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# INFLUENCE OF NATURAL EXTRACTS ON THE QUALITY OF COLD SODIUM SOAP

BY

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**Abstract.** In this study, toilet soaps containing a mixture of natural fruit and vegetable extracts were prepared. The results show that the three vegetable oils (olive, palm and coconut oil) used as a source of fatty acids, due to their acidity index, iodine and saponification index, are a good raw material for making soap. Furthermore, they contain vitamins and antioxidants, which, together with those contained in the natural extracts mixture obtained from fruits and vegetables, helps to improve the softening and soothing properties of the soap. However, anthocyanin pigments from the natural extracts do not contribute to the colour enhancement of the finished product due to the colour change based on the pH value for the alkaline solution or the soap (neutral pH). For all that reasons, the soap obtained is a quality product because it does not have alkali, and because the glycerine content helps with moisturizing and softening the skin.

**Keywords:** soap; natural extracts; cold saponification.

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## 1. Introduction

Soap is a cosmetic product obtained from fatty acids (stearic, palmitic, myristic, lauric, oleic, etc.) that reacts with alkaline solutions (Ainie *et al*., 1996). If for the saponification processes are used sodium hydroxide solutions, solids soaps are obtained, and if liquid potassium solutions are used, the soaps are liquid (Shoge, 2011). The fatty acids required for saponification are from vegetable oils, the most used in the production of soap being olive, palm and coconut (Neilsen, 2003). Both sodium and potassium soaps are used in cosmetics because they are water soluble and depending on the oil used, the finished product also has a number of specific properties (Mureşan, 1956; Chalmers and Bathe, 1978).

Saponification can be done hot or cold. In the case of hot saponification, the method of obtaining is a simple one, all the necessary materials are added to a container, connected to a heat source, continuously stirring until the reaction is completed. At the end of the synthesis, the soap separates from the glycerin water and can be used immediately. Conversely, in the case of cold saponification, the saponification process requires a period of about 6 weeks in order to complete the reaction (Hassan *et al*., 2015). Although it is obtained relatively quickly, hot soap is less recommended in cosmetics because it separates glycerin water that has emollient properties on the skin, while, in the case of cold soap the glycerin remain included in the final product. Moreover, the cold soap has better foaming and maintains their quality for a long time.

Although natural ingredients have been used for centuries for body care, they are increasingly applied in cosmetics (Fowler *et al*., 2010). The main sources of natural ingredients are herbs, flowers, leaves, buds, stems, roots, fruits, and even vegetables (Cobzaru, 2014). The effect of natural ingredients on the quality of the cosmetic products depends on their *in vitro* and *in vivo* activity and the type of dermatological base in which they are incorporated (Ribeiro *et al*., 2015).

The reasons why natural extracts are used in cosmetics are related to: a healthier body care, a positive influence on the skin's biological functions, and a supply of nutrients beneficial for a healthy skin (Dureja *et al*., 2005). Usually, plant materials are rich in vitamins, antioxidants, essential oils, proteins, terpenoids and other bioactive compounds that can lead to cosmetics with improved properties (Dubey *et al*., 2004).

Based on these considerations, in this study we intended to prepare sodium toilet soap using the cold saponification method, and adding to the mixture three different extracts, obtained separately from the following vegetable materials: mango, red beet and a mixture of cranberries and raspberries. These plant materials have been chosen because they have vitamins and antioxidants, as well as anthocyanins in their composition. As a source of

fatty acids, a mixture of three vegetable oils (olive oil, palm and coconut) was used. By analysing both the quality of the oils and the characteristics of the final product, we wanted to highlight the potential of obtaining high quality cosmetic products with fruit and vegetable extracts that may be superior to those commercially available.

## 2. Experimental

### 2.1. Preparation of Raw Materials

The vegetable oils that were used in this study, namely olive oil (UM), palm (UP) and coconut (UC) were purchased from the supermarket. Chemical reagents required for laboratory analysis were purchased from Merck.

### 2.2. Obtaining the Extracts

The plant materials required for extraction for this study were purchased from the supermarket, and each extract was obtained as follows:

a) 10 g of cranberry and raspberry mixture were infused with 100 mL of hot distilled water, for 6 minutes, then the mixture was filtered. The obtained extract had a red purple colour.

b) 10 g of peeled and minced mango was first brought introduced in 100 mL of hot distilled water and held for 30 minutes. Finally, the extract was subjected to filtration and had an intense yellow colour.

c) 10 g of red beet, peeled and grated has been immersed in 100 mL of hot distilled water and maintained for 30 minutes. Finally, the extract was subjected to filtration and had an intense red colour.

### 2.3. Obtaining Raw Soap and Soaps with Extracts

In order to obtain the crude soap, a mixture of olive oil, coconut and palm, 5:1:6 (v/v) was heated to 40°C, after which a solution of NaOH (NaOH/water, 1:3 molar ratio) was added, under continuous stirring. Next, the product was mixed until a viscous mass was obtained, which was poured into silicone forms. The crude soap sample, $S_b$, was obtained.

In order to obtain the soaps with extracts, we proceed as in the case of the crude soap, with the mention that a mixture of extracts in a ratio of 1:1:1 was used to obtain the NaOH solution. Finally, the extraction soap sample was obtained, denoted as $S_e$.

### 2.4. Analysis of Oils and Soap Samples

The determination of the most important physico-chemical characteristics for the used vegetable oils, namely the acidity index (AV), the iodine index (IV) and the saponification index (SN) were made according to the literature method (Bulancea, 2002).

Also, the qualitative and quantitative analysis of free alkalinity, saponifiable and unsaponifiable fatty acids, existing sodium chloride, and glycerine from the two soap samples was performed according to the literature method (Cernătescu, 2016).

## 3. Results and Discussions

Usually, the physico-chemical characteristics of vegetable oils play a particularly important role in soap making technology and are dependent on their chemical composition and structure. In order to establish the physico-chemical characteristics of the oil samples taken, they were analised according to the methods described in literature and stated above. The numerical values obtained were compared with the standard values. Quality indices were determined at room temperature.

Table 1 shows the physico-chemical indices for the three oil samples.

**Table 1**
*Physico-Chemical Characteristics for the Three Oil Samples*

| Oil | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | AV, mg KOH/g | Codex; HG, 2010 | IV, % | Codex; HG, 2010 | SN, mg KOH/g | Codex; HG, 2010 |
| UM | 0.3 | 0.3 | 81 | 75-94 | 192 | 184-196 |
| UC | 0.5 | 0.5 | 9 | 6.3-10.6 | 255 | 248-265 |
| UP | 0.6 | 0.6 | 53 | 50-55 | 200 | 190-209 |

As is well known, the acidity index is a measurement for the amount of free fatty acids in vegetable oil. The higher amount means more free fatty acids, which translate as a lower quality for the oil. Table 1 shows that for all vegetable oils, the acidity index falls within the limits established by the literature, which means that they are of high quality.

The iodine index point out the degree of unsaturation of the oil, a high value indicating that the oil is prone to oxidation. In the case of vegetable oils used for making soap, the value of the iodine index for each of them is within the admissible limits (Table 1), which means that they are within the shelf life and are not degraded.

The saponification index reveals the molecular weight of triglycerides in the oil. A high value suggests that there may be a high proportion of lower

fatty acids in vegetable oil because the value of the saponification index varies inversely to the average molecular weight or length of the fatty acid chain (Muhammad *et al*., 2011). From Table 1 it can be seen that the saponification index values for all vegetable oils used in this experiment are within the limits allowed by the literature, which indicates that they are a good raw material for the manufacture of soap.

In order to evaluate and compare the quality of the two soap samples Sb and Se (Fig. 1) some characteristics such as smell, appearance, consistency, color and pH were analyzed, the results are presented in Table 2.

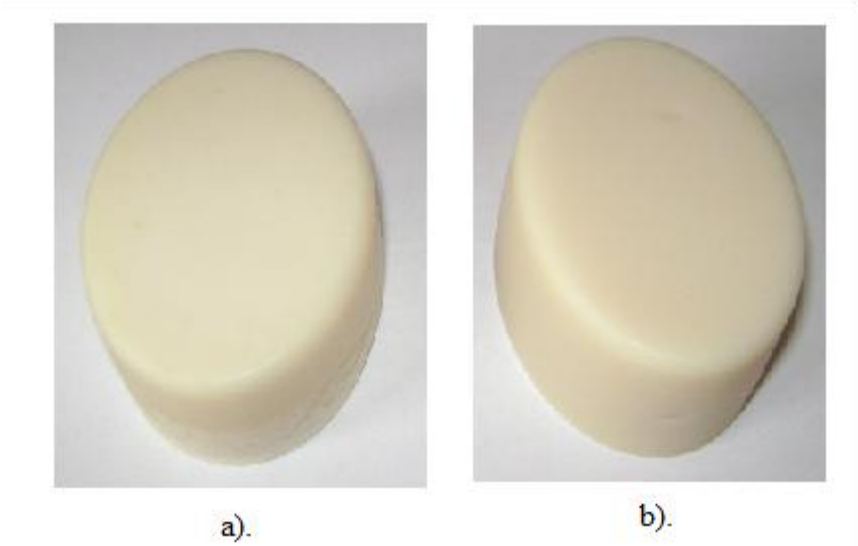


Fig. 1 – The crude soap (*a*) and the natural extracts soap (*b*) obtained in the laboratory.

**Table 2**

*The Characteristics Used for Establishing the Quality of the Two Soap Samples*

| Parameters | Sample | |
|---|---|---|
| | $S_b$ | $S_e$ |
| appearance | solid, smooth, glossy | solid, smooth, glossy |
| smell | pleasant, fresh | pleasant, slightly fruity |
| consistency | velvety | velvety |
| colour | slightly yellowish | slightly yellowish |
| pH | neutral | neutral |

As showed in Table 2, the two types of soap, according to their characteristics, are of good quality. The good quality is given by both the mixture of oils and the natural extracts used. As for oils, they contain vitamins and antioxidants that give each type of oil specific properties, such as: olive oil has excellent emollient and moisturizing properties (Covas *et al*., 2014), palm

oil tones and softens the skin (Berger and Martin, 2000), and the coconut gives brilliance to the skin (Ahmed, 1984). Natural extracts also contain vitamins and antioxidants that together with those in oils provide a soap with superior quality and unique pharmaco-dynamic properties. However, in the case of natural extracts soap (Fig. 1*b*), we would have expected a more intense coloration, specific to the extracts used, but the anthocyanin pigments in the extracts changed their colour upon contact with the alkaline solution (from red to blue) or neutral pH of soap (from blue to slight yellow).

Table 3 presents the experimental data obtained on the qualitative and quantitative determination of free alkalinity, sodium chloride and glycerin for the two soap samples.

**Table 3**
*Experimental Data on NaCl, Alkalinity and Glycerine Content in the Analysed Soap Samples*

| Characteristics | Sample | |
|---|---|---|
| | $S_b$ | $S_e$ |
| Qualitative determination of free alkalinity (phenolphthalein test) | negative | negative |
| Quantitative determination of free alkalinity, % NaOH | 0.0794 | 0.0805 |
| Unsaponifiable fat, % | 6.85 | 6.98 |
| Saponifiable fatty matter, % | 93.15 | 93.02 |
| Amount of NaCl, % | 0.033 | 0.029 |
| Glycerine content, (g/g soap) | 0.05 | 0.05 |

Typically, soap has alkali but it must be bound to the fatty acids, and in the literature it is stated that alkalinity should not exceed 0.1% for toilet soap (Cernătescu, 2016). From the data presented in Table 3, it can be said that in the qualitative determination of free alkalinity (phenolphthalein test), the two soap samples, $S_b$ and $S_e$, respectively, have been given a negative alkaline reaction, which indicates that they do not present alkali, and in the determination quantitative, the values obtained are within the limits from the literature. Moreover, it can be said that, by the glycerine content, the soaps obtained are qualitative and contributes substantially to the moisturizing and softening of the skin.

## 4. Conclusions

In this study a cold sodium toilet soap, with a mixture of natural fruit and vegetable extracts was prepared. The results have shown that the mixture of three vegetable oils (olive, palm and coconut oil) used as a source of fatty acids are a good raw material for the manufacture of soap. Furthermore, they contain vitamins and antioxidants, which together with those contained in the mixture

of the natural extracts obtained from fruits and vegetables substantially improve the soothing and softening properties of the soap. However, anthocyanin pigments in natural extracts do not contribute to the colour enhancement of the finished product due to the colour change upon contact with the alkaline solution or the neutral pH of the soap. However, the soap obtained is a quality product because it does not have free alkali, and because it has a high glycerine content that contributes substantially to moisturizing and softening the skin.

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## INFLUENŢA EXTRACTELOR NATURALE ASUPRA CALITĂŢII SĂPUNULUI DE SODIU OBŢINUT LA RECE

(Rezumat)

În acest studiu s-a preparat un săpun de toaletă cu amestec de extracte naturale din fructe şi legume. Rezultatele obţinute au arătat că cele trei uleiuri vegetale (ulei de măsline, palmier şi cocos) utilizate ca sursă de acizi graşi reprezintă o bună materie primă pentru fabricarea săpunului. Mai mult, acestea conţin vitamine şi antioxidanţi care împreună cu cele conţinute în amestecul de extracte naturale obţinut din fructe şi legume contribuie substanţial la îmbunătăţirea proprietăţilor emoliente şi hidratante ale săpunului. Însă, pigmenţii antocianici din extractele naturale nu participă la intensificarea culorii produsului finit datorită modificării culorii la contactul cu soluţia alcalină sau la pH-ul neutru al săpunului. Totuşi, săpunul obţinut este un produs de calitate deoarece nu prezintă alcalii, iar prin conţinutul de glicerină acesta contribuie substanţial la hidratarea şi emolierea pielii.