Preparation and Characterization of Nanoemulsion of Marigold Extract

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ABSTRACT

Calendula flower (*Calendula officinalis*) (CF) has been used in herbal medicine because of its anti-inflammatory activity. CF and *C. officinalis* extracts (CFE) are used as skin conditioning agents in cosmetics. Currently, the European Medicines Agency (EMEA) has approved its lipophilic and aqueous alcoholic extracts as traditional medicinal products for the treatment of minor inflammation of the skin and as an aid in the healing of minor wounds. The applications of nanotechnology have been proposed to improve stability of these bioactive compounds from plants. The aim of this study was to investigate the use of the CFE as an active agent for cosmetics. For this purpose, CFE (marigold extract) was incorporated into a nanoemulsion system by using ultrasonication method and the characterization studies were performed. Droplet size and polydisperity index (PDI) of the optimized nanoemulsion were analyzed and found to be 118.1 nm with a PDI of 0.035. Zeta potential of the optimized nanosuspension containing 1% (w/w) Marigold extract was found to be -21.4 mV. It was concluded that a novel cosmetic delivery system was developed for marigold extract in order to be used in cosmetics.

INTRODUCTION

It has been known that the effectiveness of herbal extracts depends on the appropriate delivery of therapeutically active compounds [1].CF also known as Garden Marigold, Marigold and Pot Marigold, is part of the botanical family of Asteraceae [2]. It is used topically as a natural anti-inflammatory medicine and for poorly healing wounds and leg ulcers. Other topical uses include treatment of burns and scalds, bruises, boils, and rashes[3]

MATERIALS AND METHODS

Preparation of Nanoemulsion

Droplet Size Analysis

Mean droplet size and size distribution of nanoemulsions were determined by photon correlation spectroscopy by using a Malvern Zetasizer Nano ZS (Malvern Instruments, UK). Light scattering was monitored at room temperature (25°C) at a scattering angle of 90°. The samples of nanoemulsions were suitably diluted with distilled water (1:100 v/v). Samples were considered polydisperse when the PDI was higher than 0.2.

Zeta Potential Measurement

Zeta Potential is measured by Malvern Zetasizer Nano ZS (Malvern Instruments, UK). For measuring zeta potential, nanoemulsion is diluted with distilled water (1:100 v/v) and its value is estimated from the electrophoretic mobility of oil droplets.

Rheological Characteristics

The viscosity of nanoemulsions was determined without any dilution using Brookfield cone and plate viscometer (Brookfield Engineering Laboratories, Inc., Middleboro, MA) at 25 ± 0.5°C. The viscosity (cP) at different shear rates was also determined. The graphs were plotted between viscosity versus rate of shear to evaluate rheological characteristics of nanoemulsions.

RESULTS AND DISCUSSION

Nanoemulsions of CF extract were prepared successfully by ultrasonic homogenization method with or without premixing. The nanoemulsion was formulated using low level surfactant (Tween 20) and cosurfactant (Transcutol P) mixture that is totally 25% (w/w) of the total emulsion content. By using premixing step before ultrasonication step provided a decrease in the droplet size, PDI and zeta potential (Table 1).

Sample Name	Particle size (nm)	PDI	Zeta potential (mV)
NE with premixing	118.1	0.035	-21.4
NE without premixing	132.7	0.061	-19.6

Table 1. Droplet size, PDI and zeta potential values of the nanoemulsions.

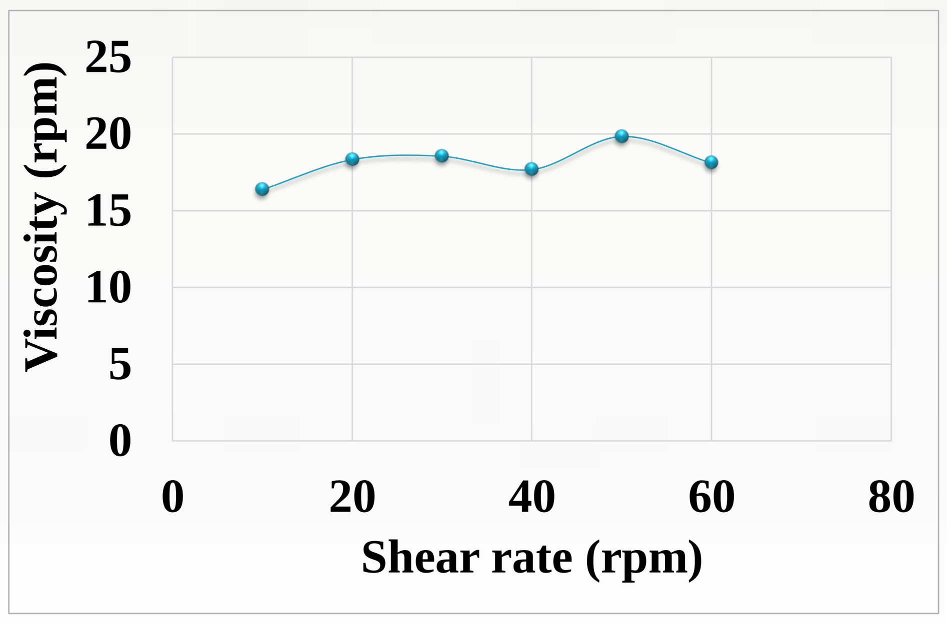

Figure 3. Viscosity graph of the optimized formulation.

With respect to this study, ultrasonic emulsification yields nanoemulsion with minimized droplet diameter with low polydispersity index (Figure 1). For the zeta potential, high negative values were observed in this study (Figure 2). Viscosity of all nanoemulsions was very low, which is one of the characteristics of nanoemulsions. There was no significant change in the viscosity of the nanoemulsions when rate of shear was increased (Figure 3) which indicated Newtonian behavior of the nanoemulsions. These results showed that the optimized nanoemulsion containing CFE with proper physicochemical characteristics was found to be suitable for cosmetic applications.

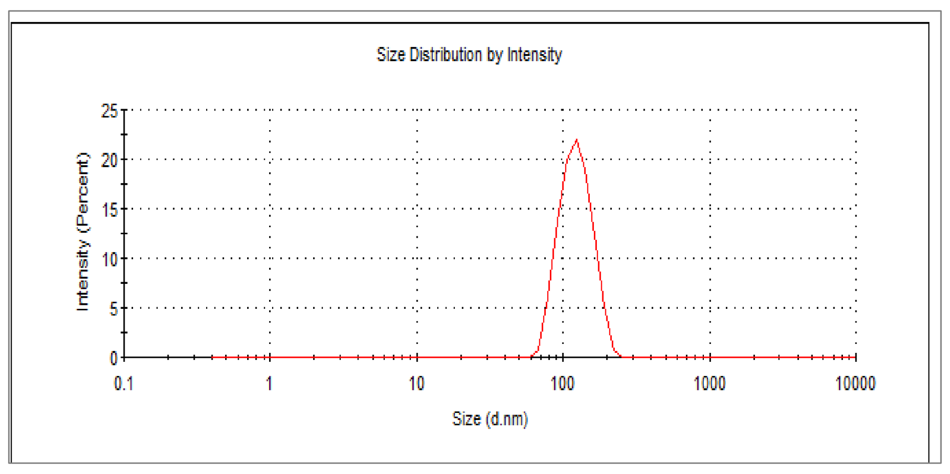

Figure 1. Particle size graph of the optimized formulation.

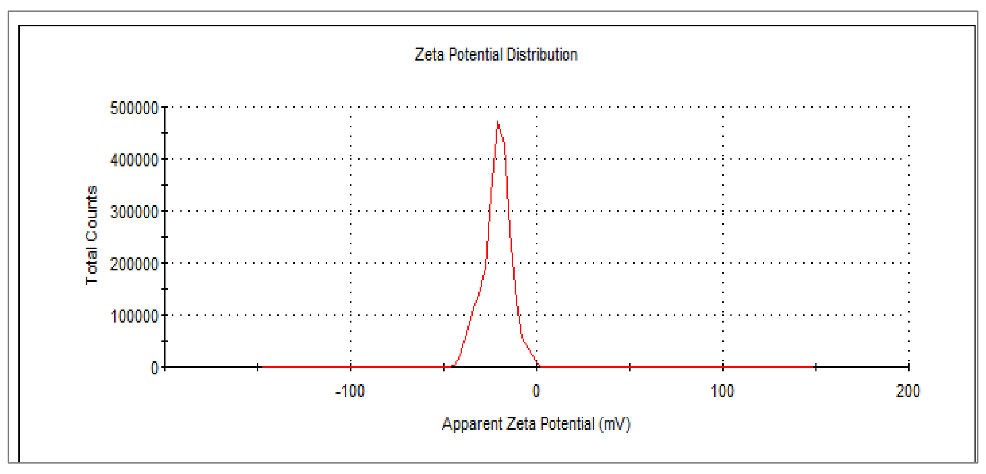

Figure 2. Zeta potential graph of the optimized formulation.

CONCLUSION

The results obtained from this study contribute to a better application of calendula officinalis extract in nanoemulsion form with promising improved stability and therefore for suitable cosmetic applications.

REFRENCES

1. Limthin, D., phromyothin, D. Improving Stability of Nanoemulsion Containing Centella asiatica, Lycopersicon Esculentum Mil. And Moringa oleifera Lam. Extract. *Materialstoday*. **2017.**
2. Kozlowska, J., Stachowiak, N., Prus, W. Stability studies of collagen-based microspheres with Calendula officinalis flower extract. *Polymer Degradation and Stability*. **2019.**
3. T.A. RE et al. Application of the threshold of toxicological concern approach for the safety evaluation of calendula flower (calendula officinalis) petals and extracts used in cosmetic and personal care products. Food and chemical Toxicology. **2009.**