

UNIVERSITI TEKNOLOGI MARA

**FORMULATION & OPTIMIZATION OF
LONG CHAIN FATTY ACID
NANOEMULSION USING HIGH PRESSURE
HOMOGENIZER**

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ABSTRACT

Nanoemulsion is a class of emulsions with small, uniformly distributed droplets particle size in the range of 20-500 nm. Nanoemulsions are not thermodynamically stable and their characteristics will depend on the preparation method. One the most common method used to produce nano-emulsion in pharmaceutical industry is by the application of high pressure homogenizer (HPH). Olive oil has many good benefits for health as well as advantages in pharmaceutical application. Olive oil emulsion is one of the products available in the market for the various heath purposes. However, the olive oil nanoemulsion when compared to Olive oil emulsion has good stability and many pharmaceutical advantages such as efficient delivery of active ingredients. Thus, the aim of this study is to investigate the formulation and determination of homogenization processing parameters of the HPH for the optimization of olive oil nanoemulsion. Initial study to obtain good formulation was done by using Tween 80, Span 80, olive oil and water. Once the formulation was obtained, the pre-mixing optimization of the emulsion was studied at the various speeds of the homogenizer and the pre-mixing time. As the speed of the homogenizer and pre-mixing time increase, the droplets particle size measured by using the Mastersizer become smaller and uniform. From this study, the best and suitable homogenizer speed and pre-mixing time was chosen. Then, the pre-mixing emulsion was submitted into the HPH and the optimization study of influence of various HPH parameters carried out. The HPH parameters are the effect of the different pressures of HPH and passing time (cycle number) to the droplets particle size and uniformity of the nanoemulsion. The result showed that as the pressure and cycle number increase, the droplets particle size of the Olive nanoemulsion will become smaller and more uniform. The stability study of olive oil nanoemulsion produced was carried show a good stability and shows no phase separation. Thus, the good olive oil nanoemulsion can be produced by using the high pressure homogenizer.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Emulsion is a metastable system whereby two immiscible liquid phases; usually oil and water are mixed together by emulsifying agent or surfactant. Emulsions can be classified based on morphology. Emulsions that have water as a dispersed phase are called 'direct, water-based, and oil/water' emulsions (Mason *et al.*, 2006). By contrast, emulsions that have oil as a continuous phase are called 'inverse, oil-based, and water/oil' emulsions (Mason *et al.*, 2006). For direct emulsions, the surfactant is generally soluble in water, provides more stability of water films and vice versa for w/o emulsions. In this research, the oil/water (O/W) emulsion type had been preferred to study.

Nano-emulsions also referred as mini-emulsions (El-Aasser *et al.*, 1988), ultrafine emulsions (Nakajima *et al.*, 1997), emulsoids (Lachampt and Vila, 1969), unstable micro-emulsions (Rosano *et al.*, 1981) and submicrometer emulsions (Benita *et al.*, 1998) are the class of emulsions with very small and uniform droplet size typically in the range of 20-500 nm. Due to their small droplet size, they may appear transparent or translucent resembling micro-emulsions (Pey *et al.*, 2006). However, in contrast to