CHAPTER ONE

OBJECTIVE OF THE PROJECT

1.1 General Introduction

Disposal of synthetic plastic materials could cause serious threat to the environment due to their non-biodegradability. Even though, incineration or landfilling was introduced to the solid waste management authorities both practices are still unable to solve the environmental problem. Incineration results in release of carbon dioxide (CO_2) and other toxic gases which deteriorate the air. Landfills could become clogged with disposed plastic materials, and this would hinder leachate flow. Programme such as recycling was introduced to reduce the amount of plastic wastes. However, the practice involves high costs. These indicate that none of the methods would be the ultimate solution to the problem of environmental pollution. Owing to environmental awareness, researchers have reported the availability of alternatives to these petrochemical-based plastics, namely biodegradable plastics (Page,1995).

Among the biodegradable plastics, bacterial poly-β-hydroxyalkanoate (PHA) has drawn much attention. PHA is a general class of polyesters produced naturally by bacteria. It is a lipidic cellular inclusion accumulated by bacteria as internal reserve of carbon and energy (Anderson and Dawes,1990). Its accumulation is in response to the unbalanced growth conditions in the presence of excess carbon. These bacterial polyesters have thermoplastic properties and can be produced from renewable resources. Hence, they have attracted much attention as environmentally degradable

plastics. Owing to its properties, PHA can be formed into films, fibres and sheets and moulded into shapes and bottles. These offer a possible wide range of applications in the area of agriculture, marine, pharmaceutical and medical (Hrabak, 1992 and Brandl, *et al.*,1995). However, the high price of PHA compared to present conventional plastics has limited its availability in wider applications. Therefore, in general one of the main aims of PHA studies would be in reducing its production cost.

One of the approaches to reducing the production cost is to use relatively inexpensive and readily available carbon source as feedstock. Secondly, is by improving the productivity of PHAs synthesis. Hence, much effort has been devoted to achieve this, particularly, by employing superior microorganisms and efficient cultivation techniques.

Cultivation techniques such as fed-batch fermentation has been the most popular method to achieve high cell density, which is often necessary for high productivity and yield of any desired product (Yamane, *et al.*,1988). Therefore, to demonstrate this, *Pseudomonas oleovorans* was cultivated in batch and fed-batch modes where oleic acid (OA) or saponified palm olein (SPO) was used as carbon substrate.

At room temperature (28°C), palm oil would fractionate into a liquid fraction known as palm oilein and a solid fraction known as palm stearin. Previous work (Tan *et al.*, 1997) reported that *Pseudomonas putida*,

utilised saponified palm kernel oil (SPKO) for growth and PHA accumulation. The PHA was characterised as a medium chain length PHA (MCL_{PHA}). Its stickiness in character provides a possible application as an adhesive. As a continuation to that study, *Pseudomonas oleovorans* which is known to be able to grow on fatty acids and produce MCL_{PHA} would be tested on its ability to utilise palm oil as the carbon source.

This research study would also be looking at isolation of local bacterial isolates from Palm Oil Mill Effluent (POME) because such isolates are envisaged to readily utilise palm oil as carbon source and produce PHA with novel properties.

1.2 Objectives

The first objective of my studies was to compare the yield of biomass and PHA of *Pseudomonas oleovorans* grown on palm olein or oleic acid by using a batch and fed-batch system.

Concurrent to the above studies, bacterial strains were isolated from POME and screened for PHA-producing ability. The objective was to obtain bacterial strains which could utilise palm oil to make PHA.