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Development of microemulsions and sticks containing passion fruit seeds oil

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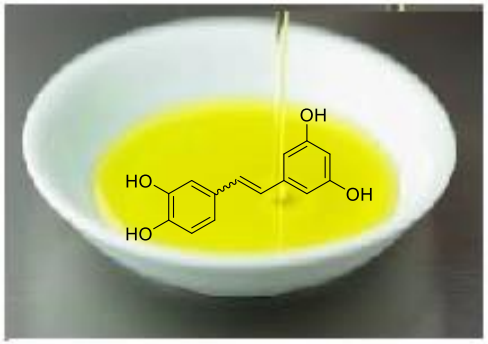
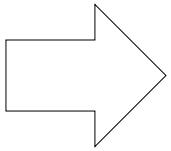
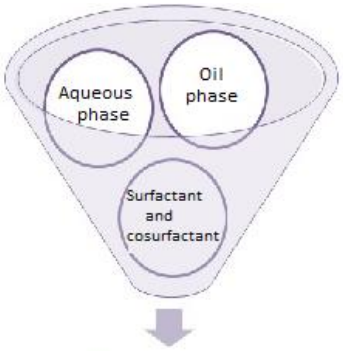
Development of microemulsions containing passion fruit seeds oil

Graphical Abstract



Passion fruit oil





Sonication

HPH

Abstract:

Passion fruit oil has been used on the skin as a moisturizer, antioxidant, and depigmenting, due to its high content of polyphenols. The objective of this work was to evaluate different methods of preparation of microemulsions containing passion fruit seeds oil. For this, it was used the sonication and the high pressure homogenization (HPH) methods under different conditions. In order to characterize the microemulsions, accelerated stability tests, pH and internal phase droplets size measurements were performed. Then, a double face hydrophilic and lipophilic stick was prepared from the microemulsion chosen and characterized according to their hardness and coloration. The results showed that the microemulsion did not change its internal phase droplets size throughout the study. The stick hydrophilic face had lower hardness and showed less color change than lipophilic face. This study showed that it is possible to develop sticks from microemulsions containing passion fruit seeds oil with good stability characteristics.

Keywords: passion fruit; microemulsions; sticks, oil

Introduction

In recent years there has been increased interest in the passion fruit seeds, because from these can be extracted an oil with a high content of unsaturated fatty acids (mainly linoleic acid) and polyphenols, in particular piceatannol [1,2].

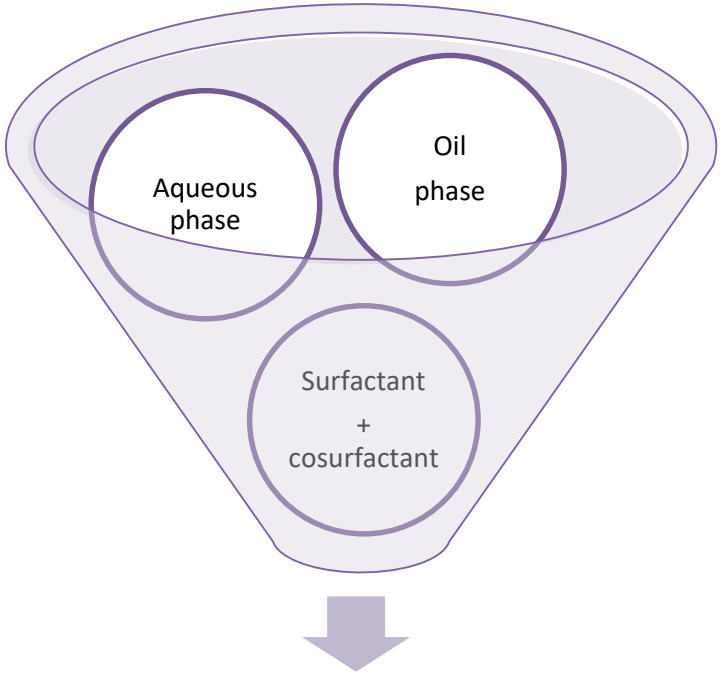
[1] Matsui Y, Sugiyama K, Kamei M, Takahashi T, Suzuki T, Katagata Y, et al. Extract of passion fruit (Passiflora edulis) seed containing high amounts of piceatannol inhibits melanogenesis and promotes collagen synthesis. Journal of agricultural and food chemistry. **2010**;58(20):11112-8.

[2] Maruki-Uchida H, Kurita I, Sugiyama K, Sai M, Maeda K, Ito T. The protective effects of piceatannol from passion fruit (Passiflora edulis) seeds in UVB-irradiated keratinocytes. Biological and Pharmaceutical Bulletin. **2013**;36(5):845-9.

Introduction

Basically microemulsions are thermodynamically stable systems, composed by two immiscible liquids (water and oil) that are mixed to form a single phase by means of a suitable surfactant, often in combination with a co-surfactant [3,4].

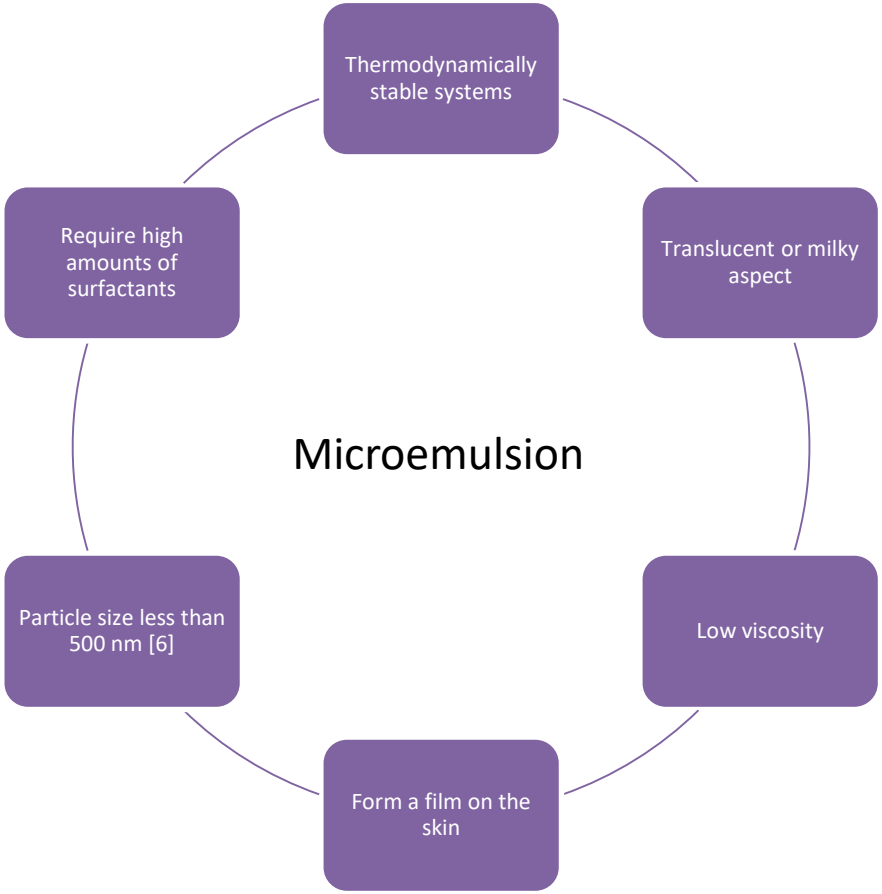
Microemulsions have the ability to deliver both hydrophobic and hydrophilic compounds. [4]



Microemulsion

[3] Shukla T, Upmanyu N, Agrawal M, Saraf S, Saraf S, Alexander A. Biomedical applications of microemulsion through dermal and transdermal route. Biomed Pharmacother. **2018**, 108:1477-1494.
[4] Fanum M. Microemulsions as delivery systems. Current Opinion in Colloid & Interface Science. **2012**, 17, 306-313.

Introduction



[6] Stubenrauch, C. Microemulsions : background, new concepts, applications, perspectives. 9 Blackwell Publishing Ltd.1st ed. India, **2009.**

Introduction

The aim of this work was the development and characterization of microemulsions containing a comercial passion fruit seeds oil, and then to prepare a double face hydrophilic and lipophilic stick from this microemulsions in order to increase the oil stability and improve skin application.

Introduction

Microemulsion composition

Composition	%
Passion fruit seeds oil (comercial)	20
Tween® 80	10
Cetrimide®	0.1
Ethanol	2.5
Milli-Q water	qsp 100mL

Introduction

Methods for obtaining microemulsions

Methods	Conditions	M1	M2	M3	M4
Ultra-Turrax	8000 rpm 5 min.	✓		✓	✓
Ultra-Turrax	9500 rpm 5 min.		✓		
Sonicator	15 min.	✓	✓		
High pressure homogenizer	1 cycle			✓	
High pressure homogenizer	2 cycles				✓

Introduction

Sticks composition

Composition	F1	F2	F3	F4	F5
Polyethylene glycol 4000	74	65			70
Polyethylene glycol 400					4
Microemulsion	25	25	25		25
Passion fruit seeds oil				5	
Titanium dioxide	1	1	1	1	1
Glycerin		9	19.5		
Vitamin E				0.05	
Stearic acid			3		
38% Sol. NaOH			1.5		
Beeswax				40	
Vaseline				10	
Castor oil				43.95	

Results and discussion

Internal phase droplets size measurement

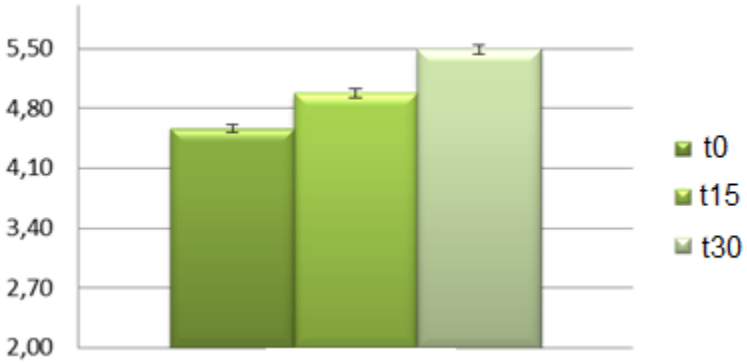
	T0	T15	t30
Dx10	0,228 ± 0,003	0,231 ± 0,004	0,243 ± 0,002
Dx50	0,394 ± 0,007	0,398 ± 0,015	0,414 ±0,010
Dx90	0,657 ±0,016	0,666 ± 0,038	0,691 ± 0,021

Internal phase droplets size measurement of microemulsion in µm after 0, 15 and 30 days. Each value represents the mean ± SD (n=5).

It can be seen that the mean size of the microemulsion internal phase droplets did not change significantly during 30 days, remaining between 0.394 µm ± 0.007 and 0.414 µm ± 0,010.

Results and discussion

Microemulsion pH



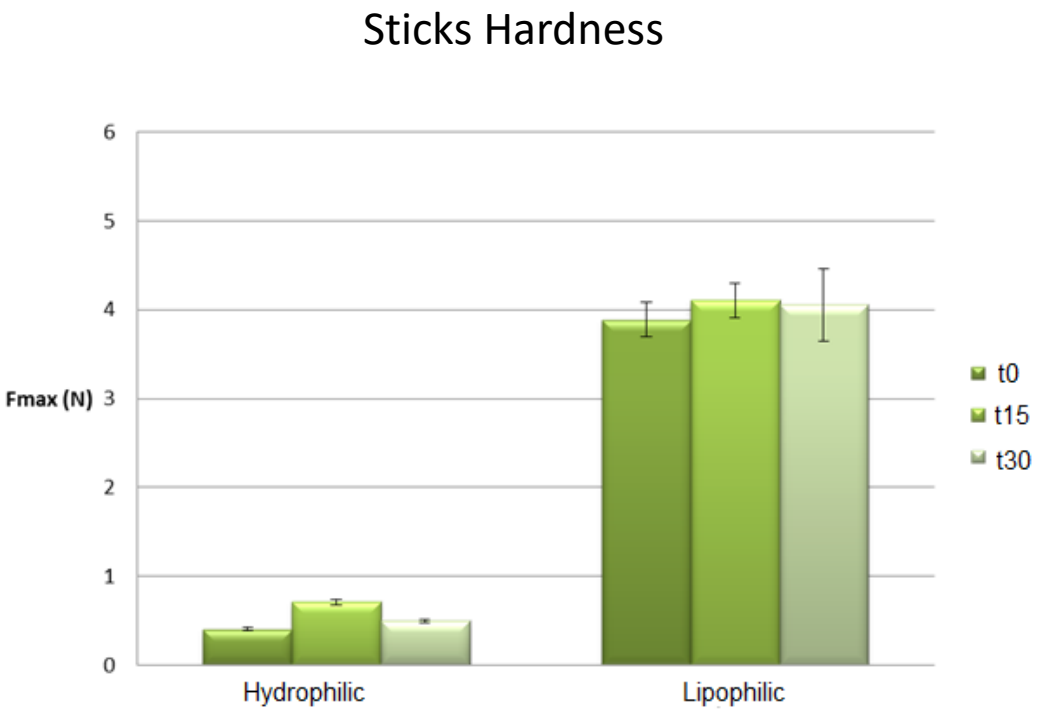
pH of the microemulsion after 0, 15 and 30 days

The pH was maintained between 4.5-5.5, which is characteristic of the skin.

Accelerated stability

After the 2 cycles of 30 min. none of the formulations showed phase separation.

Results and discussion

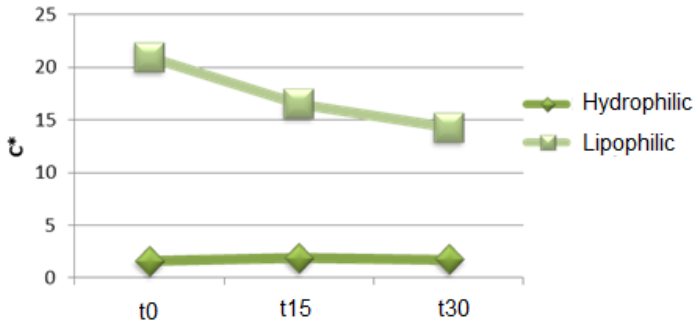


The hardness of hydrophilic and lipophilic faces of the stick after 0, 15 and 30 days

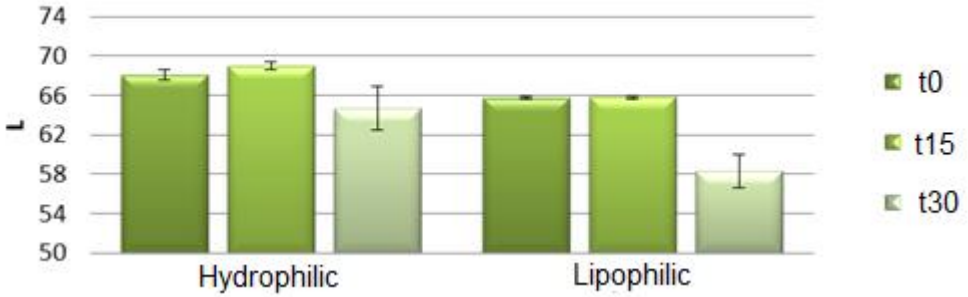
The hydrophilic face of the stick showed a significantly lower hardness than the lipophilic face over the 30 days of the study.

Results and discussion

Chroma (C *) parameter



Lightness



The hydrophilic face of the stick maintained the color unchanged over 30 days, while the hydrophobic face showed a decrease in the Chroma (C *) parameter.

Conclusions

- The microemulsion produced with Ultra-Turrax at 8000 rpm for 5 minutes, followed by 15 minutes of sonication demonstrated good stability characteristics.

- The double face hydrophilic and lipophilic stick prepared from the microemulsion was developed to improve skin application.

- However, further research regarding stick stability and skin biometrics is needed.

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