CHAPTER I

INTRODUCTION

Microemulsions have recently become increasingly important as potential vehicles for the controlled delivery of cosmetics and for the optimized dispersion of active ingredients in particular skin layers (Sharma *et al.*, 2012). Microemulsions are more suitable for the transport antioxidant vitamins and some minerals which are beneficial to the skin because they have small-sized droplet, much higher surface area and free energy than macroemulsions that make them allowing effective transport system. (Kaufman *et al.*, 2013). Moreover, microemulsion can be fabricated to be optically clear by ensuring that the droplet dimensions are much less than the wavelength of visible light ($d \ll \lambda$) so that the droplets only scatter light weakly (McClements, 2011; McClements & Rao, 2011; Wooster *et al.*, 2008). Microemulsions are acceptable in cosmetics since the relatively small size of the droplets retards the rate of gravitational separation, flocculation, and coalescence processes. For this reason, the storage stability of microemulsions is often much better than that of conventional emulsions (McClements, 2011 and Thakur *et al.*, 2013). Another advantage are non-toxic, hence can be easily applied to skin and do not damage healthy and cells, hence are suitable for human (Sharma *et al.*, 2012).

Microemulsion is thermodynamically stable and optically isotropic transparent colloidal system consisting of oil and surfactant usually in combination with a co-surfactant to form microemulsion with droplet size 100-300 nm or less (Ahmad *et al.*, 2012). Cosurfactants are surface active (Sharma *et al.*, 2012). Microemulsion often requires high surfactant concentration in order to generate very low interfacial tension ($\leq 10-3$ mN/m) and sufficient interfacial coverage to nanoemulsify entire oil and water phases (Wennerström *et al.*, 2006). Hydrophile–lipophile balance (HLB) is widely used for selection of such surfactants (Israelachvilli *et al.*, 1976). High surfactant contents are often not acceptable due to bioincompatibility or cost ineffectiveness. For this reason, co-surfactant enables the alteration of the surfactant efficiency as well as required concentration to form microemulsion (Hiuberts *et al.*, 2012; Sagitani *et al.*, 1980). For complete selfemulsification, its solubility in the formulation components, area of emulsification and droplet size distribution are the controlling parameters (Kommuru *et al.*, 2001). These parameters are influenced by the choice of oil, surfactant and cosurfactant. In the current study, we used the spontaneous emulsification method since it appears to have the greatest potential for industrial utilization due to its low cost and simplicity and can produce microemulsions at ambient temperature by simple metering of an oil–surfactant mixture into an aqueous solution with constant stirring. Because consumers increasingly prefer natural ingredients in cosmetics, the industry is extremely interested in organic skincare (Berry *et al.*, 2010). In an organic phase we use sorbitan monooleate (Span®80) and pclyoxyethylene lauryl ether (Dehydol®) which is a nonionic surfactant mixed with castor oil which are rich in ricinoleic acid that fights off the acne-causing bacteria and sunflower oil which are high concentrated fatty acids that restores hydration of the skin as an organic phase and an aqueous phase we use water mixed with prcpylene glycol (PG), ethanol or glycerol as a co-surfactant. In this study, we want to find the suitable type and amount of surfactants for preparing emulsifying castor oil and investigate on the formation, properties, and stability of microemulsions. PG ethanol and glycerol are water-soluble co-surfactant that modify the bulk physicochemical properties of aqueous solutions, such as density, refractive index, and interfacial tension (Weast, 1985). The addition of these co-surfactant to aqueous solutions may influence to impact the tendency for small droplets to be formed by spontaneous emulsification, and the long-term stability of the systems produced (Anton & Vandamme, 2009).

The aim of this work was to investigate the suitable type and amount of surfactants and the influence of PG ethanol and glycerol on the formation, properties, and stability of microemulsions. In addition, compare the effect of different types of co-surfactants on phase behavior of a pseudo ternary system, the influence of the surfactant to co-surfactant mole ratio and the influence of oil ratio (castor oil and sunflower oil) on droplet growth in water-in-oil emulsions were also studied.