CHAPTER 1

GENERAL INTRODUCTION AND THESIS OUTLINE

Thermophilic and thermotolerant microorganisms can typically be found in hot spring ecosystems. Attached algal populations that include several genera of the Cyanophyta and Bacillariophyta species are particularly found in this extreme habitat (Smith and Smith 1955). Diatoms are benthic microalgae in the Division Bacillariophyta that play crucial roles in aquatic ecosystems. They are the primary producers in the food chain and produce oxygen in aquatic ecosystems via the process of photosynthesis. They are efficient atmospheric carbon dioxide absorbers, which accordingly contribute to a decrease in global warming.

Diatom species are one of the types of microalgae that are able to grow in an extensive range of temperatures. They could be found in water bodies with temperatures ranging from 10°C to 45°C in extreme habitats (Round *et al.* 1990). Additionally, the distribution of diatoms has been established and distributed within a range of low and high limits of conductivity tolerance (Hamed 2008). Milligan and Morel (2002). It has been proposed that the silica in the diatom cell walls performs as a sufficient pH-buffering agent and helps the transfiguration of bicarbonate to dissolve CO_2, which is more willingly adapted. Thus, the selection of suitable diatom species for the purposes of cultivation while sustaining high lipid contents and growth rates could support an efficient and supportable production chain.

While diatoms are presently found to be abundant and diverse in nature, few hot spring species have currently been identified and used in biotechnologically applications. Besides, diatoms are very encouraging microorganisms for the potential generation of biofuels (Hildebrand *et al.* 2012) due to their pervasive incidences and competitive advantages when compared to other microalgae (under reasonable, controllable conditions). Thus, this allows researchers to consider persistently differing

the species that are cultivated to even more rare varieties as available optimal organisms. Moreover, they grow rapidly, multiplying their biomass in a couple of hours. Particularly, lipid portions have been reported as high as 70 – 85% in a number of diatoms, but 15 – 25% is a more conventional yield. High growth rates, along with significant lipid productivities, make diatoms a potentially good source for either bio-oil or bio-crude production. The accessibility of silicate allows them to effortlessly control their growth while the majority of their biomass can be gainfully utilized.

In previous studies, researchers have focused their attention on hot spring ecosystems in Thailand. Though the primary objective of their studies involved the study of cyanobacteria, the presence of a small range of genera of diatoms has been reported. There have also been a few studies on hot spring diatoms in Thailand. Consequently, the main purpose of this research study was to investigate the distribution of hot spring diatoms. Additionally, the cultivation and application of hot spring diatoms as a new source of lipids for bio-oil production will be investigated. The acquired knowledge from this research study will provide vital information for both the academic and industrial sectors.

Research Objectives

1.1 To study the distribution and diversity of hot spring diatoms in certain hot springs of northern Thailand

1.2 To determine the relationship between hot spring diatoms and certain water temperature and pH by varying the cultivation process to produce high levels of biomass and lipid content in order to evaluate their potential for biofuel production.