CHAPTER 1
GENERAL INTRODUCTION

1.1 Statement and significance of the problem

Free radicals, including the superoxide radical ($O_2^{\cdot-}$), hydroxyl radical ($^{\cdot}OH$), and lipid peroxide radicals have been involved in many diseases such as aging, cancer, cardiovascular disease, diabetes, gastrointestinal inflammatory diseases, liver disease, and other inflammatory processes. These reactive oxygen species (ROS) are chemically reactive molecules containing oxygen which are highly reactive due to the presence of unpaired valence shell electrons. ROS are produced in biochemical processes in the body and increased when expose to environmental stress (UV or heat) or dietary xenobiotics. The ROS are unstable molecules, which are the main initial reactants for further reaction with the parent molecules in chemical chain reaction. The chemical chain reaction has 3 steps; initiation, propagation, and termination step. The reaction caused in cell damage is known as the oxidative stress. The body's antioxidant systems, including superoxide dismutase, catalase, and glutathione, have protected the oxidative processes. There are many kinds of nutritional antioxidants such as flavonoids; vitamins A, C, E; the minerals selenium and zinc; coenzyme Q10, lipoic acid; and L-cysteine. A great number of plant medicines contain flavonoids, which have been reported in antioxidant, antibacterial, anti-inflammatory, antiallergic, antimutagenic, and antiviral activities. Flavonoids have been shown in a number of studies to be the potent antioxidants which are capable of scavenging hydroxyl radicals, superoxide anions, and lipid peroxy radicals(1). Therefore the natural flavonoid antioxidants can decrease cell damage which involves in many diseases such as aging, cancer, and other inflammatory processes. The natural antioxidants, flavonoids or bioflavonoids, are polyphenolic substances which are presented in most plants, concentrating in seeds, fruit skin, fruit peel, bark, and flowers. The flowers of *Butea monosperma* could be easily found the northern of Thailand especially Chiang mai, and were reported for its antioxidant

activities (2-3). However, the studies for its active components and suitable delivery devices are relatively scarce.

Butea monosperma (Lam.) Taub (Syn. *Butea frondosa*; Family Papilionaceae), popularly known as Flame of the Forest, Bastard teak, or in Thai as Thong-Kwao, is a medium sized deciduous tree of up to 50 feet high with stunning flower clusters, and the trunk is usually crooked and twisted with irregular branches and rough, grey bark (4). *B. monosperma* has been widely used in the traditional Indian medical system of 'Ayurveda'. The roots of *B. monosperma* are useful in the treatment of night blindness and other eye diseases (5). The gum of *B. monosperma* is used to treat microbial and fungal infections (6). The methanol extract of *B. monosperma* seeds show anthelmintic activity (7). The stem bark of *B. monosperma* displays antifungal activity (5). The bark of *B. monosperma* shows the efficacy on dermal wound healing in rats (8). The leaves of *B. monosperma* exhibit ocular anti-inflammatory activity in rabbits, antimicrobial (5) and antistress activities (9). The flowers of *B. monosperma* display antimicrobial (4, 10), and antioxidant activity by DPPH assay (2-3). The alcoholic extract of *B. monosperma* flowers exhibited hepatoprotective (11), antidiabetic (12), anti-inflammatory (13), antiestrogenic (5) and antifertility activities (3). The aqueous extract of *B. monosperma* flowers showed chemopreventive and anti-cancer properties (14). And the non-polar solvent extract from *B. monosperma* flowers have shown anticonvulsive activity (15-16). Literature reviews presented the widely pharmacological activities using of *B. monosperma* especially the part of flowers, such as antidiabetic (12), anti-inflammatory (13) and antioxidant activities (2-3). Therefore, the *B. monosperma* flowers which was reported for their antioxidant activity (2-3), entrapped in the suitable nanoparticle system to increase penetration of active compound in transdermal system.

In recent years, nanotechnology has been widely studied. The nanotechnology is an innovation sciences and develops continuously of the knowledge for making particles size in a range of 10-1000 nanometers (17). The nanotechnology can apply in many fields, especially medical and pharmaceutical fields. One of the important advantages of nanoparticle preparation in pharmaceutical and cosmetic fields are the increasing stability of natural bioactive compounds; such as antioxidant compounds and enhancing penetration of active compound in transdermal system. Thus the

nanoparticle systems may enhance penetration of flavonoid antioxidant compounds in the transdermal system.

Therefore, this research interests in the antioxidant activity of *B. monosperma* flowers extract and development of a suitable nanoparticle system to entrap the *B. monosperma* flowers extract. Isolation of active ingredient(s) of this extract was attempted and the active marker(s) was utilized in the nanoparticle formulation. Because the nanoparticles have more benefits such as increase the stability of extract and increase the product values. Thus, the aims of present research were to investigate the bioactive compounds, the antioxidant activities, and the nanoparticulate systems which are appropriated for the *B. monosperma* flowers extract.

1.2 Aims of the study

1.2.1 To study the antioxidant activity of *B. monosperma* flowers extract

1.2.2 To investigate the bioactive compounds which are responsible for antioxidant activity in *B. monosperma* flowers extract

1.2.3 To find a suitable nanoparticle preparation method for the *B. monosperma* flowers extract