

BULETINUL INSTITUTULUI POLITEHNIC DIN IAȘI

Publicat de

Universitatea Tehnică „Gheorghe Asachi” din Iași

Volumul 69 (73), Numărul 3, 2023

Secția

CHIMIE și INGINERIE CHIMICĂ

DOI: 10.5281/zenodo.10072397

## RHEOLOGICAL STUDY OF COSMETIC CREAMS WITH BASIL EXTRACTS OBTAINED BY MACERATION

BY

CLAUDIA COBZARU, CĂTĂLINA ELENA COBILIȚĂ, MARICEL DANU,  
GABRIELA ANTOANETA APOSTOLESCU and CORINA CERNĂTESCU\*

“Gheorghe Asachi” Technical University of Iași, “Cristofor Simionescu” Faculty of Chemical  
Engineering and Environmental Protection, Iași, Romania

Received: May 28, 2023

Accepted for publication: July 15, 2023

**Abstract.** This study presents the rheological properties of cosmetic creams formulated with basil extracts that were obtained by maceration with ethyl alcohol. Rheological measurements showed that all of the analysed cosmetic creams with basil extracts have a time-dependent pseudoplastic behaviour. In the case of cosmetic creams obtained in the laboratory, they are homogeneous, have a fine texture and a specific smell of basil, and on the other hand, they are moderately absorbed and give it long-lasting hydration and a velvety skin.

**Keywords:** rheology, cosmetic cream, alcoholic maceration of basil, natural extracts.

### 1. Introduction

Basil belongs to the class of aromatic plants, being known worldwide for its special aroma when used in foods. Moreover, due to its popularity, it is often referred to as the “king of plants” (Makri and Kintzios, 2008). Over time, basil also began to be studied from the point of view of composition and pharmacodynamic properties. Thus, it was concluded that basil extracts can also be used in the pharmaceutical industry due to anticancer, radioprotective, anti-

---

\*Corresponding author; *e-mail*: corina.cernatescu@academic.tuiasi.ro

inflammatory, immuno-modulatory, antistress, antidiabetic, antipyretic, antiarthritic activity and prophylactic agent in cardiovascular disease (Abbasy *et al.*, 2015; Abou El-Soud *et al.*, 2015; Joshi, 2014; Poonkodi, 2016; Sharafati-Chaleshtori *et al.*, 2015; Shahrajabian *et al.*, 2020). Moreover, experimental studies show that basil extracts can also be used in the cosmetic industry because it has compounds with antioxidant and antimicrobial properties that neutralize the free radicals responsible for oxidative damage to the skin resulting in the prevention of its aging (Grange *et al.*, 2009; Gülçin *et al.*, 2007; Hapsari and Feroniasanti, 2019; Viyoch *et al.*, 2006; Yahya *et al.*, 2018). There are many cosmetic creams on the market that can treat skin problems, but they contain various chemicals that can have a negative effect on it over time. Cosmetic creams, especially cold creams, due to the simplicity of the ingredients they contain, have the property of being moderately absorbed into the skin, giving it hydration, softness and flexibility (Popovici, 1982). Their rheological properties can be improved considerably by adding extracts obtained from plants rich in active compounds, and there are such studies in the specialized literature (Cobzaru *et al.*, 2017; Korhonen *et al.*, 2001; Sonalkar *et al.*, 2016; Wojciechowska *et al.*, 2012).

These considerations justify the appropriateness of this study, in which we propose to investigate from a rheological point of view the behaviour of cold creams formulated with alcoholic extracts of basil that were obtained by maceration with ethyl alcohol (conc. 50%). We are thus trying to prove that cosmetic creams with improved properties can be obtained by adding extracts and herbs.

## **2. Experimental**

### **2.1. Choosing materials**

For the study, dried basil from the supermarket and 96° ethyl alcohol purchased from Merck and diluted to 50°, according to the specialized literature (Horoba and Horoba, 2010), were used. The beeswax required for the preparation of the cosmetic cream was purchased from local producers, and cold-pressed olive oil purchased commercially was used as vegetable oil. Also, borax and sodium dodecyl sulphate (surfactant) were purchased from Merck.

### **2.2. Extraction methods and apparatus**

Alcoholic extract of basil was obtained by maceration. The maceration was carried out in a cork glass flask, in which basil and ethyl alcohol 50° were introduced in a ratio plant:alcohol of 1:10. The maceration was carried out at room temperature for 28 days, the mixture being stirred periodically. At the end of the extraction, the alcoholic macerate was filtered.

The rheological studies of the cosmetic creams were carried out with the help of a modular rheometer Anton Paar, Physica MCR 501 equipped with a Peltier temperature regulation system. The measurements were performed with a plane-plane geometry with striations with a diameter of 50 mm. The tests were performed in both oscillatory and rotational mode.

### 2.3. The formulation of cold creams with the basil extracts

The cold cream was prepared according to the literature method (Cernatescu, 2016). Thus, beeswax and olive oil were introduced into an Erlenmeyer glass, in a ratio of 1:35 (m/m), and the mixture was heated to 68°C, under continuous stirring. Then the water solution with borax and surfactant in proportions of 0.2% and 0.4% (m/m) was added to the mixture, also under vigorous stirring. Finally, an alcoholic extract of basil was added in proportion of 1% in the crude cream obtained. For better understanding, samples of extract cream and assigned names are shown in Table 1.

**Table 1**

*Abbreviation for creams with alcoholic basil extracts and the method of extraction*

No.	Extraction methods	Extract Type	Cream abbreviation
1.	Maceration in 50° alcohol	Extract MA	CMA
2.	-	No extract	CFE

In order to compare, from a rheological point of view, the alcoholic extracts of basil were also added to a commercially purchased crude cream, obtaining the following samples (Table 2).

**Table 2**

*Abbreviation of commercial creams enriched with alcoholic basil extracts*

No.	Extract Type	Cream abbreviation
1.	Extract MA	CMA1
2.	No extract	CFE1

## 3. Results and Discussions

Usually, a cosmetic cream must be stable before use and exhibit a suitable flow when applied (Lungu and Merica, 2000). The following figures show the superimposed rheological tests of the analysed creams: CMA, CMA1, CFE and CFE1.

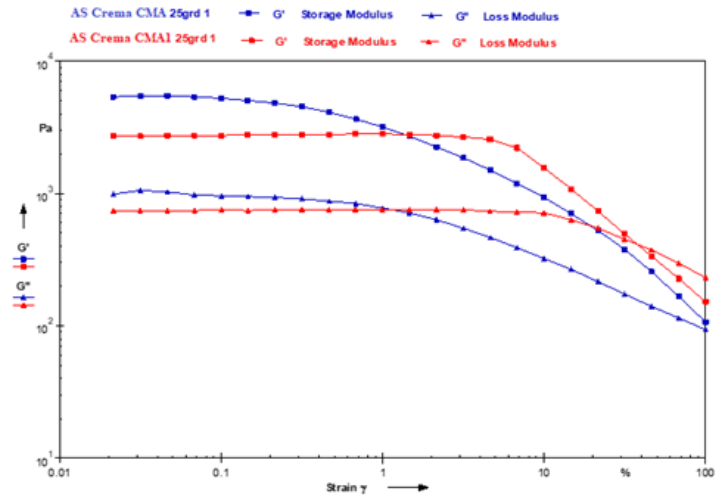


Fig. 1 – Overlap of rheological tests for creams CMA (blue) and CMA1 (red).

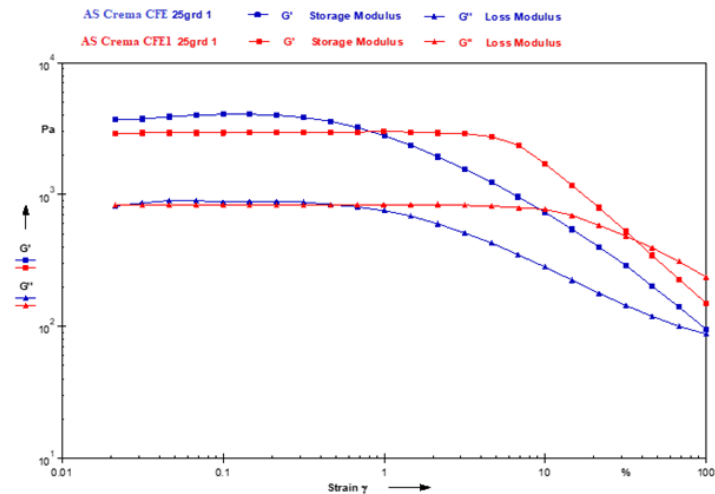


Fig. 2 – Overlap of rheological tests for creams CFE (blue) and CFE1 (red).

According to the data presented above, the creams have a solid (gel) character and are stable, fact confirmed by the dynamic moduli  $G'$  and  $G''$  which in this case is,  $G' > G''$ . However, commercial creams incorporating basil extracts (CMA1 and CFE1) are more stable, as demonstrated by the limit value of the linear viscoelastic domain, which is approximately twenty times higher than that of cold-creams. This could be explained due to the inclusion of tensioactive as emulgator agents in the commercially available creams in order to increase their stability.

In a previous study (Cobzaru *et al.*, 2017) it was shown that natural extracts can modify the viscosity of cosmetic creams. Rheological measurements can give such information because they allow the correlation of information about

the viscoelastic behaviour with the sensory perception and spreading capacity of the cream (Ibanescu *et al.*, 2010). The following figures show the overlap of the rheological tests for the studied creams in order to obtain information on their stability over time.

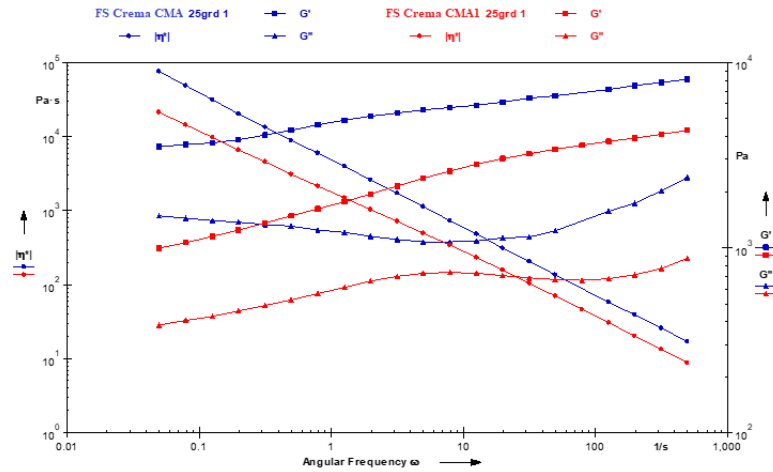


Fig. 3 – Superposition of rheological tests for cold creams CMA (blue) and CMA1 (red).

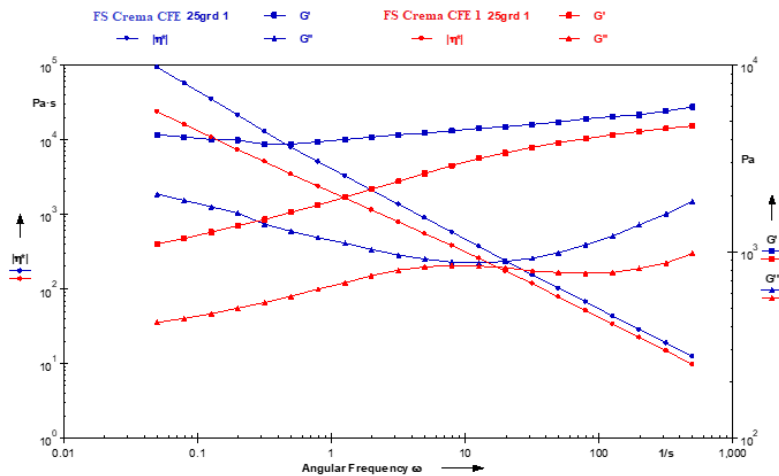


Fig. 4 – Superposition of rheological tests for cold creams CFE (blue) and CFE1 (red).

Figures 3 and 4 show that the dynamic moduli  $G'$  and  $G''$  tend to unite, which means that the CMA and CFE creams will not be stable over time requiring a short shelf life. This is obvious since only natural ingredients without preservatives were used for the preparation of the creams.

On the contrary, for the commercial creams in which the basil extracts were incorporated (CMA1 and CFE1), the dynamic modules  $G'$  and  $G''$  do not tend to unite, which denotes the fact that during their preparation they used chemical excipients, stable and strong preservatives.

In general, a cosmetic cream is favourite, from a commercial point of view, also because of its consistency. And this information is also obtained through rheological measurements, and the following figures show the superimposed rheological tests for each cream in which the same type of basil extract was incorporated.

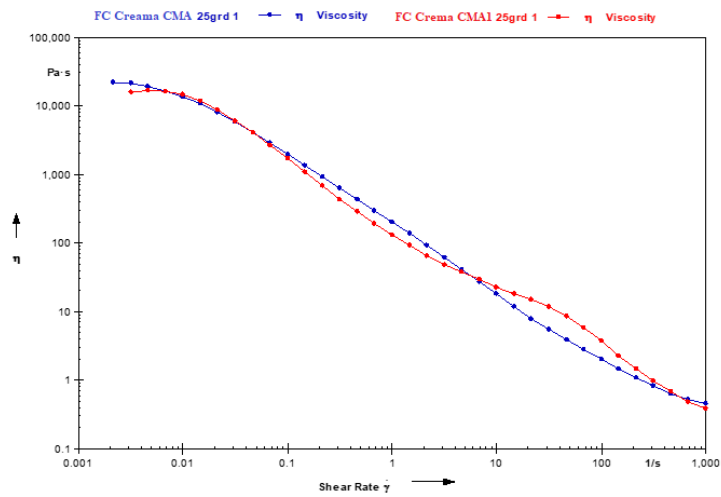


Fig. 5 – Rheological representation of creams CMA (blue) and CMA1 (red).

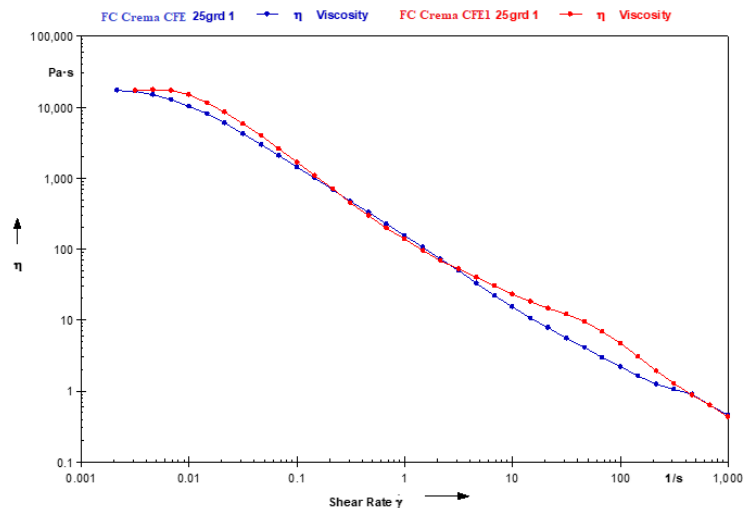


Fig. 6 – Rheological representation of creams CFE (blue) and CFE1 (red).

From Figs. 5 and 6 it can be seen that all analysed creams have a time-dependent pseudoplastic behaviour. Therefore, the rheological behaviours of CMA and CFE creams are similar to CMA1 and CFE1 creams.

#### 4. Conclusions

The rheological measurements made both for the creams obtained in the laboratory and those from the market with basil extracts provided information regarding their structural properties and stability. It was found that the alcoholic extracts of basil added to the cosmetic creams lead, from a rheological point of view, to a decreasing in the values of the dynamic modules, that translates into the fact that the tested products have a stable structure at rest, a fine texture, and after application the skin become hydrated and velvety.

#### REFERENCES

- Abbasy D.W.A., Pathare N., Al-Sabahi J.N., Khan S.A., *Chemical composition and antibacterial activity of essential oil isolated from omani basil (Ocimum basilicum Linn.)*, Asian Pac. J. Trop. Dis., **5**, 645-649 (2015).
- Abou El-Soud N.H., Deabes M., Abou El-Kassem L., Khalil M., *Chemical composition and antifungal activity of Ocimum basilicum L. Essential Oil*, Macedonian J. Med. Sci., **3**, 374-379 (2015).
- Cernatescu C., *The technology of cosmetic products, Laboratory Guide*, Pim, 2016.
- Cobzaru C., Gherghescu O., Aursulesei A. E., Ibanescu C., Danu M., Apostolescu G.A., Cernatescu C., *Rheological Behaviour of Cold Creams with Cinnamon and Thuja Alcoholic Extract*, Rev. Chim. (Bucharest), **68**, 9, 1959-1962 (2017).
- Grange P.A., Ch´ereau C., Raugeaud J., Nicco C., Weill B., Dupin N., Batteux F., *Production of superoxide anions by keratinocytes initiates P. acnes-induced inflammation of the skin*, PLoS Pathog., **5**, 268-278 (2009).
- Gülçin I., Elmastas M., Aboul-Enein H.Y., *Determination of antioxidant and radical scavenging activity of Basil (Ocimum basilicum L. Family Lamiaceae) assayed by different methodologies*, Phyther. Res. **21**, 354-361 (2007).
- Hapsari I.P., Feroniasanti Y.M.L., *Phytochemical screening and in vitro antibacterial activity of sweet basil leaves (Ocimum basilicum L.) essential oil against Cutibacterium acnes ATCC 11827*, AIP Conf. Proc., <https://doi.org/10.1063/1.5098412> (2009).
- Horoba E., Horoba L.D., *Ethyl alcohol. Obtaining. Fuel. Alcoholic beverages*, Pim, 2010.
- Ibanescu C., Danu M., Nanu A., Lungu M., Simionescu C.B., *Stability of disperse systems estimated using rheological oscillatory shear tests*, Rev. Roum. Chim., **55**, 933-940 (2010).
- Joshi R.K., *Chemical composition and antimicrobial activity of the essential oil of Ocimum basilicum L. (sweet basil) from Western Ghats of North West Karnataka, India*, Anc Sci Life, **33**, 151-156 (2014).

- Korhonen M., Hellen L., Hirvonen J., Yliruusi J., *Rheological properties of creams with four different surfactant combinations - effect of storage time and conditions*, Int. J. Pharm., 221, 187-196, doi: 10.1016/s0378-5173(01)00675-5 (2001).
- Lungu M., Merica E., *Rheology of cosmetic products*, Corson, Iași, 2000.
- Makri O., Kintzios S., *Ocimum sp. (Basil): Botany, Cultivation, Pharmaceutical Properties, and Biotechnology*, Journal of Herbs, Spices & Medicinal Plants, **13** (3), 123-150 (2008).
- Poonkodi K., *Chemical composition of essential oil of ocimum basilicum l. (basil) and its biological activities—an overview*, Journal of Critical Reviews, **3**, 3, 371-384 (2016).
- Popovici A., *Dermatology and cosmetology*, Medicala, București, 1982.
- Sharafati-Chaleshtori R., Rokni N., Rafieian-Kopaei M., Drees F., Salehi E., *Antioxidant and antibacterial activity of basil (Ocimum basilicum L.) essential oil in beef burger*, J. Agric. Sci. Technol., **17**, 817-826 (2015).
- Shahrajabian M.H., Sun W., Cheng Q., *Chemical components and pharmacological benefits of Basil (Ocimum basilicum): a review*, International Journal of Food Properties, **23** (1), 1961-1970 (2020).
- Sonalkar M.Y., Nitave S.A., *Formulation and evaluation of polyherbal cosmetic cream*, World J. Pharm. Pharm. Sci., **5**, 772-779 (2016).
- Viyoch J., Pisutthanan N., Faikreua A., Nupangta K., Wangtorpol K., Ngokkuen J., *Evaluation of in vitro antimicrobial activity of Thai basil oils and their micro-emulsion formulas against Propionibacterium acnes*, Int. J. Cosmet. Sci., **28**, 125-133 (2006).
- Wojciechowska K., Zun M., Dwornicka D., Serefko A., Świąder K., Poleszak E., *Physical and chemical properties of cosmetic cream made of ingredients obtained from Juglans regia L.*, Curr. Issues Pharm. Med. Sci., **25**, 190-193 (2012).
- Yahya N.A., Attan N., Wahab R.A., *An overview of cosmeceutically relevant plant extracts and strategies for extraction of plant-based bioactive compounds*, Food Bioprod. Process., **112**, 69-85 (2018).

## STUDIUL REOLOGIC AL CREMELOR COSMETICE CU EXTRACTE DE BUSUIOC OBȚINUTE PRIN MACERARE

(Rezumat)

Acest studiu prezintă proprietățile reologice ale cremelor cosmetice cu extracte de busuioc obținute prin macerare cu alcool etilic. Măsurătorile reologice au arătat faptul că toate cremele cosmetice cu extracte de busuioc analizate au un comportament pseudoplastic dependent de timp. În cazul cremelor cosmetice obținute în laborator, acestea sunt omogene, prezintă o textură fină și un miros specific de busuioc, iar pe de altă parte se absorb moderat în piele și conferă acestuia o hidratare îndelungată și un aspect catifelat.