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REOLOGICAL BEHAVIOR OF COLD CREAM WITH CONCENTRATED SOXHLET ALCOHOLIC EXTRACT OF BASIL

BY

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Abstract. This paper study the rheological behavior of a cream obtained with natural ingredients, but also one commercially available, in which concentrated alcoholic basil extract was incorporated. The extract was obtained by using the Soxhlet extraction method. The experimental results showed that the creams have a time dependent pseudo plastic rheological behavior, with pleasant appearance and fine texture and is moderately absorbed into the skin, providing hydration, softness and flexibility, as well as a characteristic basil smell.

Keywords: rheology, cold cream, Soxhlet alcoholic basil extract.

1. Introduction

Although intended for food use, aromatic plants can still be used to obtain extracts with applications in cosmetics and pharmaceuticals. Among these, basil

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is an aromatic plant used in many dishes. The diversified chemical composition of basil, but also the properties of basil extracts has made it the subject of several specialized studies (Poonkodi, 2016; Güez *et al*., 2017; Taie *et al*., 2010; Politeo *et al*., 2006; Verma *et al*., 2013; Pandey and Madhuri, 2010; Bilal *et al*., 2012; Flanigan and Niemeyer, 2014; Maggio *et al*., 2016; Avetisyan *et al*., 2017; Hussain *et al*., 2008; Gutierrez *et al*., 2008).

Literature shows that basil contains active compounds with antioxidant and antimicrobial properties that, when applied to the skin, neutralize free radicals that cause oxidative damage, thus preventing cell aging and even cancer. But the skin is a complex organ, it fulfills multiple functions, one of which is that of protection against harmful environmental factors such as: extreme temperatures, toxic or irritating chemicals, pathogens, ultraviolet radiation or mechanical shocks. Both for proper functioning and for maintaining firmness, elasticity and healthy appearance, the skin must be permanently hydrated. Thus, there are various cosmetics that contribute to maintaining the suppleness and firmness of the skin and represent the fastest growing segment of the skin care industry (Ribeiro *et al*., 2015). Among the cosmetics intended for moisturizing the skin, cold creams stand out. These are emollient cosmetic products, based on beeswax with a high-water content and are indicated for the care of normal and dry skin because they are moderately absorbed into the skin and give softness and flexibility to the corneous layer of the epidermis (Popovici, 1982). Over time, cold cream formulations have been improved by introducing herbal extracts into the recipe, which has made the demand for herbal creams to increase and to be the subject of many scientific studies (Marquele-Oliveira *et al*., 2007; Moghimipour *et al*., 2009; Wojciechowska *et al*., 2012; Sonalkar and Nitave, 2016; Cobzaru *et al*., 2017).

However, being complex emulsions to which plant extracts are added, the rheological studies are important for the analysis of the creams. Moreover, in addition to information on structural properties, stability and quality control, the rheology of cosmetic cream can also be a necessary warning about the inevitable deterioration of the product (Rieger, 1991; Korhonen *et al*., 2001).

These issues justify the opportunity of this study, in which we intend to rheologically investigate the behavior of cold creams with alcoholic extracts of basil. The extracts were obtained by the Soxhlet method. We are thus trying to prove that there are ways to capitalize on spicy plants such as basil, in cosmetics, especially in cold cream formulation, due to its properties. Moreover, a commercially purchased cream can be improved by incorporating a basil extract.

2. Experimental

1.1. Selection and preparation of basil

The study used dried basil without any other additives, which was bought from supermarket.

1.2. Extraction equipment and solvents

Alcoholic extracts from basil were obtained by extraction with the Soxhlet apparatus (Cobzaru *et al*., 2021). The Soxhlet extraction was performed in a laboratory extractor.

The concentration of the basil extract was performed on a rotary evaporator, type IKA RV3.

The 96º ethyl alcohol was purchased from Merck, diluted to 50º and was used as solvent according to the literature (Horoba and Horoba, 2010).

Beeswax for cosmetic cream was purchased from local producers in 2021, and the vegetable oil (olive oil) was purchased commercially being manufactured in 2021. Borax and sodium dodecyl sulphate (surfactant) were purchased from Merck.

Rheological studies of the samples were performed using a Physica MCR 501 Anton Paar modular rheometer, equipped with a Peltier temperature control system. The measurements were performed with a plane-plane geometry with ribs with a diameter of 50 mm. The tests were performed in both oscillating and rotational mode.

1.3. Obtaining basil extracts

The Soxhlet basil extracts was obtained using plant and 50º alcohol in a 1:20 ratio. The extraction was performed for 5 hours. The extract previously obtained was concentrated in a rotary evaporator and the alcoholic concentrate (named Extract A) was kept in sealed glass container.

1.4. Obtaining cold cream using the Extract A

The preparation of cold cream was performed according to the method described in the literature (Cernătescu, 2016). Thus, beeswax and olive oil in a ratio of 1:35 (m/m) were introduced into an Erlenmeyer glass, and the mixture was heated to t = 68°C under continuous stirring. Then borax and the surfactant, solved in distilled water, were added in a proportion of 0.2% and 0.4% (m/m), respectively, to the mixture, also under continuous stirring, at the same temperature. Finally, in the crude cream obtained and a concentrated alcoholic extract of basil was added in a proportion of 1%. The cream obtained was named Cream A. In order to compare, from the rheological point of view, the basil alcohol extract was added, in the same quantity and in the same way, to a commercially available raw cream, obtaining the Cream A1.

3. Results and Discussions

According to the literature (Lungu and Merica, 2000), a cosmetic cream must have a three-dimensional network structure that is stable before use and shows a proper flow behaviour when the product is applied. That is why a very

important character of the cream is that its structure recovers after application. Thus, the overlapping rheological tests of the cream samples A, A1 are presented.

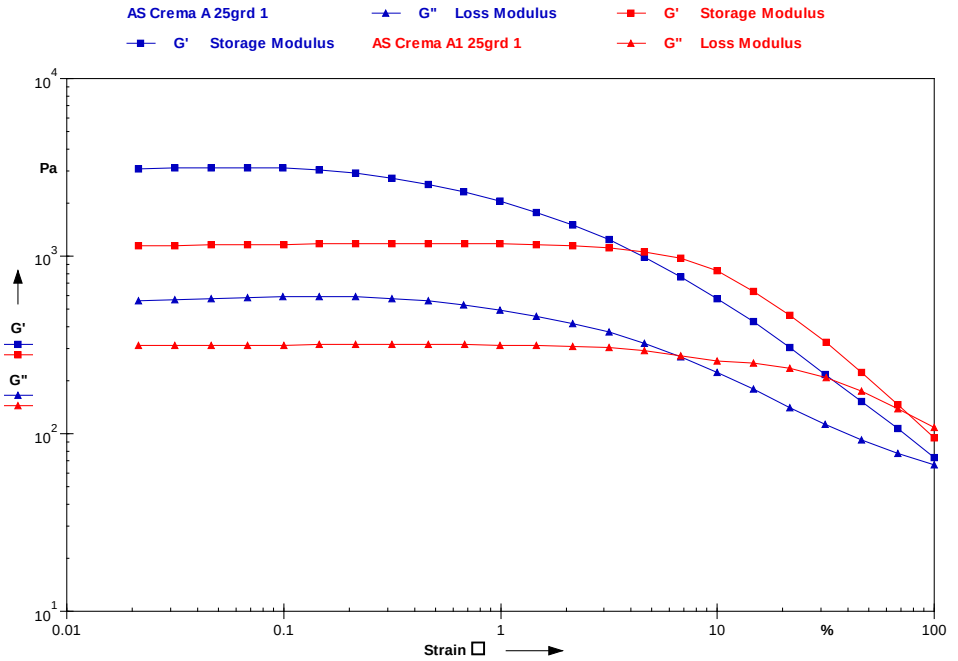

Fig. 1 − Overlapping rheological tests for creams A (blue) and A1 (red).

From the Fig. 1 it can be observed that, G' > G" which indicates that both creams are solid (gel) and are stable. However, cream A1 has a more rheologically stable behavior (the limit value of the linear viscoelastic range is about twenty times higher than that cream A, γ_{LVE} = 1%) due to the ingredients used to formulate the raw cream. However, cold cream obtained in the laboratory with alcoholic basil extract also has good stability, given that it is obtained only from natural ingredients.

Literature show that natural extracts can induce changes in the viscosity of cosmetic creams (Cobzaru *et al*., 2017). This can also be verified by rheological measurements because they allow the correlation of information about viscoelastic behavior with sensory perception and cream display capacity. The correlation between microstructure and macroscopic behavior of a material can be highlighted using oscillatory tests (Ibănescu *et al*., 2010). The following figures show the overlap of rheological tests for the cream samples studied.

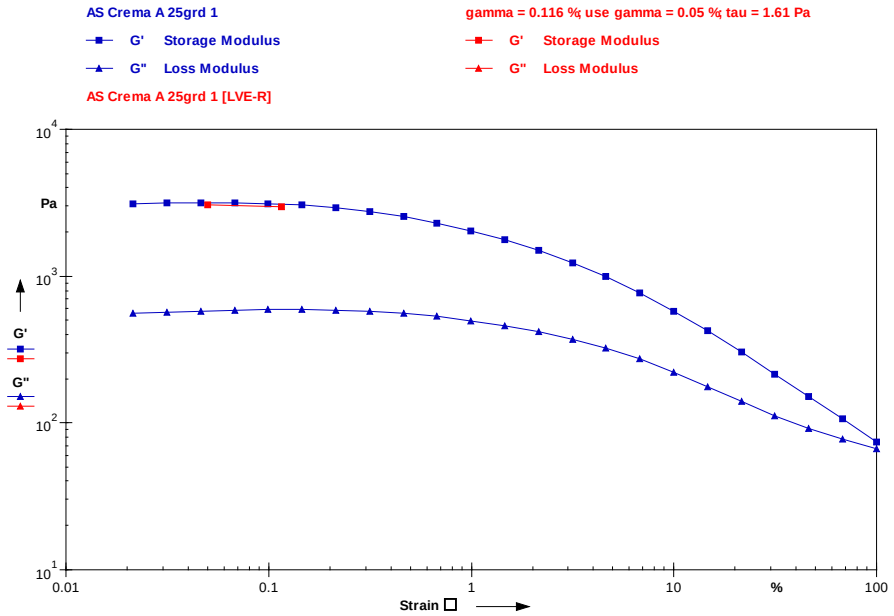

Fig. 2 − Overlapping the rheological test of cold cream A.

From this figure it can be seen that the rheological behavior of cream A indicate that built-in extract has very little influence on the cold behavior of the cream (dynamic modules vary very little).

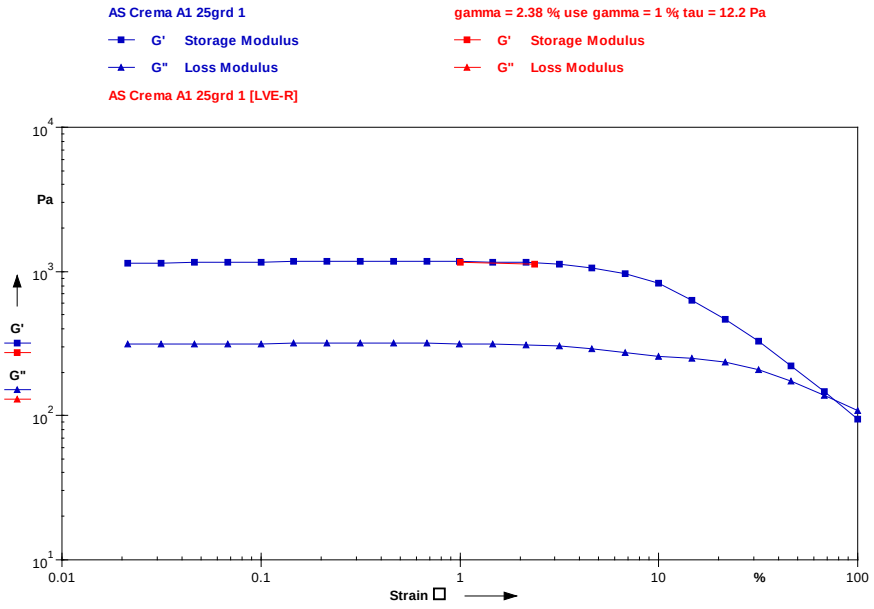

Fig. 3 − Overlapping rheological tests of creams A1.

In Fig. 3, a slight difference can be seen in the A1 cream, in which the basil extract obtained with the Soxhlet apparatus was incorporated, which indicates a lower viscosity. However, the difference is not significant, because the distance between G' and G" matters a lot, and this distance is approximately equal to the other cream.

The following figure shows the overlap of rheological test for the creams studied in order to obtain information on their stability over time.

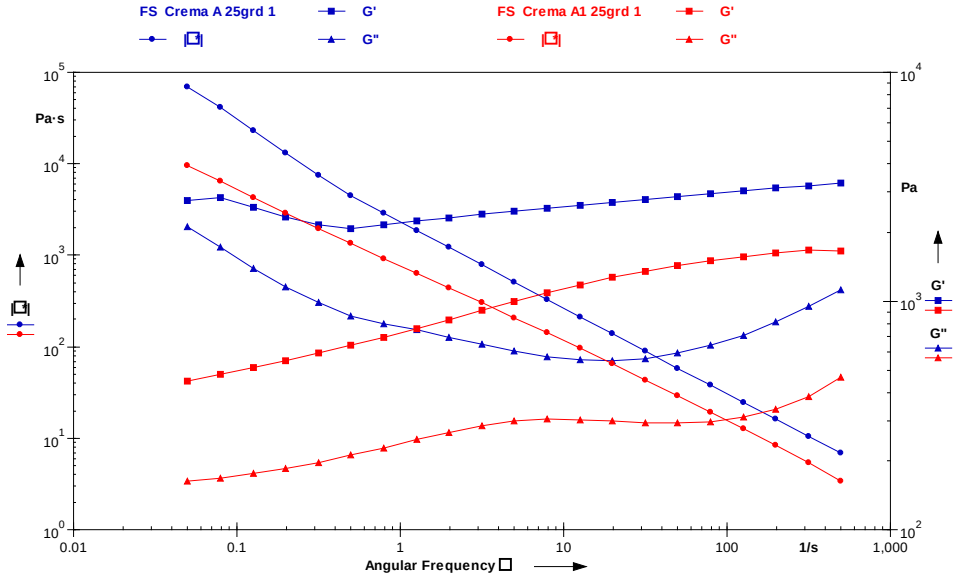

Fig. 4 − Overlapping rheological tests for creams A (blue) and A1 (red).

As observed from Fig. 4, the curves G' and G" tend to merge which means that creams A will not be stable over time and therefore require a shelf life of maximum 14 days. This is normal because cold cream is made only with natural ingredients (vegetable oils, beeswax and basil extract), without any chemical preservatives.

In the case of cream A1 the curves G' and G" do not tend to join, which leads to the fact that, through their components (chemical excipients, stable and strong preservatives) can be used on a much longer amount of time (approx. 2 years).

According to the literature (Lungu and Merica, 2000) a cosmetic cream is also favorable due to its consistency. This can be seen in rheological flow tests. In this regard, the overlapping rheological test are presented for the two creams in which the same type of basil extract has been incorporated.

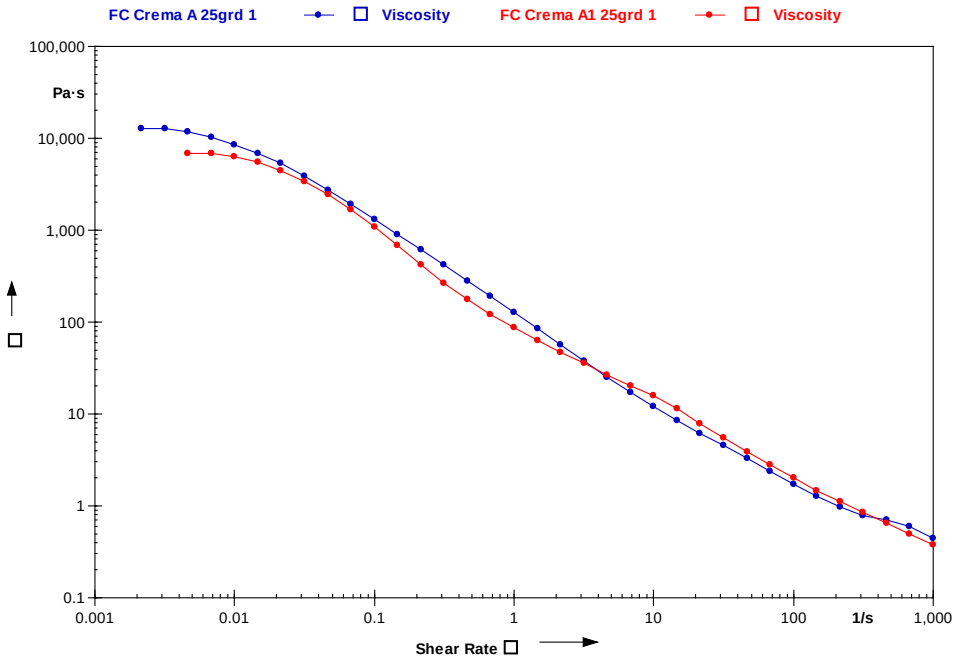

Fig. 5 − Rheological representation of creams A (blue) and A1 (red).

From the rheological graphs presented in Figure 5, it can be seen that the two creams analyzed exhibit a pseudoplastic behavior.

Flow tests reinforce the previous statements, namely, the rheological behaviors of creams A, is similar to cream A1. In terms of viscosity, it could be observed that in the two creams A and A1, the extract had very little effect on the viscosity of the cream.

Also, the cream A can be used for a shorter time due to the natural ingredients contained. However, this cream also has some exclusive properties, namely: the high-water content that produces the sensation of cooling, are moderately absorbed into the skin and give softness and flexibility to the stratum corneum. Also, thanks to the basil extract which has many properties, this cream can be used to treat skin diseases or to slow down aging. Moreover, from a commercial point of view, cold cream with basil extract has an attractive color, a fine texture and a specific smell of basil that persists longer after being applied to the skin. Compared to cream A, cream A1 can be used for a longer time due to the chemical preservatives content. However, it also has superior properties due to the built-in alcoholic basil extract.

4. Conclusions

Rheological tests performed on the creams studied provided information on their structural properties and stability. It has been found that by adding alcoholic basil extract the values of the dynamic modules decrease suggesting that the products have a soft consistency, a velvety appearance and easy to apply on the skin. Also, the values of complex viscosity at low frequencies show that the studied samples have a stable structure at rest and easy to display on the skin.

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COMPORTAREA REOLOGICĂ A COLD CREMEI CU EXTRACT ALCOOLIC CONCENTRAT DE BUSUIOC OBȚINUT LA APARATUL SOXHLET

(Rezumat)

În această lucrare s-au prezentat proprietățile reologice pentru cold crema obținută cu ingrediente naturale, dar și pentru cea achiziționată din comerț în care s-a încorporat extractul alcoolic concentrat de busuioc obținut cu aparatul Soxhlet. Rezultatele experimentale au arătat faptul că, produsele obținute au un comportament reologic pseudoplastic dependent de timp, ce se manifestă prin aspect plăcut și textură fină, ce pot fi absorbite moderat în piele, conferind hidratare, moliciune și flexibilitate, precum și un miros specific de busuioc.