

Introduction

Hop (*Humulus lupulus* L.) is known worldwide as an essential flavor in the beer industry. Its major compounds have been demonstrated to be associated to health benefits, due to its antimicrobial, antioxidant, anti-inflammatory and anticancer activities [1].

It is also essential to use effective preservatives, and there are aromatic and medicinal plants with antimicrobial activity, as is the case with *Thymus zygis* which is widespread throughout the world, and its flowers and leaves are used, which have antimicrobial properties for bacteria gram positive and gram negative in addition to antioxidant capacity [2].



Figure I: The *Humulus lupulus* L.



Figure II: The *Thymus zygis*

Aim

- Develop an anti-aging cosmetic gel by incorporation of different percentages of hydroalcoholic extracts obtained from cones and leaves of hop spontaneous and of the Cascade and Polaris cultivars and essential oil of *T. zygis*.
- Evaluate the stability of an anti-aging cosmetic gel.
- Phytochemical profile determination of hop extracts and of essential oil of thyme.
- Antimicrobial activities evaluation of hop extracts and of essential oil of thyme.



Materials and Methodology

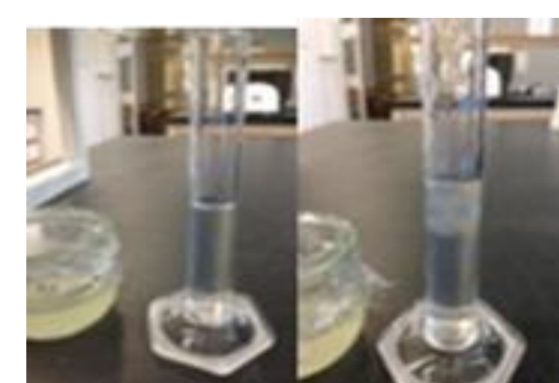
A methylcellulose gel formulation was used as base to develop the hop cosmetic product by incorporation of hydroalcoholic extracts (1,25%; 2,5% and 5%) obtained from cones and leaves of spontaneous hop and of the Cascade and Polaris cultivars and essential oil of thyme;



The phenolic profile of hop extracts was determined by:
 ➤ UHPLC-DAD-ESI-MS² [3];
 The composition of thyme essential oil was done by:
 ➤ GC and GC-MS;

The physical-chemical stability tests were:

- Organoleptic;
- pH;
- Temperatures and humidity;
- Spectrophotometric;
- Extreme temperatures;
- Density;
- Mechanical vibration;
- Centrifugation;
- Texture;
- Color;
- Light;



Results

Thyme Essential Oil Composition

- ✓ The yield of the essential oil of *T. zygis*, based on the dry mass of the plant, was as follows 1.14%;

Table I: Main compounds of *T. zygis* essential oil

Compounds	Mean values (%)
terpinen-4-ol	25.8
Carvacrol	43.60
p-cymene	24.10
trans-sabinene hydrate	15.80

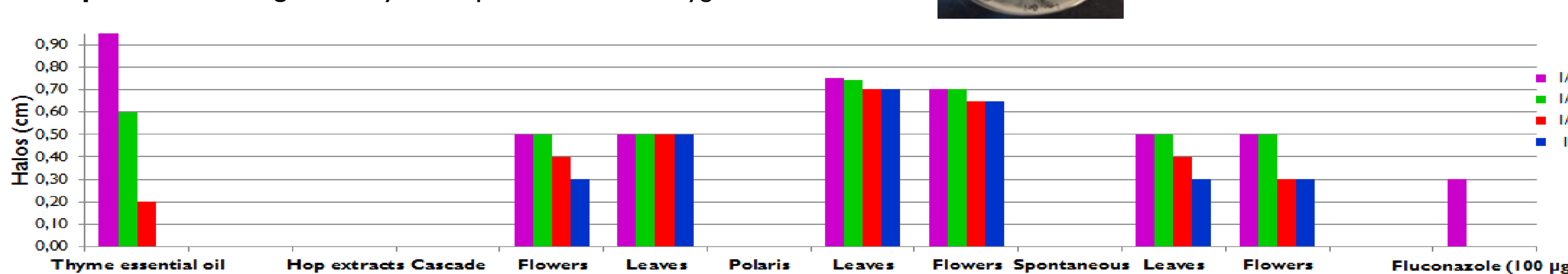
Antimicrobial Activity

Table II: Antibacterial activity of *T. zygis* essential oil

Bacteria	<i>T. zygis</i> (mg/ml)	
	MIC	MBC
<i>Escherichia coli</i>	0,31	0,31
<i>Staphylococcus aureus</i>	0,031	0,031
<i>Pseudomonas aeruginosa</i>	1,25	1,25

- ✓ Hops and oil have antifungal activity against the yeast *Candida albicans*:

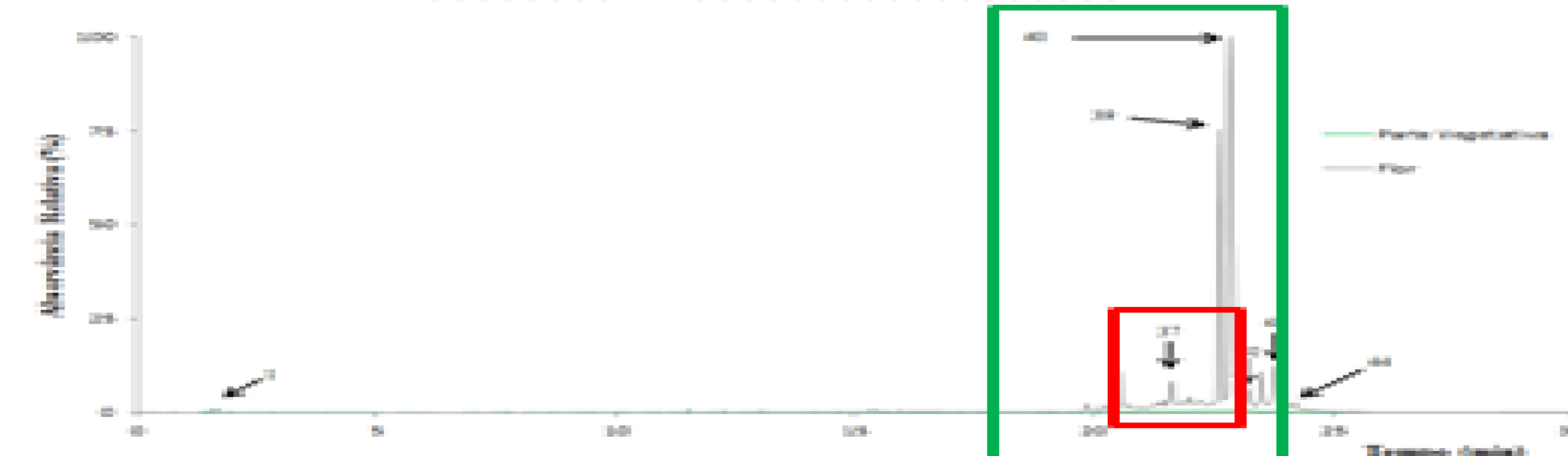
Graphic I: Antifungal activity of Hop extracts and *T. zygis* essential oil



Hop Phenolic Composition

- ✓ Hop cones were rich in phenolic compounds such as cohumulone, humulone (green) and xanthohumol, (red) which have been claimed as possessing anti-wrinkle effect [4];

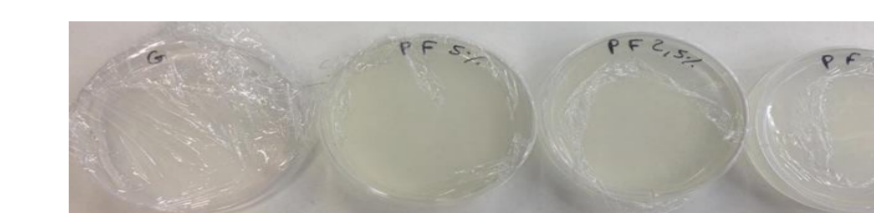
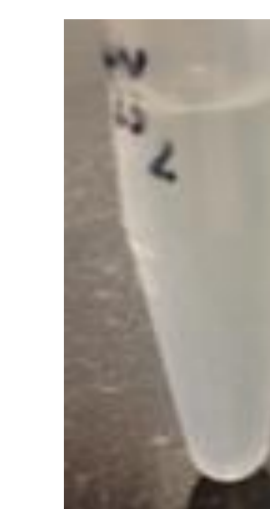
Cultivar Polaris de *Humulus lupulus* a 280nm



Stability of cosmetic formulations

Any alteration/change in the analyzed samples:

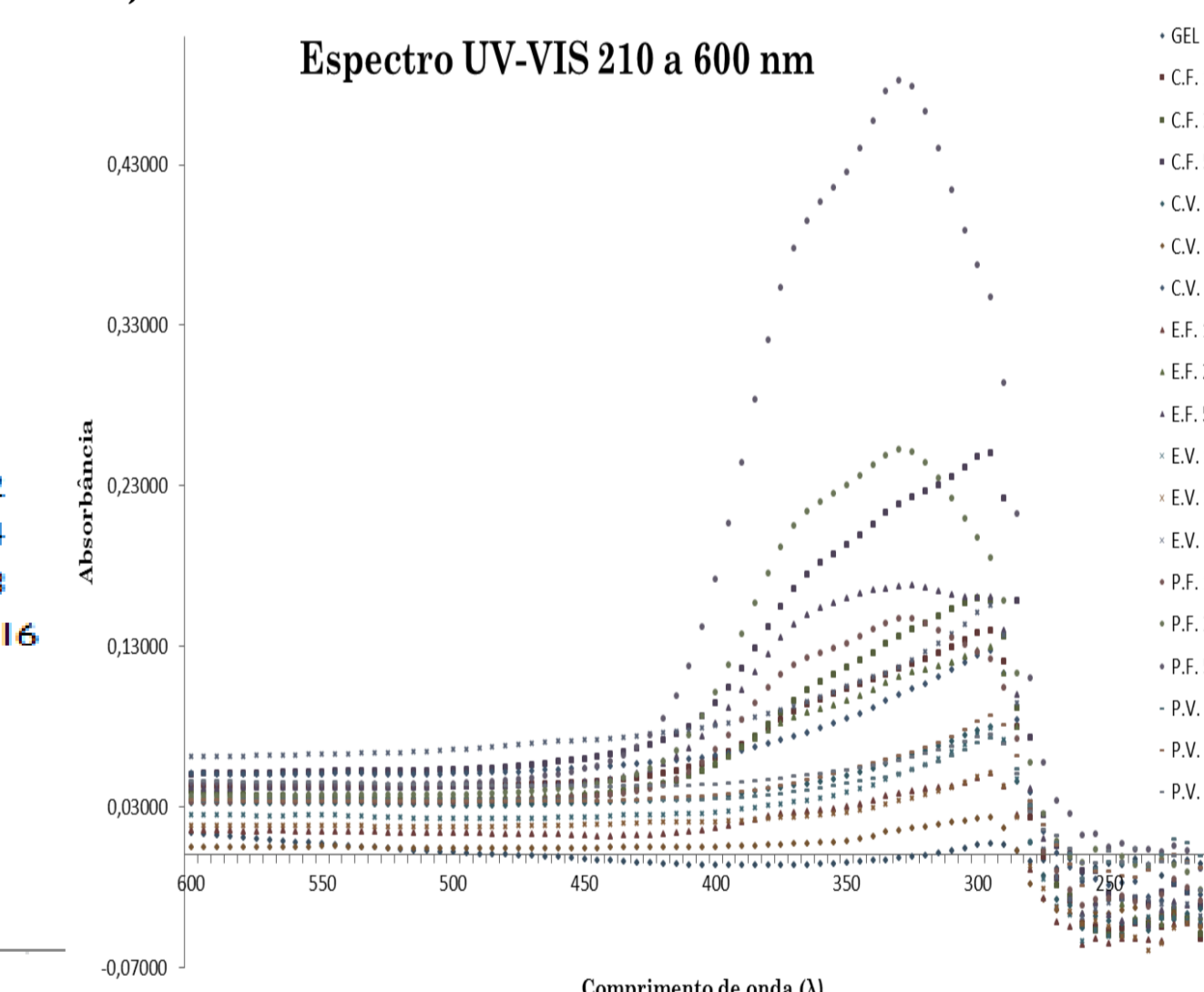
- ✓ Temperatures and humidity;
- ✓ Extreme temperatures;
- ✓ Mechanical vibration;
- ✓ Centrifugation;
- ✓ There was not a large color variance with different concentration of extracts;



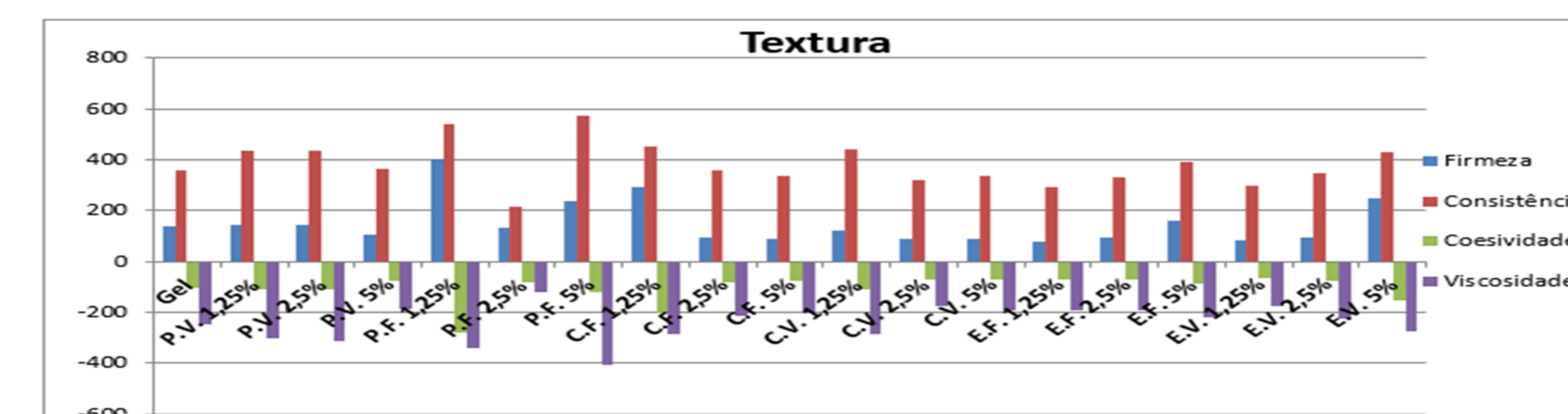
- ✓ The relative density obtained values of 1 and 0.857;
- ✓ In the light test there was phase separation in the samples due to the occurrence of dehydration;



- ✓ The pH of the formulations were slightly acidic;
- ✓ The organoleptic characteristics of the gel are refreshing, transparent in color, spread well and dry quickly and easy to remove;
- ✓ The spectrophotometric test, we found that the maximum peak is the Polaris gel in the cones at 5% with an absorbance of 0.482;

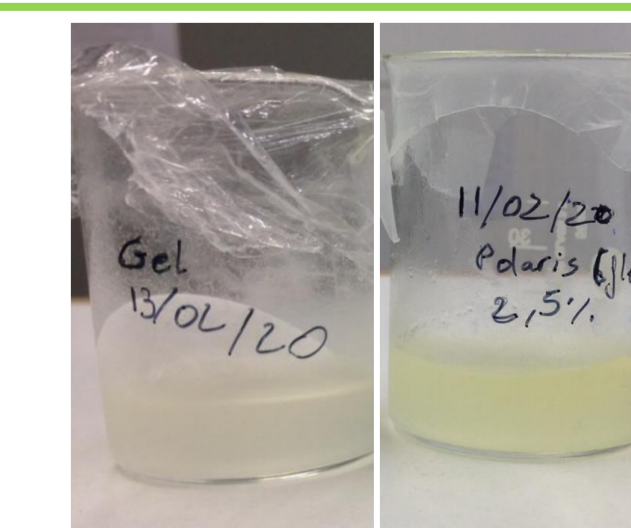


- ✓ The texture by the back extrusion it is possible to verify that the Polaris formulation has higher consistency values and lower viscosity;



Conclusion

Overall, the incorporation of hydroalcoholic extracts of hop and essential oil of thyme in methylcellulose gel formulations, especially with the 2.5% hydroalcoholic extract of Polaris variety cones, allow to obtained a stable cosmetic with anti-aging potential take into account his chemical composition.



References

- [1] Tedone, L., Staskova, L., Yan, D., Whittock, S., Shellie, R., & Koutoulis, A. American Society of Brewing Chemists, (2020) 114-125.
- [2] Rota, M., Herrera, A., Martínez, R., Sotomayor, J., & Jordán, M. Food Control, (2008) 681-687.
- [3] Afonso, A. F., Pereira, O. R., Neto, R. T., Silva, A. M., & Cardoso, S. M. Molecules, (2017) 1-14.
- [4] Lou, H., Zhang, F., Lu, L., Ding, Y., & Hao, X. RSC Advances, (2020) 13223-13231.

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