Stabilization of Ascorbic Acid using Anhydrous Multiple Emulsion

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Background : Vitamin C's function and mechanism are comparatively well known among the several kinds of vitamins. Inhibition of free radical, promotion of collagen synthesis, restraint of melanin formation and resolution of melanin are its main functions.
But Vitamin C is very easy to oxidize by heat, moisture or air so it causes stability problem to make formulation. To solve these problems unique formulating method or derivatives using method could be effective.
Object : First, stabilize 10% of Ascorbic acid as polyol/silicone emulsion and try to make polyol/silicone/polyol anhydrous multiple emulsion secondly. And then, encapsulate with porous power to enhance the stability of Ascorbic Acid from formulating method.
Method : Firstly solve 10% of Ascorbic acid in Polyol and try to make polyol/silicone Emulsion. For second stabilization, make polyol/silicone/polyol anhydrous multiple emulsion using lecithin. And then, for third stabilization, encapsulate multiple emulsion to porous power. Stability test is quantitative analysis method per week in room temperature and 40℃ using HPLC during 2months. Figure out the structure and particle size using particle size analyzer and microscope.
Result : During 2months stability test, 91% of Ascorbic acid is remained in room temperature and 68% are remained in 40℃.
In this research, remarkable result has been achieved on the stabilization of ascorbic acid.
Conclusion : Uncountable researches have been dedicating to stabilize Ascorbic acid and this was also one of the same purpose research. But the consequence of this stability test result shows us polyol/silicone/polyol anhydrous multiple emulsion system is very useful method to stabilize Ascorbic acid.

1. Introduction

L-Ascorbic Acid(AsA. Vitamin C) plays important roles in a great range of cosmetics and active oxygen species and collagen synthesis and whitening agent to inhibit a melanin formation. AsA probably suppresses melanin formation at various oxidative step of melanin formation, such as 5.6-dihyroxy indole oxidation.

AsA is also effective drug-metabolizing enzyme, production of interferon, antiviral, antibacterial and antioxidant action. However, the AsA has a weak stability to oxygen, moisture, heat, acidity, especially in aqueous solution: this is more speedy and being destroyed much portion.

Technological developments, especially stabilizing agents contained in the formulations, resulted in a high level of stability and activity of L-ascorbic acid. The type of emulsion used also seems to be of importance for the stability of an active compound.

The aim of this study is to solve AsA's instability using polyol/silicone/polyol anhydrous multiple emulsion system.

2. Material and method

2.1 Experimental material

The pure Ascorbic acid of Roche is used in this experiment, Cetyl Dimethicone Copolyol of Gold Schmidt. AG is used in primary emulsifier. Hydrogenated lecithin of Phospholipid GmbH is used the secondary emulsifier.

All materials used in this experiment are standard law material for cosmetics.

2.2 Experimental Instruments

The particle size of multiple emulsion is measured by using the laser light scattering system(Malvern, UK, Zetasizer 3000HS): The phenomenon of multiple emulsion is measured with electric microscope (Olympus, Japan, Olympus BX-41).

The stability of ascorbic acid at 25℃ and 40℃ is measured by using HPLC(Waters, USA)

2.3 Experimental method

The primary emulsion is composed of Cetyl Dimethicone Copolyol, Cyclomethicone, Propylene Glycol, Ascorbic Acid, and manufactured by using homogenizer.

The secondary emulsion, polyol/silicone/polyol multiple emulsion is composed of hydrogenated by using homogenizer. The prescription is shown in the table 1.

Table 1. The prescription of anhydrous multiple emulsion.

Primary Emulsion(polyol/silicone)	
Phase A	
Cetyl Dimethicone Copolyol	3.0
Cyclomethicone	15.0
Phase B	
NaCl	0.9
Ascorbic Acid	10.0
Propylene Glycol	to 100
Secondary Emulsion(polyol/silicone/polyol)	
Phase A	
Primary emulsion	20.0
Phase B	
Hydrogenated Lecithin	4.0
Glycerin	56.0

3. Result

3.1 Particle Size

The particle size of multiple emulsion is measured by using the laser light scattery system.(Malvern, Zetasizer 3000HS). Average particle size = 9.84μm.

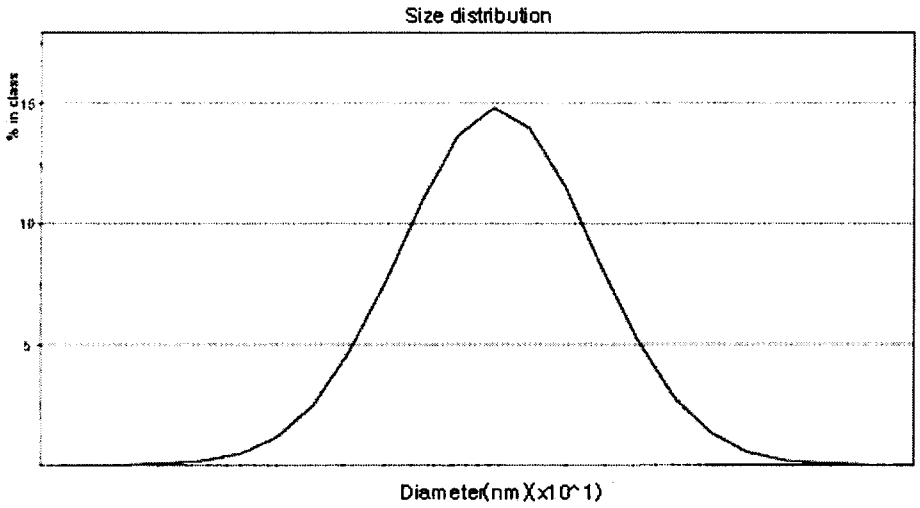

Fig1. Size Distribution

3.2 Image of Multiple Emulsion

The photo image of anhydrous multiple emulsion measured by electric microscope. (Olympus BX-41)

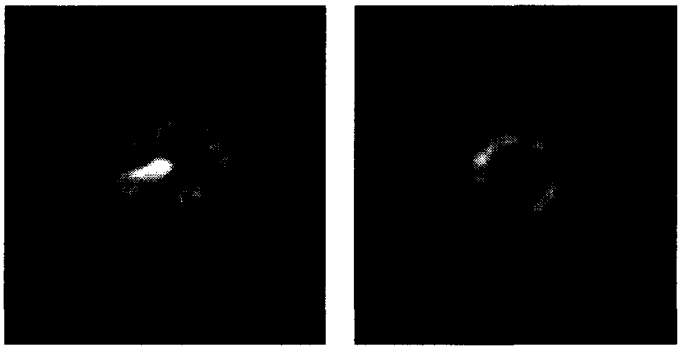

Fig.2 The photo image of anhydrous Multiple emulsion

3.3 The stability of Ascorbic Acid

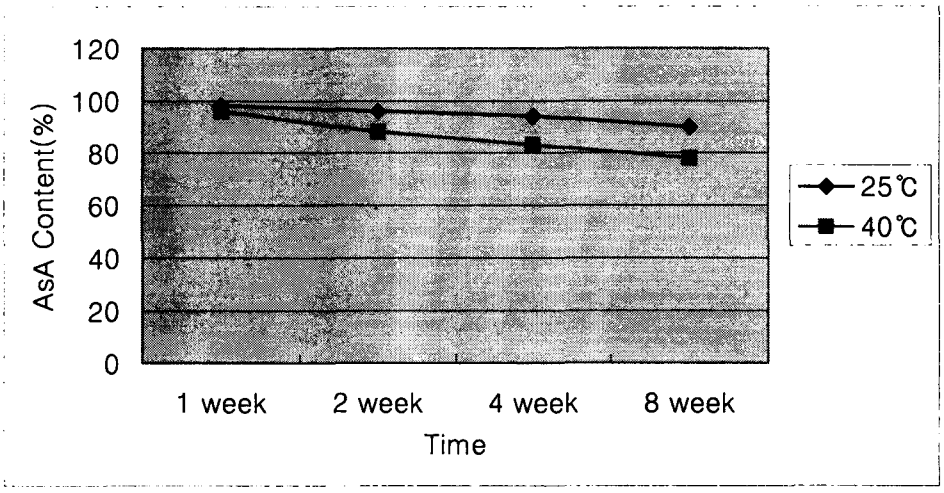

Fig.3 AsA content measured by using HPLC.
After 8weeks AsA's content is 90% in 25℃, and 78% in 40℃.

4. Discussion

We applied the prescription of an ascorbic acid to be stabilized at the cosmetics in this study. The result, 78% of an ascorbic acid content remained in a high temperature(40℃) stability experiment for a month(Fig.3) The consequence of this stability test result shows us polyol/silicone/polyol anhydrous multiple emulsion system is very useful method to stabilize ascorbic acid.
As being more research is achieved in the side to be the sensuous or functional , think that new technique considered to be developed.

5. Reference

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