# CHAPTER 1

## Introduction

Viruses are obligate intracellular microorganism. They are too small to be seen by optical microscopes. Patterns of virus infection can be divided into a number of different types such as abortive, acute, chronic, persistent infection and latent infections (Cann, 2012; Dimmock *et al.*, 2007). In latency, the virus is able to down-regulate gene expression and enters an inactive state with strictly limited gene expression without ongoing virus replication. Latent virus infections typically persist for the entire life of the host. An example of such an infection in humans is herpes simplex virus (Brook *et al.*, 2010; Kott *et al*., 1998).

Herpes simplex virus (HSV) is a causative agent of cold sore and causes various kinds of illness in human such as localized infection or systemic infection. Patients can be infected with asymptomatic symptom or the most severity lead to death in disseminated disease. The incubation period is about 6-7 days (Daheshia *et al*., 1998). Herpes simplex viruses are divided into 2 types; HSV-1 and HSV-2. Both types of HSV are characterized by their propensity of latency in sensory neural ganglia. Thus, the viruses remain in the body for the lifetime and latent viruses are reactivated from nerve ganglia leading to the main problem of disease in both developed and developing countries. The site of latency is the trigeminal ganglion in HSV-1 infection and the sacral ganglion in HSV-2 infection (Serkedjieva and Ivancheva, 1998).



Several anti-HSV agents are quite expensive and some drugs have side effect. In prolong therapy may result in drug resistant HSV and become an issue of increasing clinical importance (Tolo *et al*., 2006). Moreover, other nucleoside derivatives, famciclovir, ganciclovir, penciclovir, valaciclovir and vidarabine have been approved for treatment HSV infection worldwide. However, these synthetic drugs have high cost,

and viral resistance against antiviral drugs may emerge after receiving long-term prophylactic treatment. Virus latency also remains unsolved problem. These lead to important clinical problems that affect high dose of drug to treat the disease and ineffective therapy (Greco *et al*., 2007; Lipipun *et al*., 2003).

Many researches interested in the biological substances from nature to substitute the synthetic agents. In this study, antiviral activities of *Spirogyra* spp. extracts were investigated against HSV-1 and HSV-2. *Spirogyra* spp. or Tao is green macroalgae and it has filamentous cell, outer mucilaginous sheath and commonly found in freshwater areas. Tao is well-known consumed green macroalgae with valuable nutrition. Moreover, the prior report showed high efficacy of *Spirogyra* spp. as an antioxidant source, which analyzed by ABTS radical assay when compared with the other freshwater algae. This algae have abilities to inhibit free radicals such as OH radical, lipid peroxidation and superoxide anion radical ($O_2^-$). In addition, *Spirogyra* spp. extract could inhibit and protect injury in stomach ulcer from inductive with stress, HCL/ethanol solution and indomethacin treatment (Duangjan *et al*., 2009; Kartal *et al*., 2009; Mandal *et al*., 2008).

Therefore, anti-HSV acitivities of *Spirogyra* spp. extracts that affected various stages of viral multiplication cycle such as viral attachment and viral replication were performed in this study. Effects on viral particle, viral DNA and proteins were also investigated. The active substances from this extract that affected the virus were determined and product containing *Spirogyra* spp. extract was developed as a new therapeutic agent.



Objectives of the study

1. To study anti-HSV activities of *Spirogyra* spp. extracts.
2. To determine mechanism of HSV inhibition of *Spirogyra* spp. extracts.
3. To investigate bioactive compounds of *Spirogyra* spp. that confers anti-HSV activity.
4. To produce algal product for inhibition of HSV infection.