ASIAN JOURNAL OF PHARMACEUTICAL SCIENCES 11 (2016) 227–228

HOSTED BY ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/ajps

Factors affecting formation of nanoemulsions containing modified coconut oil and spearmint oil

Kamonchanok Wangjit [a,b], *Chutima Limmatvapirat* [c], *Nattawat Nattapulwat* [a], *Wanchai Sutananta* [a], *Sontaya Limmatvapirat* [a,b,*]

[a] *Department of Pharmaceutical Technology, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand*
[b] *Pharmaceutical Biopolymer Group (PBiG), Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand*
[c] *Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Silpakorn University, Nakhon Pathom 73000, Thailand*

ARTICLE INFO

Article history:
Available online 25 November 2015

Keywords:
Coconut oil
Spearmint oil
Nanoemulsions

Dental caries is one of the major oral health problems in most countries, affecting more than 50% of school children and majority of adults. Normally, we can prevent the disease by utilization of suitable antiseptics, e.g. alcohols and chlorhexidine [1]. However, most antiseptics cause irritation or straining of the mucous membrane and teeth. Therefore, finding a more safe and efficient antiseptics is still a matter of interest to eradicate the causative pathogen. Volatile oils from plants including spearmint oil (SMO) could reduce the number of *Streptococcus mutans* counts in plaques and saliva. Recently, modified coconut oil (MCO) was also introduced as an alternative antimicrobial agent against various microbes. However, the oils are difficult to incorporate into aqueous solutions for oral administration because they have a limited water solubility. Thus, the development of alternative dosage forms should be further investigated. Nanoemulsions are one of the popular systems since they are compatible with water, can be easily removed, are safe and a large amount of oils could be loaded [2]. Therefore, formulation of spearmint and MCO into nanoemulsions should be a possible troubleshooting.

To investigate the formation of nanoemulsions, the pseudo-ternary phase diagrams were constructed by a previously described method [3]. The combinations of MCO and SMO with the mass ratios of 100:0, 75:25, 50:50, 25:75 and 0:100 were used as oil phase. Each oil phase and aqueous solution of Cremophor® RH-40 (surfactant) was mixed in the test tube. The 95% v/v ethanol (co-surfactant) was then added and mixed thoroughly by a vortex mixer. The mixture was checked under light versus a dark background to check for clearness, cloudiness or phase separation. The clear isotropic region or the mis-

* *E-mail address:* sontayal@hotmail.com.
Peer review under responsibility of Shenyang Pharmaceutical University.
http://dx.doi.org/10.1016/j.ajps.2015.11.023

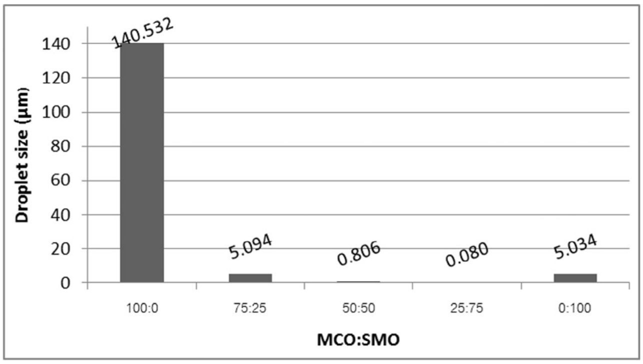

Fig. 1 – Droplet size of emulsions with different compositions of MCO and SMO.

cible area was also later determined for droplet size, zeta potential and physical stability.

The result indicated that a transparent region was observed at the area which contains high percentage of ethanol and oil phases regardless of the composition of the oil phase. However, the weight ratio of oil phase directly affected the droplet size of the emulsions. As shown in Fig. 1 at the weight ratio of 20:15:30 (oils:Cremophor®:ethanol), the MCO alone could not produce nanoemulsions while the droplet size was in the nano range for those containing the combination of MCO and SMO (Fig. 1). For example, the droplet sizes of a formula with MCO:SMO 50:50 and 25:75 were 806 and 80 nm, respectively. Additionally, the droplet size was not changed even under stress conditions. The result revealed the formation of stable nanoemulsions by specific combination of oil phases and surfactant. However, the antimicrobial susceptibility of nanoemulsions needs to be further investigated.

REFERENCES

[1] Karthikeyan R, Amaechi BT, Ralph Rawls H, et al. Antimicrobial activity of nanoemulsion on cariogenic *Streptococcus mutans*. Arch Oral Biol 2011;56:437–445.

[2] Lee VA, Karthikeyan R, Ralph Rawls H, et al. Anti-cariogenic effect of a cetylpyridinium chloride containing nanoemulsion. J Dent 2010;38:742–749.

[3] Faiyaz S, Nazrul H, Fars K, et al. Removal of glibenclamide from aqueous solution using water/PEG-400/ethanol/eucalyptus oil green nanoemulsions. J Mol Liq 2015;203:120–124.