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# The Influence of Tween 80 in The Formulation of Nanoemulsion Virgin Coconut Oil

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**Abstract.** Virgin coconut oil is a functional food oil that is beneficial to health. Nanoemulsion can increase the comfort of using VCO orally. This study aims to determine the effect of Tween 80 concentration on VCO nanoemulsion formulations. The concentration of Tween 80 used in Formula I, II and III is 30%, 20%, and 10%. nanoemulsion was prepared by using the water titration method. Characterizations of nanoemulsion were carried out organoleptic, Phase Separation, globular Size, Polydispersity index, and zeta potential. The results showed that Formula I and II in the form of a clear solution, while Formula III was a turbid solution. The formula I, II, and III are stable during storage. The best formula is F I because it has a globular size of 13.4 nm, the value of polydispersity index 0.265 and Zeta Potential is -1.8 mV.

**Keywords:** Tween 80, Nanoemulsion, VCO

## 1. Introduction

Virgin coconut oil is a functional food oil that is beneficial for health. Several studies have shown that VCO has anti-inflammatory, analgesic, antioxidant, anti-stress, anti-cancer, cardioprotective and anti-microbial effects [1,2,3,4,5,6,7,8]. These pharmacological effects are carried out by chemicals in the VCO which contain medium-chain fatty acids (lauric, myristic, palmitic, capric, stearic, oleic, and linoleic acids), tocopherols and phenolic compounds [9,10].

Virgin coconut oil on the market is still in the form of oil if taken orally directly will cause a sense of discomfort. Therefore, it is necessary to develop a suitable dosage form as formulated in nanoemulsion dosage forms. Nanoemulsion is a thermodynamically stable, clear preparation and has a very small globule size [11].The components of nanoemulsion generally consist of oil, surfactants, and cosurfactants). The oil-water surface tension is lowered by Surfactant, in some cases, it is necessary to add cosurfactant. Nonionic surfactants are usually used more in the manufacture of nanoemulsions than ionic group surfactants because they have lower toxicity [12]. Tween 80 is one of the non-ionic compounds. Tween 80 can generally be used in food, cosmetics, and some pharmaceutical preparation formulas [13]. This study aims to determine the effect of variations in concentration of tween 80 in VCO nanoemulsion formulations.

## 2 Methodology

### 2.1 Materials

The chemicals used in this study were Virgin Coconut Oil, Tween 80, distilled water obtained from PT. Bratachem.

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### 2.2 Methods

#### *2.2.1 Nanoemulsion Preparation*

VCO nanoemulsion formula was made with three variations of Tween 80 concentration as stated in table 1. Water titration method was used to make VCO nanoemulsion. Tween 80 was mixed with VCO using a magnetic stirrer with a speed of 400 rpm for 30 minutes. Aquadest was added dropwise for 20 minutes and sonication for 15 minutes.

**Table 1.** Composition of VCO nanoemulsion

| Components | Percent composition of different Formula (% b/b) | | |
|---|---|---|---|
| | FI | FII | FIII |
| VCO | 3 | 3 | 3 |
| Tween 80 | 30 | 20 | 10 |
| Distilled water | 67 | 77 | 87 |

#### *2.2.2 Characterization of nanoemulsion*

#### *2.2.2.1 Organoleptic*

Organoleptic observations include color and odor.

#### *2.2.2.2 Stability during storage*

The test is carried out by storing VCO nanoemulsion at room temperature for one month, then phase separation is observed.

#### *2.2.2.3 Particle Size, Polidispersity index and zeta potential*

Determination of particle size and zeta potential was observed using Horiba SZ-100 Particle Size Analyzer (PSA). 100 µL of nanoemulsion sample was dissolved in 50 mL of distilled water. 3 ml of solution was put into the cuvette for analysis.

## 3. Result and discussion

Virgin Coconut Oil nanoemulsion was formed by combination methode. Sonication was useful to help reduce particle size. The mechanism of particle size reduction by utilizing ultrasonic waves that convert electrical energy into physical vibration can reduce particle size up to 0.2 µm [12].

The results of the organoleptic evaluation of nanoemulsion were found in table 2. The formula I and II were clear while in Formula III the color was cloudy. According to Shakeel, et al (2008) [14] nanoemulsion is a transparent and translucent preparation. F III showed that the macroemulsion dispersion system. The appearance of macroemulsion is cloudy or not translucent (opaque), while the appearance of nanoemulsion is transparent or slightly cloudy [15]. The three formulas had a distinctive smell of VCO. There was no phase separation in all formulas. it can be concluded that the three formulas are stable in storage for one month.

**Table 2**. Results of organoleptic test and phase separation

| Formula | Color | Odor | Phase separation |
|---|---|---|---|
| FI | Clear solution | Smell like VCO | No |
| F II | Clear solution | Smell like VCO | No |
| F III | Cloudy solution | Smell like VCO | No |

Droplets size is the most important characteristic of the nanoemulsion. The nanoemulsions have very small droplet diameter size. The droplet size of nanoemulsion is < 100 nm [16]. The result of Droplet size nanoemulsions was shown in Figure 1.

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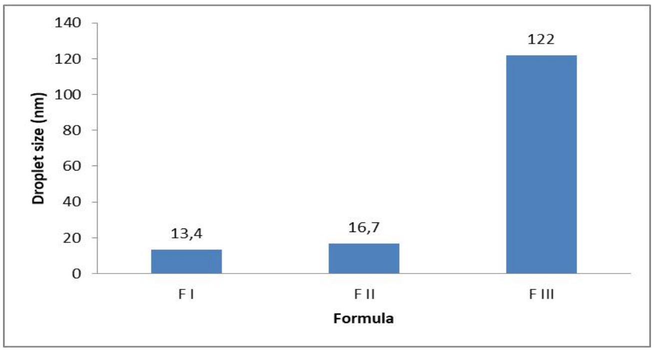


**Fig 1.** Droplet size nanoemulsion VCO

Based on figure I, the formula I and II are nanoemulsion, while Formula III is macroemulsion. Macroemulsion has a particle size above 100 nm [16].

Surfactant concentration also played a major role in droplet size of the nanoemulsion. Increasing surfactant concentration resulted in a decrease in droplet the diameter . The effect of variations in concentration Tween 80 on droplet size is shown in Figure 2.

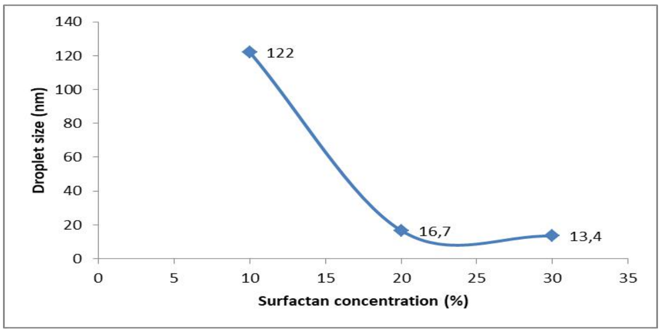


**Fig 2.** Effect of surfactant concentration on the droplet size of the nanoemulsion

Surfactants act as emulsifiers and serve the process by lowering the free energy required for the preparation of nanoemulsion by decreasing interfacial tension at the oil/water interface. In the o / w nanoemulsion system containing nonionic surfactants, surfactants will form a film layer on the surface of the droplet. The film layer will prevent the incorporation of droplets in the dispersing medium [17].

Polydispersity index of the nanoemulsion system describes the globule size distribution. The index values is in the range between 0 (uniform size distribution) to 0.5 (wide size distribution). This polydispersity index provides information about the physical stability of a dispersion system. Low polydispersity index values indicate that the dispersion system that is formed is more stable for the long term [18]. The result showed that all formula have a Polidispersity Index below 0.5. It can be concluded that the three formulas have a uniform size and will be stable in long-term storage.

**Table 3.** Polydispersity index of Nanoemulsion VCO

| Code formula | Polydispersity index |
|---|---|
| FI | 0,296 |
| F II | 0,407 |
| F III | 0,389 |

Zeta potential of nanoemulsion is used to characterize the charge on the droplet surface. The zeta potential value can show the stability of a system containing dispersed globules through the repulsion between the same charged particles when close together. The zeta potential value greater than (+30) mV or less than (-30) mV will be electrostatically stable, while the zeta potential value greater than (+20) mV or less than (-20) mV will be stable sterically [18]. The Zeta Potential of FI, FII, FIII -1.8; -37.4; -34.9 respectively (Fig. 3). Only zeta potential FI according to the requirements.

Tween 80 used in the formulation is a nonionic surfactant that has no charge on its hydrophobic group so that the surface of the oil droplet covered by this

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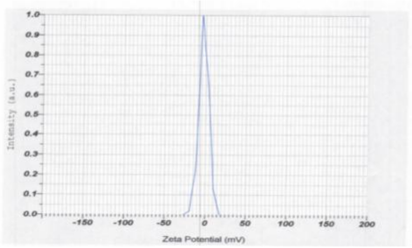
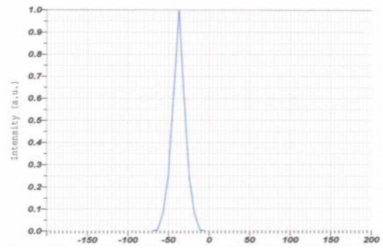
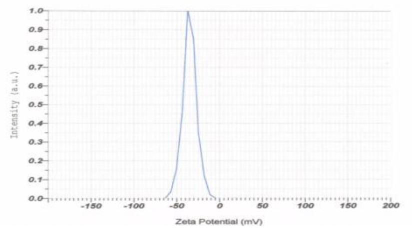
surfactant tends to be uncharged as seen from the low zeta potential value. in this case the possibility of stability of nanoemulsion VCO through a steric stability mechanism.



FI



FII



FIII

**Fig 3.** Zeta Potensial of nanoemulsion VCO

## 4. Conclusion

The results showed that droplet size and nanoemulsion stability were influenced by the concentration of tween 80. The best formula is F I because it has a globular size of 13.4 nm, the value of polydispersity index 0.265 and Zeta Potential is -1.8 mV.

## 5. Acknowledgments

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