Chapter 1

Introduction

Thailand's value of energy consumption had been increasing each year. In 2012, the nominal terms of energy consumption in Thailand totaled 2,139 billion Baht (approx. US$ 57.7 billion, at a rate of 31 THB/US$), an increase of 10.2% from that in 2011. Petroleum product consumption was worth 1,311 billion Baht, an increase of 7.4% compared with the previous year, accounting for the largest share of 61% of the total energy consumption value. The worth of diesel consumption increased by 10.6%, accounting for the largest share (48%) of the total petroleum product consumption value (EPPO, 2014). Hence, Thai government tries to promote the policy on energy efficiency improvement and alternative energy development, i.e. the use of liquid biofuel.

Liquid biofuel can be produced from biomass (Vasudevan *et al*., 2005; Nigam and Singh, 2010), by fermentation of sugar into alcohol (bioethanol and biobutanol), or the transesterification (triacylglycerol) to produce mono-alkyl ester (biodiesel). Biodiesel, as the name implies, can be used as an alternative to petrodiesel. Many plant oil, such as soybean, sunflower and rapeseed are currently used as feedstock for biodiesel production (Vasudevan *et al*., 2005).However, they are food crop which are not most desirable feedstock for biodiesel as they can compete directly with the food supply. Thus many countries have been carried out to look for plant bearing non edible oil as potential biodiesel feedstock (Chhetri *et al*., 2008).

Jatropha curcas L., the common name physic nut is a shrub plant in the family Euphorbiaceae and is popular energy crop in tropical countries, because of its seed oil content and non-edible vegetable oil. It has potential of providing a promising and commercially viable alternative to petro-diesel (bio-diesel) (Koh and Gazhi, 2011). However, it still has some limitations, i.e. difficult to harvest and produce low yield.

The last decade witness a blooming interest in the development of in vitro culturing technology for the energy crop *J. curcas* L. Plant cell culture techniques provide an alternative approach to the plants which are difficult to cultivate and would help in producing the active compounds in vitro with better productivities without cutting down the natural resources. There are important tool for basic plant biochemistry and molecular biology which dedifferentiated cultures (callus and cell suspension culture) can be useful for study tissue-specific biosynthetic pathways (Garg *et al*., 2011; Attaya *et al*., 2012).

Endosperm plays an important role in life cycle of angiosperm. In *J. curcas* L., its play an important role in accumulation of *J. curcas* L. seed oil (Gu *et al*., 2012). Endosperm is formed during the process of double fertilization as a result of fusion of three haploid nuclei : two origin acting from the embryo sac (polar nuclei) and one from male gamete; hence it is triploid. Triploid plants are reported to have an apparent effect on many physiological properties of a plant. The most discernable of these has been the increase in secondary as well as primary metabolism. They are reported to have some advantage over diploids, show better grain filling, enhanced photosynthetic ability, delayed maturity, increased biomass and high oil content (Li *et al.*, 1999). Endosperm culture is an alternate way to produce the triploid plant.

Nowadays, the studies on the lipid production from endosperm culture of *J. curcas* L. have not been carried out extensively. This dissertation was attempted to study on the lipid production from endosperm suspended cell of *J. curcas* L., both in vitro and in the bioreactor. It may be espected that the information gained from these studies will provide better understanding in the lipid production from endosperm suspended cell of *J. curcas* L., better a formulation of medium and conditions that could be used to induce oil production from endosperm suspended cells in vitro and in the bioreactor. In addition, the results from these studies will beneficial for development into commercial production in the future.

Objectives of the experiments

1. To find out a formulation of medium that could be used to induce callus from the endosperm of *J. curcas* L.

2. To improve a formulation of medium and optimum condition that appropriate for growth and oil production from endosperm suspended cell of *J. curcas* L.

3. To optimize the conditions that maintain growth, produce highest lipid content (percentage of total lipid extract, %TLE) from endosperm suspended cells of *J. curcas* L. in a bioreactor.