condition.