Microemulsion Formulation of Natural Plant Oils for Topical Delivery

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Plant essential oils that can be used as potential antioxidant and antimicrobial as well as aromatherapeutic agent in cosmetic and pharmaceutical use are the growing interest of consumers because of increasing concern about potential side-effect of synthetic additives. They are generally provided in form of macroemulsion and used by diluting it with various vegetable oils and alkanols for topical use which has relatively poor skin absorption and shelf life, and thermodynamically instability producing phase separation on storage time. To overcome these problems, we are developing new and more effective delivery systems such as microemulsions.

Microemulsions are optically transparent, thermodynamically stable, low viscous, macroscopically homogeneous and isotropic nanodispersions with typical sizes of 5 ~ 100 nm of oil and aqueous phase stabilized by an interfacial film of surface active molecules frequently in combination with a cosurfactant. Microemulsions are excellent candidates for novel delivery systems because of thermodynamic stability which has a long shelf life, relatively easy preparation and scale-up without any significant external energy input, the improvement of the solubilization of poorly water soluble compounds for better bioavailability, and high possibility of enhanced absorption behavior. Even though microemulsion system has many advantages, their use in pharmaceutical and cosmetic applications is limited because all components must be biologically and pharmaceutical acceptable.

The purpose of this study is to explore the structural aspect and antioxidant activity of biocompatible and less temperature-sensitive alkanol-free microemulsions containing the essential oils by the presence of non-toxic sucrose laurate as main surfactant and propylene glycol as cosurfactant which is generally recognized as safe (GRAS). The results shown in Fig. 1 demonstrated that globular structures can be observed, coexisting small or big spherical swollen micelles indicating oil-in-water microstructure. The essential oil-based microemulsions have a higher capacity for scavenging free radicals as compared to ethanol-based formulations because of the larger interfacial area. These formulations give an improved shelf life and stability because the encapsulation effect by the surfactant monolayer prevents oxidation and evaporation. The higher interfacial area of microemulsion also has higher bioavailability than a comparable macroemulsion. These alkanol-free microemulsions containing essential oils have significant potential as novel topical delivery systems.

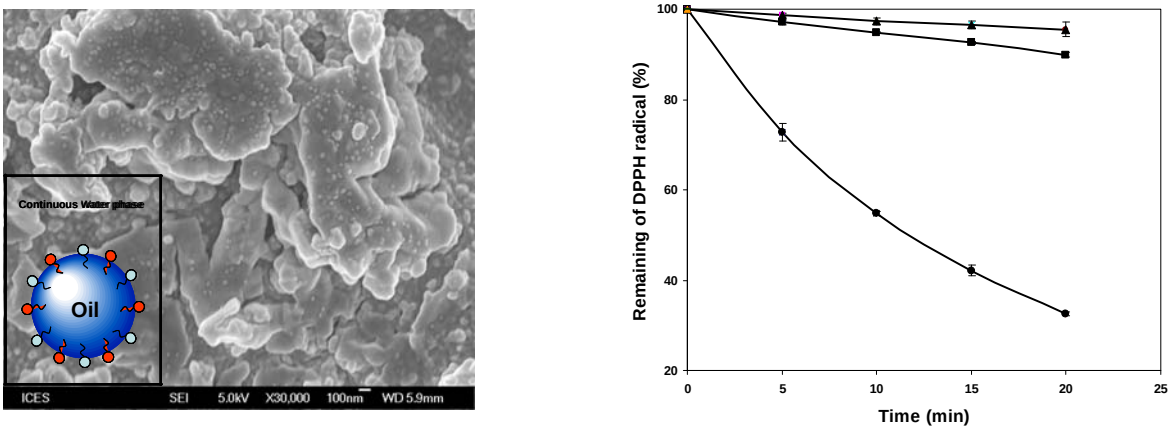

Fig. 1 Cyro-FESEM micrograph (a) and DPPH free radical scavenging activity (b) of microemulsion system consisting of 16 wt% [sucrose laurate + propylene glycol (2:1)]/4 wt% [ethyl oleate + tea tree oil (1:1)]/ 80 wt% water.

References:

“Sugar-based surfactant microemulsions with essential oils for cosmetic and pharmaceutical use”, PCT patent application (2009).

Kim, S.; Ng, W. K.; Shen, S. C.; Dong, Y. C.; Tan, R. B. H., Phase behavior, microstructure transition, and antiradical activity of sucrose laurate/propylene glycol/the essential oil of Melaleuca alternifolia/ water microemulsions. *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 2009, 348 (1-3), 289-297.