Increasing of Lycopene's Antioxidant Stability In Solid Lipid Nanoparticle (SLN) and Nanostrcture Lipid And Carrier (NLC) in Use As Antiaging

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Increasing of Lycopene's Antioxidant Stability In Solid Lipid Nanoparticle (SLN) and Nanostrcture Lipid And Carrier (NLC) in Use As Antiaging

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Abstract- Lykopene is known as lipophilic antioxidant are often used as an anti-aging cosmetic active ingredient. Antioxidants is easily degraded so that its activity is reduced. To improve the stability, lycopene was loaded in nanolipid structure, such as: Solid Lipid nanoparticles (SLN) and Nanostructrure lipid carrier (NLC). Lycopene loaded in SLN and NLC are made with High Shear homogenisation (HSH) method. An antioxidant stability is determined based on IC_{50} value changes. IC_{50} is determined using 1, 1-Diphenyl-2-picrylhydrazyl (DPPH) after being kept in controlled conditions on days 1 and 30. Their oclusivity was determined also. The conclusion is the NLC is able to improve the stability of the lycopene antioxidant and have oclusiviry greater than the SLN. Oclusivity nature can indicate the ability of the formula to retain skin moisture.

Keywords: Lycopene, Solid Lipid Nanoparticles (SLN) and Nanostrcture Lipid Carrier (NLC), setil alcohol, oleic acid.

Background

Lycopene is a lipophilic antioxidant that easily oxidized. It is necessary to improve the stability of lycopene so that it remains effective. One of the delivery system that proper is nanolipid-based systems, such as Solid Lipid Nanoparticles (SLN) and Nanostructure Lipid Carrier (NLC). The emolien effect of lipid can increase skin softness.

This study compared the SLN and NLC ability in maintaining the lycopene antioxidant stability and also on their oclusivity. Solid lipid used was ceryl alcohol, while the liquid lipid used to form the NLC was oleic acid 1.5%. Olcic acid is a fatty acid with the highest content in olive oil and has penerrant enhacher effect. Systems that do not contain liquid lipid referred to SLN. Furthermore lykopene-NLC and lycopene-SLN stability antioxidant were determined on days 1 and 30 by determining of IC_{50} in controlled conditions. Their oclusivity in vitro was also determined. The oclusivity effect related with the ability of retaining skin moisture.

Materials and Methods

SLN made of lycopene 10 %, 10 % ceryl alcohol, 1.5 % tween 80, 20% propilenglikol and acetate buffer pH 4.2 ad 100 % with High Shear homogenization method [1] with a speed of24,000 rpm conducted for 8 minutes at 4 cycle. The NLC made by the same methode and formula, but 1.5 % cctyl alcohol was replaced with oleic acid. Furthermore, their lipid characteristic was analysed by their recrystallization index that was calculated based on the enthalpy value was determined by Differential Thermal Analysis (DTA) [2]

$$\% \text{ Crystalinity index} = \frac{\Delta H_f \text{ formula}}{\Delta H \text{ Lipid phase} \times \text{Lipid Phase Concentration}} \times 100\%$$

The crystal diffraction pattern determined by X Ray Defrakrometer. Do also checks pH, morphology, particle size and particle size distribution with Dynamic Light Scattering (DLS). Trapping efficiency is determined by the method of dialysis and determined by spectrophotometry. Stability antioxidants determined in accordance with the method IC50 1, 1-Diphenyl - 2 - picrylhydrazyl (DPPH) on day 1 dan30 in controlled conditions. IC50 is the concentration of materials to be dampening the free radicals by 50 %. The larger the IC50, the smaller the antioxidants activity. Percent reduction is calculated by the formula (3)

$$\% \text{ peredaman} = \left\{ \frac{A_{\text{control}} - A_{\text{sompel}}}{A_{\text{control}}} \right\} \times 100\%$$

Oclusivity test performed with in vitro methods. Calculated based on the percentage of water that evaporates in a vial covered with a membrane that is smeared preparations and which are not. Membrane used is a membrane filter (cellulose filter with pores 0.45 mm, Whatman no. 4). Observations were made during a week. The oclusivity (F) is calculated by the following formula [4] :

$$r=\left(\frac{B}{A}\right) \times 100$$

Information :
A= The amount of water lost in the control
B = The amount of lost water in the sample

Results and Discussion

Based on the data OTA thermogram single cetyl alcohol, base SLN and NLC base note that due to the addition of oleic acid peak calorimetry be more gentle. It shows become more amorphous. Based on calculations, percent recrystallization index, NLC is lower than the SLN, respectively: 0.32% dan l,0 l%. It stretcher in accordance with the stated Hu et.al (2005) [5] that the decline in the degree of crystallinity of a material due to a lower order of the crystal lattice. The fall in the regularity of the crystal lattice has resulted in active ingredients more easily trapped and not easily terekspulsi out during storage. This makes the NLC able to trap larger lycopene (75.52 ± 2.75%) than the SLN (57.30 ± 5.10%). The presence of lipid liquid, in this case oleic acid, significantly decreased the size of the particles. SLN particle size of 226.67 ± 22.72 nm while NLC 134.03 ± 19.01 nm. Neither the particle size distribution of 0.63 ± 0.03% of SLN and NLC 0.48 ± 0.06%.

Stability is expressed based on changes in antioxidant power IC50. The smaller the IC50, the greater the antioxidant activity. From Figure 1 it appears that at the initial antioxidants activity determination, lycopene has antioxidant power greater than when lycopene is made either SLN or NLC. This caused by lycopene was trapped in the SLN and NLC lipid matrix. After storing for 30 days, the opposite happens that pure lycopene antioxidant activity declined sharply. While the antioxidant activity of lycopene in SLN lower than in NLC. It shows that the NLC system was better able to maintain the stability of lycopene antioxidant compared with SLN. It was related to lycopene trapping efficiency of the system. Lycopene efficiency entrapment of NLC was 75.52 ± 2.75%, while in the SLN: 57.30 ± 5.10%. That made the lycopene had better protected from environmental influences that can accelerate degradation.

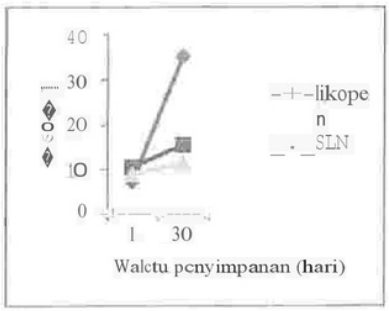

Figure 1 Diagram IC50 of lycopene, lycopene in the lycopene in the SLN and NLC on the 1st and 30th

The result of NLC oclusivity NLC was 40.33 ± 2.08%, higher than the SLN (34.67 ± 2.51%). This can be due to the smaller size of lycopene NLC particle there for no gaps between the particles . Oclusivity effect of nano-sized particles larger than micro-sized particles on the skin. It leads to reduced transcellular evaporation water lost. That's why the nano-sized cosmetic preparation can maintain skin moistur .

Conclusion. The conclusion of this study were: 1) SLN and NLC system were able to improve the stability of the lycopene antioxidant. 2). The NLC delivery system (with oleic acid as a liquid lipid) better to improve the stability of the lycopene antioxidant than the SLN .

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