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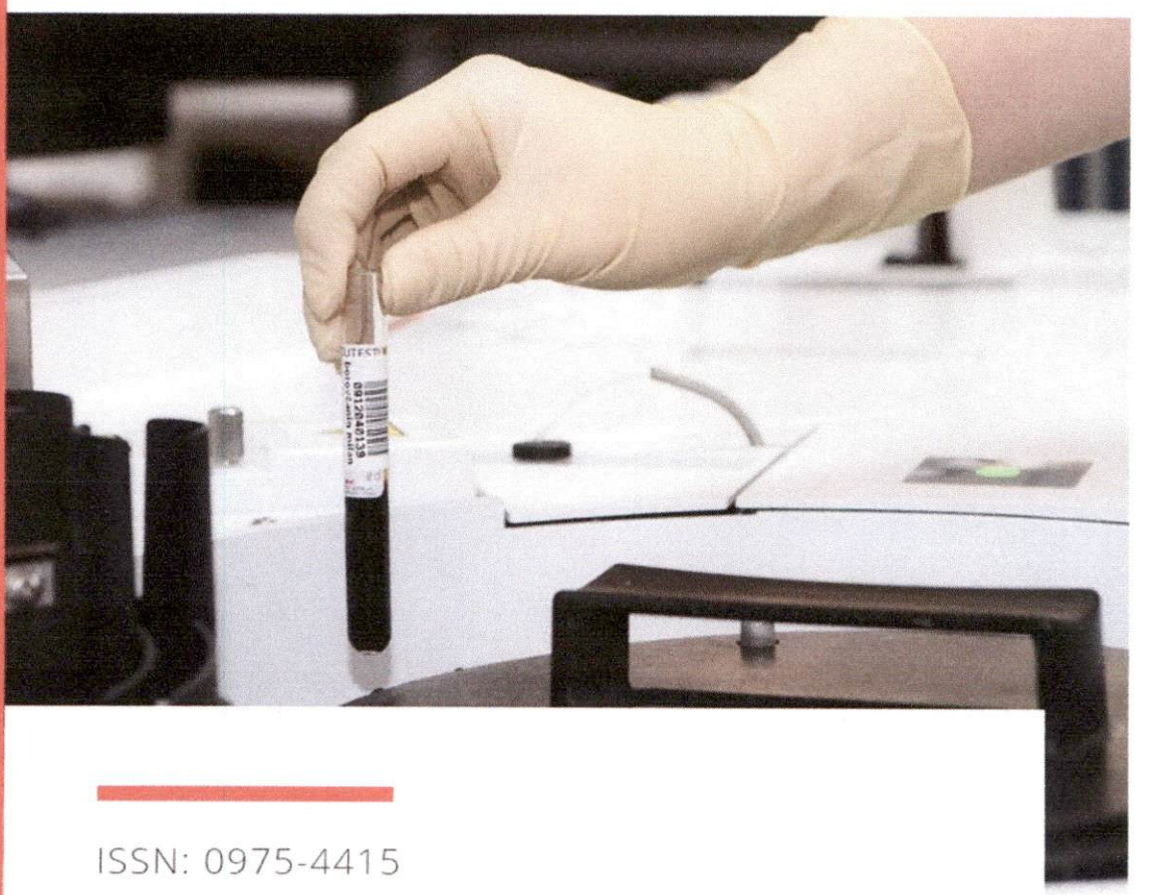

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Research Article

Virgin Coconut Oil as Oil Phase in Tretinoin Nanoemulsion

Tristiana Erawati M*, Retnowati, Amalia Wardatul F, Widji Soeratri

Pharmaceutics Department of Faculty of Pharmacy, Airlangga University, Kampus B UNAIR, Jl Dharmawangsa Dalam Surabaya, 60286.

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ABSTRACT

This study was aimed to determine the characteristic and tretinoin release in nanoemulsion using virgin coconut oil (VCO) as oil phase compared with emulsion. The characteristics of the tretinoin nanoemulsion (TN) were observed in terms of droplet morphology by Transmission Electron Microscopy (TEM) and droplet size by particle analyzer and light microscope and the pH value by pH meter. The release rate of tretinoin in nanoemulsion and emulsion was measured by Franz diffusion cell using cellophane membrane. Result of this research showed the droplet morphology of tretinoin nanoemulsion and emulsion were spherical. The droplet size of tretinoin nanoemulsion (72.57 ± 18.16 nm) was smaller than tretinoin emulsion (10.54 ± 0.61 µm). The pH value of tretinoin nanoemulsion and tretinoin emulsion was 6.24 ± 0.01 and 6.21 ± 0.02. In interval times 5 – 60 minutes the tretinoin release rate (flux) in nanoemulsion was 0.158 ± 0.016 µg/cm^2/minute higher than in emulsion which was 0.048 ± 0.016 g/cm^2/minute. In interval times 60 – 180 minutes, tretinoin release rate (flux) in nanoemulsion was 0.046 ± 0.005 g/cm^2/minute lower than in emulsion which was 0.090 ± 0.016 g/cm^2/minute. In interval times 180 – 720 minutes the tretinoin release rate (flux) in nanoemulsion was 0.025 ± 0.001 g/cm^2/minute which had no significant different compared to in emulsion which was 0.022 ± 0.002 g/cm^2/minute. The statistical analysis of the tretinoin release rate value using independent T-test result was known that there were significant different between nanoemulsion (TN) and emulsion (TE). Conclusion: The droplet size of tretinoin nanoemulsion was below 100 nm, pH value 6.24 ± 0.01 and the tretinoin release rate in nanoemulsion using VCO was higher than in emulsion.

Keywords: Characterization, Nanoemulsion, Release rate (Flux), Virgin Coconut Oil (VCO), Tretinoin.

INTRODUCTION

Virgin coconut oil (VCO) is one of vegetables oil that used as oil phase in nanoemulsion. In the previous study nanoemulsion using VCO produced droplet size smaller than nanoemulsion using corn oil and soybean oil.[1] Smaller droplet size caused rapid drug release that can increase penetration into the skin. Nanoemulsion also known can increase solubility of drug. In this research VCO used in nanoemulsion for delivery system of Tretinoin an antiaging, [2, 3] it was practically insoluble in water. Tretinoin nanoemulsion using VCO was than characterized and tested on the tretinoin release compared with tretinoin in emulsion.

MATERIAL AND METHODS

Research Materials

Tretinoin (PT. Cortico Mulia), virgin coconut oil (VCO), Tween 80 (Sigma Aldrich), Span 80 (Sigma Aldrich), ethanol 96 % (E-Merck), NaH2PO4 (E-Merck) and Na2HPO4 (E-Merck), aquademineralisata (PT Brataco), Methanol (E-Merck)

Research Instruments

Stirrer plate (Dragon Lab MS-Pro), ultrasonic (Branson 3510), shaker machine (Wine shake), pH meter (Eutech Instruments pH 700), particle analyzer (Delsa Nano C), Franz diffusion cell with cellophane membranes, spectrophotometer (Shimadzu UV-1800), Transmission Electron Microscopy (TEM-type JOEL JEM-1400), light microscope.

Methods

Nanoemulsion and emulsion preparation:

Nanoemulsion and emulsion preparation was done by Erawati and Soeratri method.[4] Formulas tretinoin nanoemulsion (TN) and tretinoin emulsion (TE) was presented in Table 1. The tretinoin nanoemulsion was characterized included; pH, droplet morphology by TEM-type JOEL JEM-1400, droplet size and polydispersity index by particle analyzer Delsa Nano C. The tretinoin emulsion characterized included; pH, droplet morphology and droplet size by light microscope.

Release Study

A cellophane membrane was immersed in water for ± 12 hours. It was drained until no water is dripping before used, and then was mounted on the surface of the receptor compartment of Franz diffusion cell. Franz diffusion cell Receptor compartment was filled with phosphate buffer medium pH 6.0 ± 0.2 up to full (temperature 32 ± 2°C, at 100 rpm). Then, 2 ml of tretinoin nanoemulsion or tretinoin emulsion was inserted into the donor compartment. Samples (1 ml) were taken within a certain time interval, i.e. at 0, 5, 10, 15, 30, 45 minutes, and then 1, 1.5, 2, 3, 4, 6, 8, 10, 12 hours. Immediately after

Author for Correspondence: era_ffua@yahoo.co.id

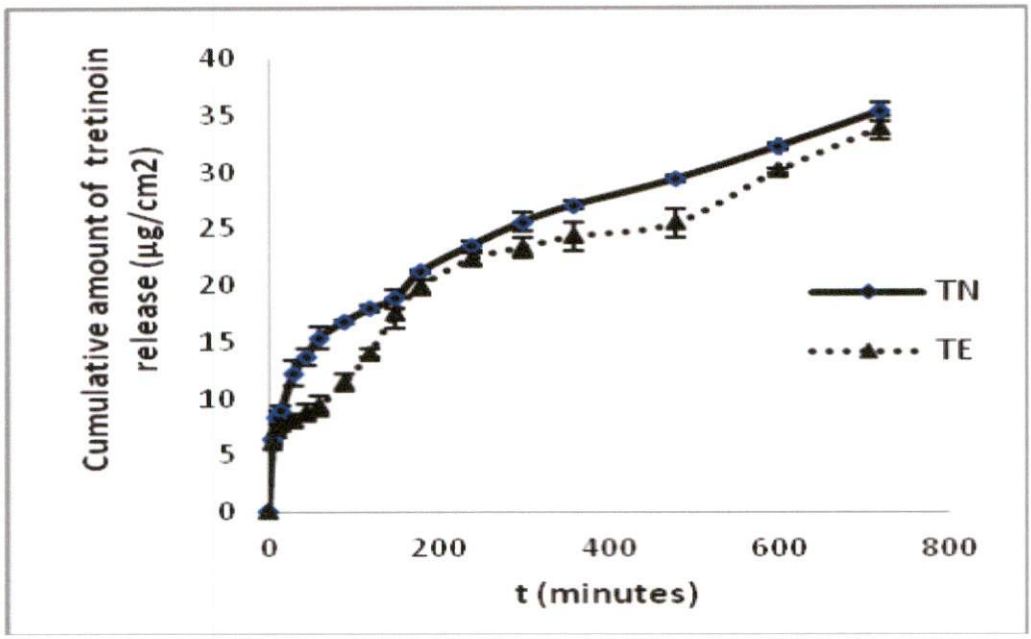

Figure 1: Release profile of tretinoin in nanoemulsion (TN) and in emulsion (TE).

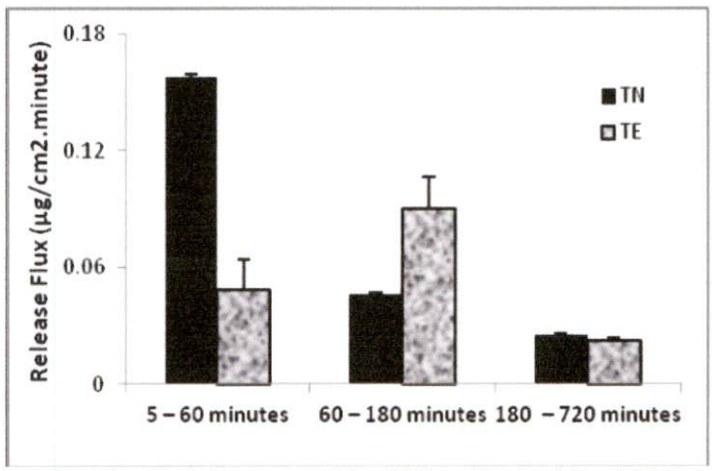

Figure 2: Histogram release flux of tretinoin in nanoemulsion (TN) and in emulsion (TE) in interval times 5 – 60, 60 – 180 and 180 – 720 minutes.

Table 1: Formula of Tretinoin in Nanoemulsion (TN) and Emulsion (TE) using VCO as oil phase.

Materials	Concentration (%)	
	TN	TE
Tretinoin	0.1	0.1
VCO	2.66	1,66
Span 80	1.92	14,17
Tween 80	18.66	6,40
Ethanol 96%	3.42	-
Phosphate buffer solution pH 6.0 ± 0.5	ad 100	ad 100

sampling medium was replaced with phosphate buffer pH 6.0 ± 0.2 with a volume of samples taken. Subsequently, samples were taken and were observed with UV-Vis spectrophotometer. Tretinoin concentration in the sample was calculated using the standard curve regression equation, then correction to the measured concentration using the Wurster equation.

Table 2: Characteristics of Tretinoin Nanoemulsion (TN) and Treninoin Emulsion (TE).

Characteristic	TN	TE
pH	6.29 ± 0.01	6.21 ± 0.015
Droplet size	85.53 ± 6.28 nm	11.70 ± 2.51 µm
Polidispersity Index	0.676 ± 0.05	-

RESULT AND DISCUSSION

The characteristics of tretinoin nanoemulsion (TN) and tretinoin emulsion (TE) included pH, droplet size and polidispersity index was presented in Table 2. The pH value of both nanoemulsion and emulsion tretinoin were in the range of pH skin, it was expected that would not cause irritation when used.

Tretinoin nanoemulsion droplet size was about 85.53 ± 6.28 nm; it was smaller than tretioin emulsion droplet size of 11.70 ± 2.51 µm (Table 2). Droplet morphology of

Table 3: Release Flux of Tretinoin Nanoemulsion (TN) and Tretinoin Emulsion (TE) in interval times 5 – 60, 60 – 180 and 180 – 720 minutes.

Sample	Release Flux in interval times (minutes) mean ± SD (μg/cm².minute)		
	5 – 60	60 – 180	180 – 720
TN	0.158 ± 0.016	0.046 ± 0.005	0.025 ± 0.001
TE	0.048 ± 0.016	0.090 ± 0.016	0.022 ± 0.002

tretinoin nanoemulsion by TEM and tretinoin emulsion by light microscope both was appeared spherical. The release profiles of tretinoin in nanoemulsion (TN) and in emulsion (TE) were presented in Figure 1 and the tretinoin release-rate (Flux) in nanoemulsion and emulsion was presented in Table 3 and Figure 2. From the release profile it was known that there were three interval times that gave different release rate (Flux). In first five minutes, the amount of tretinoin release from nanoemulsion (TN) and emulsion (TE) was equal; it may be caused by tretinoin existing in the water phase. From 5 to 60 minutes tretinoin release rate (Flux) from nanoemulsion (TN) was 0.158 ± 0.016 μg/cm²/minute, higher than in emulsion (TE) is 0.048 ± 0.016 g/cm²/minute. It can caused by droplet size of tretinoin nanoemulsion was smaller than tretinoin emulsion so it more rapid to release. In the second interval times (from 60 to 180 minutes) tretinoin release rate (flux) from nanoemulsion (TN) is 0.046 ± 0.005 g/cm²/minute lower than in emulsion (TE) is 0.090 ± 0.016 g/cm²/minute, it can caused by concentration tretinoin in nanoemulsion became lower than in emulsion. In the third interval times (from 180 to 720 minutes) tretinoin release rate (flux) in nanoemulsion is 0.025 ± 0.001 g/cm²/minute had no significant different with in emulsion which was 0.022 ± 0.002 g/cm²/minute. The result of statistical analysis by independent T-test with degree of confident 95% (α = 0.05), known that release-rate (Flux) tretinoin in nanoemulsion was higher than in emulsion.

CONCLUSION

The conclusion of this study is tretinoin nanoemulsion using virgin coconut oil (VCO) produced droplet sizes below 100 nm, the pH value 6.24 ± 0.01 and the value of tretinoin release rate in nanoemulsion was higher than in the emulsion.

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