# CHAPTER 1

# GENERAL INTRODUCTION

For some people, the worst part of aging isn't feeling old, but looking old. Pigmentation and wrinkles are described for aging skin. There are 2 ways in which we age. They are referred to as intrinsic factors and extrinsic factors. Extrinsic factors are the result of environmental impact such as wind, pollution, and sun exposure. Just a few minutes of exposure to UV rays over the course of time can have a profound impact on the look and feel of your skin, as well as your overall health. Yin *et al.* (2001) reported that visible signs of aging are caused by excessive sun. UV radiation leads to oxidative stress and causes aging skin. Wearing only sunscreen isn't enough to prevent future UV damage and to repair existing damage (Rosenbaum, 2010). Moreover, as we age, the concentration of natural antioxidants in our bodies declines in parallel with the environmental skin damage caused by free radicals increases. The rate of age pigment formation is increased when there are lots of free radicals. Antioxidants have important roles on skin protection from oxidative damage. Defence mechanisms against the effects from free radical are provided by the action of antioxidant. Lycopene is much more interesting than other active compounds for cosmeceutical applications because of its universal benefits. It has been reported to be the most potential antioxidant over other carotenoid compounds (Anguelova and Warthesen, 2000). It provides photoprotection which protects skin against UV-induced damage. Lycopene is also found to increase collagen synthesis, therefore, it is the potent compound to prevent wrinkles and skin aging. Lycopene can also act as anti-inflammatory, anti-cancer, and anti-mutagenic agents. This compound is powerful to prevent coronary heart disease (CHD), and chronic diseases such as cancer of prostate, lung, stomach, pancreas, colon, rectum, esophagus, oral cavity, breast. Nevertheless, its water solubility is too low but soluble well in oil. The limitation of lycopene solubility will affect the absorption of lycopene as well as its bioavailability.

For cosmeceutical applications, dermal administration is the most suitable route because of its simply, comfortable, and cost effectiveness. Among nanocarrier systems, lipid nanoparticle has advantages over other traditional carrier systems. It is simple and available for a big scale production. Moreover, it reduces irritation, increases the absorption of active compound to skin. It is very useful for protecting photolabile agent from light. Most of the materials, which are biocompatible, are tolerance to the body. Moreover, it can be applied in many topical dosage forms such as gel, cream, lotion, ointment. Hence, to enhance the absorption of lycopene and to reduce patient compliance, dermal lipid nanoparticle will be the most suitable carrier for lycopene. The aims of this study are to prepare and characterize lycopene loaded NLC for cosmeceutical applications and to evaluate lycopene loaded NLC for cosmeceutical applications. The study details were divided mainly into 5 parts.

**Part I:** The preliminary physicochemical properties of lycopene and carriers (lipids and oils) were investigated. The physicochemical properties of lycopene include the solubility of lycopene in different solvents, thermal behavior, crystalline characteristic, lycopene identification, outer physical characterization, biological action (antioxidant activity), and stability of lycopene. The physicochemical properties of carriers include their outer physical characterization, thermal behavior, crystalline characteristics, and antioxidant activities.

**Part II:** Formulations of lipid nanoparticle were optimized. The optimization include the effect of different lipids and oils, production parameters (the amount of the cycle and pressure), and the effect of contact angle were investigated. NLC was developed in comparison with an NE. The effect of surfactant on NLC stability was also study.

**Part III:** Lycopene-loaded NLC was developed. Characterizations of formulation include the effect of lipid, rice bran oil and cholesterol on the state of the internal phase, the effect of rice bran oil and cholesterol on particle size, the effect of rice bran oil and cholesterol on zeta potential, stability, occlusive property. Crystallization behavior of lycopene-loaded NLC was also investigated.

**Part IV:** The effect of lycopene concentration and the physicochemical properties of lycopene-loaded NLC were investigated. The physicochemical properties of lycopene-loaded NLC include the particle size, PdI, ZP, entrapment efficiency, the *in vitro* release study, occlusive property, antioxidant activity and stability.

**Part V:** Topical dosage forms were prepared and evaluated. The evaluations of topical dosage forms include the occlusive property, stability, and *in vitro* antioxidant activity.

**In Chapter 4**, the results and discussion of all preparation systems were reported, and conclusion was given in **Chapter 5.**