UNIVERSITI TEKNOLOGI MARA

FORMULATION AND OPTIMIZATION OF LONG-CHAIN FATTY ACID NANOEMULSION BY USING SELF-EMULSIFICATION METHOD

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ABSTRACT

Purpose: The specific aim of this study is to find the optimal formulation and conditions in order to produce sunflower oil nanoemulsion which has minimum droplet size and optimum stability by using self-emulsification method. **Methods:** Optimized nanoemulsion formulation of sunflower oil was prepared by self-emulsification method. The nanoemulsion was produced in three systems containing 10%, 15% and 20% sunflower oil respectively. The nanoemulsion was prepared by simple mixing for 10 minutes to get a clear solution. There were three major steps in this experiment: (a) Initial study to choose the best formulation in every system, (b) Further optimization of selected formulation by using several parameters including the concentration of surfactant, surfactant/co-surfactant ratio, mixing time and homogenization processing parameters, (c) Final preparation of sunflower oil nanoemulsion using the best formulation and conditions obtained from all previous study. Then, the efficiency of emulsification was studied using a laser diffraction sizer to determine mean droplet size and distributions of the resultant emulsions. **Results:** From the study, the trend shows that at a constant % sunflower oil (10% and 15%), an increase in surfactant concentration will decrease the droplet size of emulsions produced. The result showed that, the mean droplet size of nanoemulsion decreases with the increasing rotation per minute and mixing time. The best formulation that can produce the lowest mean droplet size was F33, with mean droplet size of 0.182 μm and uniformity of 0.194. The formulation consisted of 10% sunflower oil, 80% glycerin and combination of 10% surfactant/co-surfactant of Tween 80/Span 80 at 3:1 ratio. **Conclusion:** This study signifies the effect of emulsifying parameters such as the type and concentration of surfactants, homogenization speed, time and ratio of surfactant/cosurfactant on the properties of the long-chain fatty acid (sunflower oil) nanoemulsions with the aim of finding the optimal formulation and conditions.

CHAPTER 1

INTRODUCTION

1.1 Research background

An emulsion can be defined as ''a system comprised of two immiscible liquids, one of which is dispersed as droplets (the dispersed or internal phase) throughout the other (the continuous or external phase)'' (Friberg and Larsson, 1997; Becher, 2001). Emulsions are thermodynamically unstable liquid/liquid dispersions stabilized by surfactants, polymers or solids particles. The sizes of the droplets, which constitute the dispersed phase, are in the range from 0.5 to 100 μm (Forgiarini, 2001).

Oil-in-water emulsions are important vehicles for the delivery of hydrophobic bioactive compounds into a range of food products, nutraceuticals, cosmetic compounds, and drugs. But, the efficacy of drug can be severely limited by instability or poor solubility of drug in the vehicle. That is why the design of effective formulations for drugs has long been a major challenge. One of the most promising technologies is the nanoemulsion drug delivery system, which is being applied to enhance the solubility and bioavailability of lipophilic drugs. The nanosized droplets leading to an enormous