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Aromatic Plants and Cosmetic Symposium, 2019

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AN OVERVIEW ON COSMETIC SECTOR REGARDING NEW PRODUCT DEVELOPMENT AND BRANDING PROCESSES

Prof. Dr. Nazan APAYDIN DEMİR (Opening speech).

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Abstract: The chemistry industry supplies a wide array of processed products including plastics, cosmetics, pharmaceuticals and paints as well as non-processed raw materials to other sectors (textile, electrical, metal, metal products, construction, automotive, paper, service sector). For this reason, the chemical industry has a privileged place in terms of people's daily lives and other sectors. The chemical industry is of the undisputed scientific areas with the respect to preserving ecological balances and quality of human life. Turkey host different climate and soil characteristics due to its geographical regions and thence exhibits rich plant diversity with a total number of 11.000 whereas there are about 12.500 different plant species in Europe. Compared to other European countries, Turkey has a high rate of endemism (34%) with a total number of 3000 species. Of those plants, some plants have great potentials to be used and to be marketed globally in the fields of medicine and cosmetics. In Turkey, citrus, rose, St. John's wort, Thyme, bay and leaves, sweet gum tree and opium are of the common species. European Union countries are of the leading countries in cosmetics sector and marketing. In this sector, Turkey's share in the global cosmetics market stood at around 1.5% until ten years ago but the recent share is around 0.7%. Of qualified and branded cosmetic products marketed in Turkey constitute only 10% of the Turkey-based products. Turkey's imports of cosmetics and personal care products were approximately $ 589 million in 2010. For the presentation, the private and state sectors concerning cosmetics sectors, attempts towards production of cosmetic products and the potential of plant diversity of Turkey werediscussed.

Keywords: Cosmetics, Care Products, Plant Diversity, Turkey

INVITED SPEAKERS

Future perspectives for medicinal and aromatic plant production in Turkey

Prof. Dr. Nazım ŞEKEROĞLU

Kilis 7 Aralık University Faculty of Engineering and Architecture Department of Food Engineering, Kilis, Turkey

The Future of Naturals in the Cosmetics Industry; Ancient Knowledge, Modern Evidence

Rvt. Rana Babaç ÇELEBİ

Founder of Cerci Yusuf.org & Istanbul Medipol University, History of Medicine & Ethics Phd. Candidate, Aromatherapist, İstanbul, Turkey

Assessment of skin-whitening effect of cream prepared using cyanobacteria

Asst. Prof. Dr. Ahmad ALI

Department of Life Sciences, University of Mumbai, Vidyanagari, Santacruz (East), Mumbai,INDIA

Antiquorum sensing effect of volatile oils in aromatherapeutical formulations: might be a solution for antibiotic resistance?

Assoc. Prof. Dr. Ufuk Koca ÇALIŞKAN

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Future Perspectives for Medicinal and Aromatic Plant Production in Turkey

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Abstract: Turkey has a great deal of plant diversity in its flora. The number of used plants for ethnobotanical purposes is around one thousand, eight percent of the total plant richness. Around five hundreds plant species have been mostly used and traded in local and international markets. Currently, eighty percent of these plants have been obtained from nature by wild harvesting. Limited numbers of Medicinal and Aromatic Plants (MAPs) have been cultivated under field conditions. Oil rose, poppy, cumin, black cumin, fennel, anise, red pepper, tea, mint, fenugreek, dill, oregano, sage etc. are of the cultivated MAPs. Although field cultivation have a great portion in the total production, wild harvesting of some oregano and thyme species is going on. Similarly, bay leaf is one of the most exported MAP species; all the traded materials have currently been wild collected. Because of high crop yield with lower investment, standard quality with high secondary metabolite content with desired composition, lower labor costs by modern agricultural techniques, conservation of natural resources, novel crops with high income, and sustainable stocks for market demand, mostly demanded MAPs should be cultivated on the field conditions. In order to support field cultivation; technical information, registered seed or seedlings, postharvest processing equipment and storage support must be given to farmers by local governmental bodies. Additionally, in-situ cultivation of the most demanded MAP species should be started according to Good Agricultural Practices (GAP) after economic analysis for long term benefits and this production should be encouraged by the government for rural development. Besides our local plant species, some MAPs having big global market should be introduced from their origin countries and cultivated in different regions of Turkey.

Keywords: Aromatic Plants, Cultivation, Medicinal plants, Marketing, Quality, Wild Harvesting,

The Future of Naturals in The Cosmetics Industry; Ancient Knowledge, Modern Evidence

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Abstract: For at least the past 25 years - in parallel to the rapidly changing consumer priorities and preferences - the global cosmetics industry has turned to nature to find inspiration and build a positive image. At the dawn of the modern environmental movement, what lies ahead for the cosmetics industry? Could the answer be hidden in the past?

Keywords: Ancient Knowledge, Cosmetics, Future of Naturals, Industry

Antiquorum Sensing Effect of Volatile Oils in Aromatherapeutical Formulations: Might be A Solution for Antibiotic Resistance?

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Abstract: Aromatherapy is a complementary treatment that uses essential oils to promote both physical and emotional health. Lately, aromatherapy has gained more recognition in the fields of science and remedy. Quorum sensing (QS) is a molecular mechanism of gene regulation, the cell-to-cell signaling system in which bacteria adapt their performance consistent with cell concentration and the neighboring environment. Multidrug-resistance microbes frequently use this system for developing the antimicrobial resistance; consequently, anti quorum sensing (AQS) effect could be an applicable methodology for the prevention of bacterial contaminations therefore resistance, with the discovery of new anti-QS agents. In this study, it is aimed to give general information about QS, QSI systems, and antibiotic resistance. Moreover, the presentation will be elaborated with the antiquorum sensing activity on *Chromobacterium violaceum* biosensor system of selected volatile oils used in 'Aromatherapy'. Aromatherapy is a complementary treatment that uses essential oils to promote bothphysical

Keywords: Aromatherapy, *Chromobacterium violaceum* CV026, Quorum Sensing, Volatile Oils

Assessment of Skin-Whitening Effect of Cream Prepared Using Cyanobacteria

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Abstract: High sensitivity of facial skin makes it more susceptible to damage. However, being the most noticeable feature of the body, there has been a consistent desire amongst consumers to beautify it. Skin whitening being the most noticeable feature, consumers tend to use several synthetic creams which indirectly leads to skin damage. This study uses cyanobacterial extract to determine its effect on reduction of melanin pigments. Tyrosinase is one of the key enzymes in the melanin-synthesis pathway. The extract could reduce tyrosinase activity more efficiently when compared with Kojic acid, most widely used tyrosinase inhibitor, and orange peel, a traditional herbal ingredient. A cream was synthesized using this extract which showed tyrosinase inhibition. Furthermore, high antioxidant activity of this cream imparts several other features to the cream such as dead skin removal and reduction of toxins on facialsurface.

Keywords: Cyanobacteria, Melanin, Skin cream, Skin-whitening, Tyrosinase inhibition

FULL TEXT PROCEEDINGS

Antioxidant Properties of Some Herbs and Spices Traditionally Used in Middle-East Food Preparation

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Abstract: Antioxidant activity forms an essential component of bioactive properties of plant products. Three types of aqueous extracts of four herbs and spices were prepared. The antioxidant properties were evaluated by measuring the total phenolic content, DPPH radical scavenging activity and oxidoreduction potential methods. The antioxidant results showed that all extracts contained phenolic compounds with a total phenolic content ranged from 22.68 to 51.63 mg GA/g. All the aqueous extracts could scavenge the radical DPPH with significant differences ($P<0.05$) with values ranged from 32.95 to 84.84%. The phenolic content linearly correlated ($R^2=0.827$) with DPPH scavenging activity of the studied plants following the order: sumac>ginger>rosemary>cinnamon. The oxidoreduction potential values linearly correlated with both the phenolic content ($R^2\approx0.88$) and DPPH scavenging activity values ($R^2\approx0.96$). The oxidoreduction potential could be proposed as a useful companion tool combined with other techniques when determining the antioxidant activity of plant extracts and food products is considered.

Keywords:**Antioxidant Activity, Cinnamon, Ginger, Oxidoreduction Potential, Phenolic content, Sumac, Rosemary.**

1. Introduction

Herbs and spices have been traditionally added to many foods since ancient times by different nations. The nutritional properties, health benefits, preservation capacity and desirable flavor and aroma were the major reasons for using these herbs and spices. These plants are known to possess many different bioactive compounds demonstrating antioxidant and antimicrobial activities such as organic acids, phenolic compounds, sulfur compounds, pigments, glucosinolates, essential oils, oleoresins and alkaloids (Aligiannis et al., 2001; Beuchat, 2007; Proestos et al., 2005).

Many types of solvents have been used in the extraction process of these bioactive compounds from herbs from spices. The chemical composition, generally, and the bioactive compounds extracted, especially, changes in terms of the solvent used during the extraction procedure. Furthermore, the geographical location and the climacteric conditions as well as the botanical variety are the main factors affecting the chemical composition of herbs and spices. This matter appears clearly when searching the antioxidant activity of herbs and spices in literature. For example, Kossah et al., (2009) reported that Syrian sumac contained a higher concentration of organic acids, potassium and calcium ions, and vitamins than Chinese sumac (Kossah, 2009). Much effort has been put to characterize their bioactive compounds as well as the antioxidant activity and their potential pharmaceutical and food processingapplications.

Herbs and spices are used in the food culture of nations by different forms such as fresh or dried, complete or ground, and direct or infusion. Its uses as infusion or maceration form are common for preparing the traditional foods and herbal infusions/teas. This is the reason why the aqueous extracts form of herbs and spices has been chosen in the present study.

On the other hand, an effective search for sources of naturally occurring antioxidants requires reliable methods of antioxidant activity evaluation (Shahidi & Zhong, 2015). Methods and tools used for measuring antioxidants activity have remarkably advanced during the last few decades. To date, various chemical assays coupled with highly sensitive and automated detection technologies are employed for evaluation of antioxidant activity through particular mechanisms, for example, scavenging activity against certain types of free radicals or ROS, reducing power, and metal chelation (Shahidi & Zhong, 2015). These methods vary in terms of antioxidant mechanism, substrate type, oxidation initiator, result expression and ease of operation. Generally, *in vitro* antioxidant tests using free radical traps are relatively straightforward to perform. Among free radical scavenging methods, DPPH method is furthermore rapid, simple and inexpensive in comparison to other test models (Alam, Bristi, & Rafiquzzaman, 2013). However, authors concluded that antioxidant activity should not be based on a single antioxidant test model.

We hypothesized that oxidoreduction potential value, which represents the sum of all oxidant and reductant (antioxidants) pairs present in medium/product, could demonstrate the oxidative or reducing state (antioxidant activity) of the medium/product. To test this hypothesis, we

evaluated different analytical measurement of the antioxidant activity for different types of plants and extracts.

There were many aims of the present study:

1) the determination of the antioxidant activity of some herbs and spices commonlyused in food preparation,

2) evaluation of the relationship between the oxidoreduction potential value and both the antioxidant activity and the phenolic content, and

3) evaluation of the possibility of using the oxidoreduction potential method as a companion tool when the antioxidant properties of plant extracts wereconsidered.

2. Materials and Method

2.1. Plant materials

Sumac (*Rhus coriaria* L.) fruits, Rosemary (*Rosmarinus officinalis* L.) leaves, Cinnamon (*Cinnamomum zeylanicum*) barks and Ginger (*Zingiber officinalis*) roots were purchased from a local supplier in dried form.

2.2. Chemicals

2,2-Diphenyl-1-picrylhydrazyl (DPPH)(Aldrich, USA), gallic acid (Lobachemie, India), sodium carbonate (Merck, Germany), glycerol (Merck, Germany), methanol (HPLC grade) and Folin–Ciocalteu (Merck, Germany) reagents were used for carrying out theassays.

2.3. Preparation of plant materials prior to extraction

The dried plants were kept in a refrigerator for no longer than three days prior to extraction. Before extraction, the plants were milled into a fine powder using a home mill.

2.4. Extraction and preparation of aqueous extracts

Five grams of each plant material were put in an Erlenmeyer, and then 100 mL of distilled water was added. Three extraction methods were employed: (1) maceration in water at room temperature for 24 hours, (2) maceration in water at 50°C for 24 hours and (3) boiling in water for 2 min. The extracts were filtered using Whatman No. 4 filter paper (Whatman International, UK). The filtrated extracts were then concentrated to the tenth of its volume (1/10) using vacuum drier at 50°C (Fratelli Galli, Italy). The obtained extracts were stored in a freezer at - 18°C until use. The pH of all samples was determined with a combined pH electrode (Inlab 427, Metler-Toledo).

2.5. Determination of total phenolic content

The amount of phenolic compounds in the extracts was determined by the Folin–Ciocalteu colorimetric method (Macheix, Sapis, & Fleuriet, 1991). Determinations were carried out in triplicate and calculated from a calibration curve obtained with gallic acid. The total phenolic contents were expressed as *mg gallic acid equivalents* (mg GA/g extract).

2.6. Determination of antioxidant activity

Antioxidant activity of the prepared extracts was determined with 2,2-diphenyl-1-picryl-hydrazyl (DPPH) assay (Singh, Chidambara Murthy, & Jayaprakasha, 2002). The free-radical DPPH was served as the model oxidizing agent to be reduced by the antioxidant compounds present in the extracts. The extracts were dried at 50°C using vacuum dryer (Fratelli Galli, Italy). One gram of a dried extract was dissolved in 100 mL methanol. The same volumes of methanolic dissolved samples and DPPH solution (60 μM) were vortexed together. The final solution was allowed to react in the dark for 30 minutes. It was then centrifuged (5500 rpm (1165×g), Engelsddre/lepzig DDR-7123 Centrifuge, Germany) for 15 minutes. The absorbance of the supernatant was measured at 517 nm with a UV spectrophotometer (Analitica, Germany). The tests were carried out in triplicates. The DPPH free-radical scavenging activity was calculated by the following formula:

$$\text{DPPH free radical scavenging activity (\%)} = [A_0\text{-}A_1]/A_0 \times 100$$

Where A_0 is the absorbance of the control solution containing only DPPH after incubation and A_1 is the absorbance in the presence of plant extract in DPPH solution after incubation.

2.7. Oxidoreduction potential measurement

The oxidoreduction potential (Eh) value of plant extracts was measured with a combined redox electrode (Pt4805-DXK, Metler-Toledo, France) referred to the Ag/AgCl system and connected to a redox-controlled interface (Consort 835, Belgium). The Eh values were calculated according to Jacob (1970)(Jacob, 1970): $Eh = E_m + E_r$; where Eh, the electrode potential referred to the normal hydrogen electrode, E_m, the measured potential, and E_r, the potential of the reference electrode (Ag/AgCl). The Eh values at pH=7 (Eh_7) were obtained after correcting Eh values according to the pH value of the extract as follows:

$Eh_7 = Eh - 59(7 - pH_m)$; where pH_m, the measured pH value of the extract.

2.8. Data and statistical analysis

All experiments were performed in different sets, with each set in triplicate. Statistical analysis was performed for ANOVA (Analysis of variance). Values of P, which were ≤ 0.05, were considered significant.

3. Results and Discussion

3.1. Total phenolic compounds content of extracts

The content of the phenolic components of the studied spices differs according to both the extraction method and spice type (Table 1). The phenolic content of the studied plants follows as: sumac > ginger > rosemary > cinnamon. These findings confirm with the results reported by Ünver et al., (2009), who demonstrated that the total phenolic contents of sumac was higher than rosemary when extraction was conducted in mixture of 90% methanol + 9% water + 1% acetic acid at 24°C for 24 h (Ünver, 2009). All the studied spices in the present work exhibited similar results except for the cinnamon which exhibited a low phenolic content in heated extracts (Table 1.). The 50°C maceration extracts and the boiled aqueous extracts exhibited higher phenolic content than the room temperature aqueous extracts. When a statistical study has been conducted to compare the different extraction methods for all spices, it could be noted that the room temperature aqueous extracts had the lowest content of phenolic compounds followed with a similar effect of both 50°C maceration and boiled aqueous extracts (Table 1). For example, the 50°C maceration extract and the boiled aqueous extracts of sumac exhibited a higher phenolic content than the room temperature aqueous extract with 49.97±0.85, 51.63±0.96 and 41.45±1.44 mg GA/g extract, respectively ($p<0.05$) (Table 1).

Table 1. The total phenolic content of different aqueous extracts of sumac, rosemary, cinnamon and ginger.

Plant	Extraction method	Phenolic content (mg GA/g extract)
Sumac	Maceration at room temperature	$^{a}41.45\pm1.44^{A}$
	Maceration at 50°C	$^{b}49.97\pm0.85^{A}$
	Boiled aqueous	$^{b}51.63\pm0.96^{A}$
Rosemary	Maceration at room temperature	$^{a}31.67\pm0.15^{B}$
	Maceration at 50°C	$^{ab}34.34\pm1.54^{B}$
	Boiled aqueous	$^{b}37.08\pm0.48^{B}$
Cinnamon	Maceration at room temperature	$^{a}26.56\pm0.62^{C}$
	Maceration at 50°C	$^{b}22.68\pm0.51^{C}$
	Boiled aqueous	$^{b}24.17\pm0.07^{C}$
Ginger	Maceration at room temperature	$^{a}41.76\pm0.08^{A}$
	Maceration at 50°C	$^{b}43.04\pm0.46^{D}$
	Boiled aqueous	$^{b}43.68\pm0.22^{D}$

Each value represents mean±SD (n=4)

The same small letters for the same plant show no significant effects between extracts at $p<0.05$ according to Tukey.

The same capital letters show no significant effects between all plants for the indicated extract type at $p<0.05$ according to Tukey.

This increase of the phenolic compounds with the increase of temperature could be explained by the fact that the temperature of extraction led to the increase of the liberation of some phenolic molecules from spice. On the other hand, the low content of phenolic content in heated extracts of cinnamon could be explained by the formation of gelatinous extract which led to difficulties in the filtration and maybe in the separation of phenolic compounds.

Our findings are also in agreement with the results of Bozan et al. (2003), who found that aqueous methanol (80%) extract of sumac contained 37.4 mg GA/g extract (Bozan, Kosar, Tunalier, Ozturk, & Baser, 2003). Gallic acid, a phenolic compound and an active principle of sumac, in a comparison study *in vitro* experiments showed 50 times more protective (DNA-protective effects) activity than the vitamins C and E (Ferk, Chakraborty, Simic, Kundi, & Knasmüller, 2007). On the other hand, the phenolic content of ginger in the present study(41.76 - 43.68 mg GA/g extract) was higher than that reported by Hinneburg et al., (2006) that was 23.5 mg GA/g extract (Hinneburg, Damien Dorman, & Hiltunen, 2006). The maceration time was 2 hours for the latter study while it was 24 hours for our study. El-Ghorab et al., (2010) reported 67.5 and 71.1 mg GA/g extract for hexane and methanolic extract of dried ginger, respectively (El-Ghorab et al., 2010). This difference from our findings may be due to the difference in the temperature of extraction and solvent type applied, which significantly affect the quantification of total phenolics. On the other hand, Proestos et al., (2005) found that among 28 herbs and spices rosemary (*Rosmarinus officinalis*) had the highest amount of phenolic compounds (Proestos et al., 2005).

3.2. Measurement of DPPH free-radical scavenging activity

DPPH is a stable nitrogen-centered free radical the color of which changes from violet to yellow upon reduction by either the process of hydrogen- or electron-donation. Substances which are able to perform this reaction can be considered as antioxidants and therefore radical scavengers (Brand-Williams, Cuvelier & Berset, 1995). Scavenging of the stable radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) is considered a valid and easy assay to evaluate scavenging activity of antioxidants, since the radical compound is stable and does not have to be generated as in other radical scavenging assays (Suhaj, 2006). The values of antioxidant activity of spices used in this study were determined by radical scavenging activity of DPPH method. The DPPH values of spices were 75.29, 81.36 and 84.84% for sumac, 69.24, 71.75 and 74.00% for rosemary, and 71.62, 73.95 and 76.10% for ginger at the room temperature, aqueous 50°C maceration, and the boiled aqueous extracts, respectively ($P<0.05$)(Table 2).

Table 2. DPPH free-radical scavenging activity of different aqueous extracts of sumac, rosemary, cinnamon and ginger.

Plant	Extraction method	DPPH free-radical scavenging activity (%)
Sumac	Maceration at room temperature	$^{a}75.29\pm0.68^{A}$
	Maceration at 50°C	$^{b}81.36\pm0.67^{A}$
	Boiled aqueous	$^{c}84.84\pm0.83^{A}$
Rosemary	Maceration at room temperature	$^{a}69.24\pm0.19^{B}$
	Maceration at 50°C	$^{ab}71.75\pm1.74^{B}$
	Boiled aqueous	$^{b}74\pm0.01^{B}$
Cinnamon	Maceration at room temperature	$^{a}38.17\pm0.70^{C}$
	Maceration at 50°C	$^{b}32.95\pm1.32^{C}$
	Boiled aqueous	$^{ab}34.70\pm1.36^{C}$
Ginger	Maceration at room temperature	$^{a}71.62\pm0.43^{D}$
	Maceration at 50°C	$^{b}73.95\pm0.09^{B}$
	Boiled aqueous	$^{c}76.10\pm0.15^{B}$

* Each value represents mean±SD

Same small letters show no significant effects between extracts for the indicated herb/spice at $p<0.05$ according to Tukey.

Same capital letters show no significant effects between different herbs and spices for the indicated extract at $p<0.05$ according to Tukey.

These results demonstrated an increase in the DPPH free-radical scavenging activity ofsumac, rosemary and ginger extracts with the increase of the temperature of extraction. Parameters that generally have a high influence on the amount and composition of antioxidants in extracts include the extraction solvent, temperature, extraction time (duration), solvent-to-solid ratio, and storage conditions (Makanjuola, 2017). For example, extraction of antioxidants from tea, ginger, and their blends have been reported to be affected by extraction temperature, powder concentration, extraction time, pH, solvent type, and solvent concentration (Makanjuola, 2017). However, the room temperature aqueous extract of cinnamon exhibited a higher value of DPPH than boiled aqueous one with 38.17 and 34.70 %, respectively ($P<0.05$). This dissimilarity in results between cinnamon and other spices could be due to the formation of gelatinous extract in the case of cinnamon which led to difficulties in filtration and maybe in the separation of antioxidant compounds like phenol compounds. The potency of DPPH free-radical scavenging activity of the studied plants was as follows: sumac> ginger≈rosemary>cinnamon. Similar results showed that the antioxidant activity of sumac determined by DPPH for the methanol/acetic acid/water extracts was higher than sage and rosemary (Ünver, 2009). Both ferric reducing power and total phenolic content of water extract of sumac were higher than those of ethanol extract, and then water extract showed more potent antioxidant and radical scavenging activity than ethanol extract (Bursal & Köksal,2011).

Furthermore, the methanol extract of sumac (*Rhus coriaria* L.) exhibited strong antioxidant activity rich in anthocyanins and water-soluble tannins, and moderate lipid peroxidation inhibition effect compared with the synthetic antioxidants (Kosar, Bozan, Temelli, & Baser, 2007).

In the DPPH assay, rosemary boiled aqueous extract showed the highest activity between different Lamiaceae herbs (oregano, sage and thyme) (Dorman et al., 2003). Carnosic acid and carnosol were identified as the two major phenolicditerpenes possessing antioxidants activity of rosemary (Loussouarn et al., 2017). On the otherhand, El-Ghorab et al., (2010) studied the DPPH radical inhibition of the methanolic and hexaneextracts of dried ginger (200 µg/mL) which was 77.88 and 73.87%, respectively (El-Ghorab etal., 2010). Furthermore, it was demonstrated that aqueous extracts of two varieties of gingerroots (Guangdong-ginger and Chu-ginger) were more effective than ethanolic extracts for both free radical scavenging activities and chelating abilities (Yeh et al., 2014).

3.3. Determination of the oxidoreduction potential values

Oxidoreduction potential or Eh was used generally to determine the redox value of the medium. This value exhibits the sum of the total oxidant/reductant compounds found in the medium. The higher the oxidant compounds concentration is, the higher the Eh value of the medium is, and *vice versa*. The antioxidant activities of studied spices according to Eh method were as follows: sumac > ginger > rosemary > cinnamon (Table 3).

Table 3. Oxidoreduction potential values of different aqueous extracts of sumac, rosemary, cinnamon and ginger.

Plant	Extraction method	Oxidoreduction potential (Eh_7, mV)
Sumac	Maceration at room temperature	+63
	Maceration at 50°C	+55
	Boiled aqueous	+52
Rosemary	Maceration at room temperature	+96
	Maceration at 50°C	+91
	Boiled aqueous	+88
Cinnamon	Maceration at room temperature	+152
	Maceration at 50°C	+180
	Boiled aqueous	+179
Ginger	Maceration at room temperature	+66
	Maceration at 50°C	+65
	Boiled aqueous	+65

Data shown in Table 3 indicate that the Eh_7 values of sumac extracts were lower (more reducing properties) than other spices. This could be explained by the high phenolic content of sumac extracts compared to other plants that could confirm this hypothesis. Otherwise, the decrease of the Eh_7 value was observed when the temperature of extraction increased except cinnamon. This maybe occurred due to the liberation of some reducing property molecules such as phenolic compounds especially flavonoids, vitamin C and molecules containing -SH group during the heating phase.

3.4. Correlation between DPPH assay and oxidoreduction potential values

The correlation coefficient (R^2) between DPPH assay and oxidoreduction potential values of the aqueous extracts of the plant studied was determined. Results showed a good positive linear correlation between DPPH assay and oxidoreduction potential values ($R^2 \approx 0.96$). When the value of DPPH scavenging activity of extracts increases its Eh value decreases. For example, the lowest Eh_7 value was for boiling extract of sumac with +52 mV and a DPPH value of 84.84%; whereas, the highest Eh_7 value was for 50°C maceration of cinnamon with +180 mV and a DPPH value of 32.95% (Table 3). It was reported that the degree of electron donation capacity of rosemary boiled aqueous extract was about 19% of this of ascorbic acid with a higher value compared with oregano and thyme (Dorman et al., 2003). The antioxidant activity of extracts combines with the high content of bioactive molecules possessing low oxidoreduction potential values such as phenolic compounds, vitamin C and E, molecules containing -SH group. These bioactive molecules with reducing property are responsible for the decrease of Eh value of the medium.

3.5. Correlation between phenolic content assay and oxidoreduction potential values

To correlate the results obtained from the phenolic content assay and oxidoreduction potential methods, a regression analysis was performed (the correlation coefficient (R^2). Results show a positive linear correlation between phenolic content values and oxidoreduction potential ones ($R^2 \approx 0.88$). When the phenolic content of the extract increases its Eh_7 value decreases. A similar work performed by Firuzi et al., (2005) demonstrates that when cyclic voltammetry has been applied to measure the oxidizability of various compounds such as flavonoids in different buffers and pH, good correlations between redox potentials and antioxidant properties were observed (Firuzi, Lacanna, Petrucci, Marrosu, & Saso, 2005). Furthermore, results of FRAP assay and electrochemical methods were in good agreement, and an inverse correlation was

observed between them (Firuzi et al., 2005). The latter study reported that an increase in the number of hydroxyl groups enhances the antioxidant activity of the flavonoids; and concluded that while good correlations were not found between the total number of hydroxyl groups of flavonoids and FRAP values (R= 0.656) nor electrochemical values (R= 0.676), good correlations were found in the group of flavonols between these parameters (R=960). Other researchers reported that the antioxidant activity of flavonoids is inversely proportional to their electrochemical values, *i.e.*, the lower electrochemical value of flavonoids is, the higher the antioxidant is (Yang, Kotani, Arai, & Kusu, 2001). The results of latter reports are in agreement with our findings.

3.6. Correlation between phenolic content and DPPH activity values of plantextracts

When subjecting the results of DPPH scavenging activity and phenolic content for all plant extracts studied to the regression analysis, a high correlation coefficient could be observed between the phenolic content and the DPPH scavenging activity. Results show a positive linear relationship between phenolic content and DPPH activity values for all types of plant extracts studied (R^2=0.827) indicating that phenolic compounds are the major contributors to the antioxidant properties of these plants. When the contribution of the different phenolics groups to the pomegranate juice antioxidant activity (measured as a DPPH scavenging activity) was calculated, the anthocyanins accounted for only 1.4 mM of Trolox, and the ellagic acids only 0.5 mM of Trolox, the punicalagins, however, accounted for 9.9 mM Trolox and the other hydrolyzable tannins (calculated as gallic acid) reached 6.2 mM of Trolox (Gil, Tomás-Barberán, Hess-Pierce, Holcroft, & Kader, 2000). Authors concluded that the contribution of the different phenolic groups reached 87% of the antioxidant activity experimentally determined for this juice. The latter finding was supported by another work in which the antioxidant capacity of high molecular weight polyphenolics (tannins) was reported to be 15-30 times more effective at quenching peroxyl radicals than simple phenolics or Trolox (Gil et al., 2000). Furthermore, it was demonstrated that the simple phenolics and tannins are thermodynamically able to reduce the peroxyl radical (Hagerman et al., 1998). Authors concluded that tannins, or polymeric polyphenolics, may be much more potent antioxidants than are simple monomeric phenolics.

The linear reliability between the content of total phenolic compounds and the antioxidant activity of plant extracts has been similarly proved, like our finding, by many researchers.

Wong et al., (2006) reported a significant and linear correlation coefficient between the antioxidant activity and the total phenolic content in both aqueous (R^2 = 0.7917, FRAP) and methanol (R^2 = 0.7584, FRAP) extracts of 30 Chinese medicinal plants, with phenolic compounds were thus a major contributor of antioxidant activity (Wong, Li, Cheng, & Chen, 2006). Similarly, a positive significant and linear correlation between antioxidant activity and total phenolic content of aqueous and methanolic extracts of 112 traditional Chinese medicinal plants (all R^2 values ≥ 0.95, DPPH)(Cai, Luo, Sun, & Corke, 2004), aqueous ethanol extracts of some Algerian medicinal plants (R^2 = 0.7931, DPPH)(Djeridane et al., 2006), Labiatae spice family (R^2 = 0.91, FRAP)(Wojdylo, Oszmianski, & Czemerys, 2007), aqueous extracts of 30 plant of industrial interest (R^2 = 0.939, DPPH; R^2 = 0.966, ABTS and R^2 = 0.906, FRAP)(Dudonne, Vitrac, Coutiere, Woillez, & Merillon, 2009), methanolic extracts of Mediterranean herbs and aromatic plants (R^2 = 0.70−0.83, DPPH), aqueous extracts of 70 medicinal plants (R^2= 0.9825, FRAP)(Katalinic, Milos, Kulisic, & Jukic, 2006) was reported. These reports confirm the presence of significant linear correlation between the free radical scavenging activity determined by the DPPH, ABTS and FRAP methods, and total polyphenolic compounds (phenolic and flavonoids). Otherwise, one report indicated that although there was a significant linear correlation between the free radical scavenging activity determined by using the DPPH, ABTS and FRAP method, and total polyphenolic compounds (phenolic and flavonoids) in the leaves of *H. halimifolium*, no significant relationship between antioxidant activity (DPPH and ABTS) and total condensed tannins was observed (Rebaya et al., 2015).

On the other hand, a research illustrated that among the three radical scavenging methods used to determine the scavenging activity of plants (Free radical scavenging activity, hydroxyl radical scavenging activity and superoxide anion scavenging activity) the highest correlation coefficients were found between the phenolic content and the DPPH radical scavenging activity, followed by the hydroxyl radical scavenging activity (Parejo et al., 2002). This observation was confirmed by another study that demonstrated a weak correlation (R^2 = 0.58) between the phenolic content of commonly consumed fruits in the UK (apple, pear, peach, plum, and kiwi) and the total antioxidant activity estimated by the FRAP assay (Imeh & Khokhar, 2002).

Antioxidant properties of phenolic compounds are directly linked to their structure. Indeed, phenolics are composed of one (or more) aromatic rings bearing one or more hydroxyl groups and are therefore potentially able to quench free radicals by forming resonance-stabilized phenoxyl radicals (Dudonne et al., 2009). In general, the antioxidant activity of flavonoids depends on the structure and substitution pattern of hydroxyl groups. The essential requirement for effective radical scavenging is the 3′,4′-orthodihydroxy configuration in ring B and 4-carbonyl group in ring C. Such results indicate that DPPH radical scavenging activity can be credibly predicted on the basis of the phenolic compound content assay and that these two methods depend on a similar mechanism: the propensity to donate hydrogen (Katsube et al., 2004).

On the other hand, a study has shown that the Folin-Ciocalteu reagent used in the phenolic content assay is significantly reactive towards other compounds besides phenols such as vitamins (ascorbic acid, folic acid, folinic acid, NADH, pyridoxine, retinoic acid, thiamine and Trolox (ascorbic and retinoic acids has the greatest reactivity), amino acids (tyrosine, tryptophan and cysteine), thiols, inorganic ions Fe^{+2}, Mn^{+2}, I^{-} and SO_3^{-2}. As other investigators have suggested, the Folin-Ciocalteu assay should be seen as a measure of total antioxidant capacity similar to the ABTS assay rather than phenolic content. Since phenolics are the most abundant antioxidants in most plants, it gives a rough approximation of total phenolic content in most plants (Everette et al., 2010). These phenolics are known as the most abundant secondary metabolites in plants and can be classified into non-soluble compounds such as condensed tannins, lignins, cell-wall bound hydroxycinammic acids, and soluble compounds such as phenolic acids, phenylpropanoids, flavonoids and quinones (Rispail, Morris, & Webb, 2005).

Medini et al., (2014) indicated that the recovery of polyphenols from plant materials is influenced by their solubility in the extraction solvent, the type of solvent, the degree of polymerization of phenols, the interaction of phenols with other plant constituents and the formation of insoluble complexes. The differences in the polarity (and thus the extractability) of antioxidants may explain differences in extraction yield and antioxidant activity. Furthermore, solvent polarity plays a key role in increasing phenolic solubility. It is therefore difficult to define a standard procedure for the extraction of plant phenols (Medini, Fellah, Ksouri, & Abdelly, 2014). In our assays, the aqueous extraction of plant could be defined as a good choice if we consider that the free fraction of phenolics compounds that could be dissolved

in water has high antioxidant activities, compared with the soluble conjugate and insoluble-bound fractions that require an acidified organic solvent (Sun, Zhang, & Zhuang, 2012). Our results could be also proved by another work where a positive correlation between antioxidant activity and total free phenolics ($R^2 = 0.96$) for seven cultivars was found (Wang, Jiang, Wang, Jiang, & Feng, 2017). Authors found that the total conjugated phenolics significantly correlated (but with a low correlation coefficient) with DPPH and FRAP, showing R^2 of 0.84 and 0.88, respectively.

4. Conclusion

In the present study it was observed that the aqueous extracts of studied spices demonstrated different antioxidant properties for the different types of extraction methods. It appears thatthe bioactive compounds extracted responsible for the antioxidant activity found in the aqueous extracts of the studied plant differs according to both the plant and extraction type. The use of different aqueous extracts of herbs and spices at home when making recipes and in food industry could be useful to increase the nutritional characteristics and safety of food products. Our work extends those previous studies performed in this area and provides several arguments supporting the results of research performed on herbs and spices extracts to date indicating a promising potential to provide renewable bioproducts with nutritional properties. The findings of this study demonstrate the importance of aqueous extracts of sumac, rosemary, cinnamon and ginger when applying in food preparations as natural sources of bioactivecompounds.

The antioxidant activity of the studied plants depends on the temperature of the extraction procedure. This increase in antioxidant activity was consistent with the increase of the phenolic content. Many techniques have been developed to measure the antioxidant property in food and biological systems using different methods such as the free radical scavenging capacity, reducing power and overall oxidation inhibition. Our finding proved a positive linear relationship between oxidoreduction potential values and those of DPPH and phenolic content assays. Since previous studies advised that when analysing the antioxidant activity it is preferable to use at least two methods (Schlesier, Harwat, Böhm, & Bitsch, 2002), it could be then recommend to combine the oxidoreduction potential measurement method with other different antioxidant methods such as FRAP, ABTS and DPPH assays generally applied when the measurement of antioxidant properties of samples is considered. Combination of oxidoreduction potential measurement with these methods could be a useful and easy tool for valid assessment of antioxidant activity.

5. References

Alam, M. N., Bristi, N. J., & Rafiquzzaman, M. (2013). Review on in vivo and in vitro methods evaluation of antioxidant activity. *Saudi Pharmaceutical Journal, 21*(2), 143-152. doi: https://doi.org/10.1016/j.jsps.2012.05.002

Aligiannis, N., Kalpoutzakis, E., Chinou, I. B., Mitakou, S., Gikas, E., & Tsarbopoulos, A. (2001). Composition and antimicrobial activity of the essential oils of five taxa of Sideritis from Greece. *Journal of Agricultural and Food Chemistry, 49*(2), 811-815. doi: Doi 10.1021/Jf001018w

Beuchat, L. (2007). Control of Foodborne Pathogens and Spoilage Microorganisms by Naturally Occurring Antimicrobials *Microbial Food Contamination, Second Edition*: CRC Press.

Bozan, B., Kosar, M., Tunalier, Z., Ozturk, N., & Baser, K. H. C. (2003). Antioxidant and free radical scavenging activities of rhus coriaria and cinnamomum cassia extracts. *Acta Alimentaria, 32*(1), 53-61. doi: 10.1556/AAlim.32.2003.1.7

Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *LWT - Food Science and Technology, 28*(1), 25-30. doi: https://doi.org/10.1016/S0023-6438(95)80008-5

Bursal, E., & Köksal, E. (2011). Evaluation of reducing power and radical scavenging activities of water and ethanol extracts from sumac (Rhus coriaria L.). *Food Research International, 44*(7), 2217-2221. doi: https://doi.org/10.1016/j.foodres.2010.11.001

Cai, Y., Luo, Q., Sun, M., & Corke, H. (2004). Antioxidant activity and phenolic compounds of 112 traditional Chinese medicinal plants associated with anticancer. *Life Sciences, 74*(17), 2157-2184. doi: https://doi.org/10.1016/j.lfs.2003.09.047

Djeridane, A., Yousfi, M., Nadjemi, B., Boutassouna, D., Stocker, P., & Vidal, N. (2006). Antioxidant activity of some algerian medicinal plants extracts containing phenolic compounds. *Food Chemistry, 97*(4), 654-660. doi: https://doi.org/10.1016/j.foodchem.2005.04.028

Dorman, H. J. D., Peltoketo, A., Hiltunen, R., & Tikkanen, M. J. (2003). Characterisation of the antioxidant properties of de-odourised aqueous extracts from selected Lamiaceae herbs. *Food Chemistry, 83*(2), 255-262. doi: https://doi.org/10.1016/S0308-8146(03)00088-8

Dudonne, S., Vitrac, X., Coutiere, P., Woillez, M., & Merillon, J. M. (2009). Comparative Study of Antioxidant Properties and Total Phenolic Content of 30 Plant Extracts of Industrial Interest Using DPPH, ABTS, FRAP, SOD, and ORAC Assays. *Journal of Agricultural and Food Chemistry, 57*(5), 1768-1774. doi: 10.1021/jf803011r

El-Ghorab, A. H., Nauman, M., Anjum, F. M., Hussain, S., & Nadeem, M. (2010). A Comparative Study on Chemical Composition and Antioxidant Activity of Ginger (Zingiber officinale) and Cumin (Cuminum cyminum). *Journal of Agricultural and Food Chemistry, 58*(14), 8231-8237. doi: 10.1021/jf101202x

Everette, J. D., Bryant, Q. M., Green, A. M., Abbey, Y. A., Wangila, G. W., & Walker, R. B. (2010). A Thorough Study Of Reactivity Of Various Compound Classes Towards The Folin-Ciocalteu Reagent. *Journal of Agricultural and Food Chemistry, 58*(14), 8139-8144. doi: 10.1021/jf1005935

Ferk, F., Chakraborty, A., Simic, T., Kundi, M., & Knasmüller, S. (2007). Antioxidant and free radical scavenging activities of sumac (Rhus coriaria) and identification of gallic acid as its active principle. *BMC Pharmacology, 7*(2), A71. doi: 10.1186/1471-2210-7-s2-a71

Firuzi, O., Lacanna, A., Petrucci, R., Marrosu, G., & Saso, L. (2005). Evaluation of the antioxidant activity of flavonoids by "ferric reducing antioxidant power" assay and cyclic voltammetry. *Biochimica et Biophysica Acta (BBA) - General Subjects, 1721*(1), 174-184. doi: https://doi.org/10.1016/j.bbagen.2004.11.001

Gil, M. I., Tomás-Barberán, F. A., Hess-Pierce, B., Holcroft, D. M., & Kader, A. A. (2000). Antioxidant Activity of Pomegranate Juice and Its Relationship with Phenolic Composition and Processing. *Journal of Agricultural and Food Chemistry, 48*(10), 4581-4589. doi: 10.1021/jf000404a

Hagerman, A. E., Riedl, K. M., Jones, G. A., Sovik, K. N., Ritchard, N. T., Hartzfeld, P. W., & Riechel, T. L. (1998). High molecular weight plant polyphenolics (tannins) as biological antioxidants. *Journal of Agricultural and Food Chemistry, 46*(5), 1887-1892. doi: Doi 10.1021/Jf970975b

Hinneburg, I., Damien Dorman, H. J., & Hiltunen, R. (2006). Antioxidant activities of extracts from selected culinary herbs and spices. *Food Chemistry, 97*(1), 122-129. doi: https://doi.org/10.1016/j.foodchem.2005.03.028

Imeh, U., & Khokhar, S. (2002). Distribution of Conjugated and Free Phenols in Fruits: Antioxidant Activity and Cultivar Variations. *Journal of Agricultural and Food Chemistry, 50*(22), 6301-6306. doi: 10.1021/jf020342j

Jacob, H. E. (1970). Redox potential. In J. R. Norris & D. W. Ribbons (Eds.), *Methods in microbiology* (Vol. 2, pp. 92-121). London: Academic press.

Katalinic, V., Milos, M., Kulisic, T., & Jukic, M. (2006). Screening of 70 medicinal plant extracts for antioxidant capacity and total phenols. *Food Chemistry, 94*(4), 550-557. doi: https://doi.org/10.1016/j.foodchem.2004.12.004

Katsube, T., Tabata, H., Ohta, Y., Yamasaki, Y., Anuurad, E., Shiwaku, K., & Yamane, Y. (2004). Screening for Antioxidant Activity in Edible Plant Products: Comparison of Low-Density Lipoprotein Oxidation Assay, DPPH Radical Scavenging Assay, and Folin−Ciocalteu Assay. *Journal of Agricultural and Food Chemistry, 52*(8), 2391-2396. doi: 10.1021/jf035372g

Kosar, M., Bozan, B., Temelli, F., & Baser, K. H. C. (2007). Antioxidant activity and phenolic composition of sumac (Rhus coriaria L.) extracts. *Food Chemistry, 103*(3), 952-959. doi: 10.1016/j.foodchem.2006.09.049

Kossah, R., C. Nsabimana, J.X. Zhao, H.Q. Chen, F.W. Tian, H. Zhang and W. Chen,. (2009). Comparative study on the chemical composition of Syrian sumac (Rhus coriaria L.) and Chinese sumac (Rhus typhina L.) fruits. *Pak. J. Nutr., 8*, 1570-1574.

Loussouarn, M., Krieger-Liszkay, A., Svilar, L., Bily, A., Birtić, S., & Havaux, M. (2017). Carnosic Acid and Carnosol, Two Major Antioxidants of Rosemary, Act through Different Mechanisms. *Plant Physiology, 175*(3), 1381-1394. doi: 10.1104/pp.17.01183

Macheix, J. J., Sapis, J. C., & Fleuriet, A. (1991). Phenolic compounds and polyphenoloxidase in relation to browning in grapes and wines. *Crit Rev Food Sci Nutr, 30*(4), 441-486. doi: 10.1080/10408399109527552

Makanjuola, S. A. (2017). Influence of particle size and extraction solvent on antioxidant properties of extracts of tea, ginger, and tea–ginger blend. *Food Science & Nutrition*.

Medini, F., Fellah, H., Ksouri, R., & Abdelly, C. (2014). Total phenolic, flavonoid and tannin contents and antioxidant and antimicrobial activities of organic extracts of shoots of the plant Limonium delicatulum. *Journal of Taibah University for Science, 8*(3), 216-224. doi: https://doi.org/10.1016/j.jtusci.2014.01.003

Parejo, I., Viladomat, F., Bastida, J., Rosas-Romero, A., Flerlage, N., Burillo, J., & Codina, C. (2002). Comparison between the radical scavenging activity and antioxidant activity of six distilled and nondistilled Mediterranean herbs and aromatic plants. *Journal of Agricultural and Food Chemistry, 50*(23), 6882-6890. doi: 10.1021/jf020540a

Proestos, C., Chorianopoulos, N., Nychas, G. J. E., & Komaitis, M. (2005). RP-HPLC Analysis of the Phenolic Compounds of Plant Extracts. Investigation of Their Antioxidant Capacity and Antimicrobial Activity. *Journal of Agricultural and Food Chemistry, 53*(4), 1190-1195. doi: 10.1021/jf040083t

Rebaya, A., Belghith, S. I., Baghdikian, B., Leddet, V. M., Mabrouki, F., Evelyne, O., & Ayadi, M. T. (2015). Total Phenolic, Total Flavonoid, Tannin Content, and Antioxidant Capacity of Halimium halimifolium (Cistaceae).

Rispail, N., Morris, P., & Webb, K. J. (2005). Phenolic compounds: extraction and analysis *Lotus japonicus handbook* (pp. 349-354): Springer.

Schlesier, K., Harwat, M., Böhm, V., & Bitsch, R. (2002). Assessment of antioxidant activity by using different in vitro methods. *Free Radical Research, 36*(2), 177-187.

Shahidi, F., & Zhong, Y. (2015). Measurement of antioxidant activity. *Journal of Functional Foods, 18*(Part B), 757-781. doi: https://doi.org/10.1016/j.jff.2015.01.047

Singh, R. P., Chidambara Murthy, K. N., & Jayaprakasha, G. K. (2002). Studies on the antioxidant activity of pomegranate (Punica granatum) peel and seed extracts using in vitro models. *J Agric Food Chem, 50*(1), 81-86.

Suhaj, M. (2006). Spice antioxidants isolation and their antiradical activity: a review. *Journal of Food Composition and Analysis, 19*(6), 531-537. doi: https://doi.org/10.1016/j.jfca.2004.11.005

Sun, L., Zhang, H., & Zhuang, Y. (2012). Preparation of Free, Soluble Conjugate, and Insoluble-Bound Phenolic Compounds from Peels of Rambutan (Nephelium lappaceum) and Evaluation of Antioxidant Activities in vitro. *Journal of Food Science, 77*(2).

Ünver, A., Arslan, D., Özcan, M.M., Akbulut, M. (2009). Phenolic Content and Antioxidant Activity of Some Spices. *World Applied Sciences Journal, 6*(3), 373-377.

Wang, M., Jiang, N., Wang, Y., Jiang, D., & Feng, X. (2017). Characterization of Phenolic Compounds from Early and Late Ripening Sweet Cherries and Their Antioxidant and Antifungal Activities. *Journal of Agricultural and Food Chemistry, 65*(26), 5413-5420. doi: 10.1021/acs.jafc.7b01409

Wojdylo, A., Oszmianski, J., & Czemerys, R. (2007). Antioxidant activity and phenolic compounds in 32 selected herbs. *Food Chemistry, 105*(3), 940-949. doi: 10.1016/j.foodchem.2007.04.038

Wong, C. C., Li, H. B., Cheng, K. W., & Chen, F. (2006). A systematic survey of antioxidant activity of 30 Chinese medicinal plants using the ferric reducing antioxidant power assay. *Food Chemistry, 97*(4), 705-711. doi: 10.1016/j.foodchem.2005.05.049

Yang, B., Kotani, A., Arai, K., & Kusu, F. (2001). Estimation of the antioxidant activities of flavonoids from their oxidation potentials. *Analytical Sciences, 17*(5), 599-604. doi: DOI 10.2116/analsci.17.599

Yeh, H.-y., Chuang, C.-h., Chen, H.-c., Wan, C.-j., Chen, T.-l., & Lin, L.-y. (2014). Bioactive components analysis of two various gingers (Zingiber officinale Roscoe) and antioxidant effect of ginger extracts. *LWT - Food Science and Technology, 55*(1), 329-334. doi: https://doi.org/10.1016/j.lwt.2013.08.003

Unguentarium As A Ceramic Vessel

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Abstract: The Unguentarium is a type of ceramic vessel whose use is thought to date back to the Hellenistic period, although it is not known exactly when it originated, it is known that in the 20th century. French archaeologists first named it Unguentarium. These vessels, which are small in size and made in various models, may have thin necks, wide mouths and seal patterns. On the outside, they are likened to a small amphitheatre. There are unguentariums made of ceramic material as well as those made of glass material. When we look at the usage areas, it is understood that various cosmetic products, perfumes, creams made from different plants, massage oils are kept in these containers. According to some sources Unguentariums have also been used as tear bottles. These vessels are thought to have been used in religious rituals due to their presence in cemeteries. Sometimes ceramic and glass Unguentarium can be removed together from the same tomb. A few can be found together in the excavation of the grave, as well as tens of others can be found. It is known that very valuable liquids are not transported in terracotta vessels, the reason of they can leak.

Keywords: Ceramic, Ceramic vessel, Tear bottle, Unguentarium.

1.Introduction

1.1.What Is Unguentarium?

The term Unguentarium derives from the Latin word unguent, which is the name given to vessels that are thought to carry fragrant oils or ointments. This form was first found in the excavations of Kerameikos in Athens, the earliest dates back to the third quarter of 4 Century B.C. (Bilgin, 2015). Its name, which was used in early times, is not fully known. In the 20th century, French archaeologists first named it Unguentarium. Balsamarium, lacrimarium, Olfactoriolum (Ergürer, 2012). Many names have been used.

1.2. Where Has Been Unguentarium Used?

Unguentariums are described in archaeological literature as teardrop bottles. It is common for them to be used as scent bottles and grave gifts. These vessels usually found in graves and in small amounts in residential areas, show different characteristics according to the periods. (Baldıran, 1998). Forms have different names according to their shape.

Between the centuries 4 B.C and 1 B.C. the forms referred to as the “spindle-shaped type", used extensively, have been the defining characteristic of unguentariums (Dündar, 2006). When examined in general they may be small in size, thin necked, wide mouthed, seal patterned and lined. It is thought to have been used in a wide geography.

Figure **1**.Unguentarium, Ceramic, Roman period, 8,5 cm

(Source**.** https://www.yourantiquarian.com/product/roman-terracotta-unguentarium-85mm/)

1.3. What Materials Is Unguentarium Made Of?

When the material properties of unguentariums are examined, besides the Unguentariums made of clay, they are produced from precious metals such as glass, silver, gold. Colorless and tinted glasses are used in the following examples. There are examples with handles, though few. Figure 3 shows an Unguentarium with glass and handles belonging to the Romanperiod.

Figure 2. Unguentarium, Glass, Roman period A.C. 4

(Source**.** https://www.christies.com/lotfinder/Lot/a-roman-green-glass-unguentarium-circa-4th-5425341-details.aspx)

Figure 3. Unguentarium, Glass, Roman Period, A.C. 3-4
(Source. https://tr.pinterest.com/pin/202310208238426430/)

Figure 4. Unguentarium, Glass
(Source. https://www.youtube.com/watch?v=4YKGJSEiuwo)

In general, fine necked specimens are observed. The teardrop bottles found mostly in the graves can be found only as well as tens of others in the same excavation. They can be made of different materials.

Figure 5. Unguentarium, Glass, Roman period, first century, 12 cm
(Source. https://www.colorado.edu/classics/2018/05/15/20081828-roman-unguentarium)

The unguentarium in Figure 6, which belongs to the Hellenistic period, has blue and yellow colors and marbling like effects on it. It has small handles.

Figure 6. Unguentarium, Hellenistic period, Grecee, Glass, three century

(Source. https://www.barnebys.com/auctions/lot/ancient-hellenistic-greek-glass-unguentarium-gtgn-gye-t)

1.4. For What Purpose Was The Unguentarium Used?

It is thought that these containers are used for the preservation of various cosmetic products, perfumes, creams and massage oils. According to some sources it was also used as a tear bottle. It is assumed that it was used in religious ceremonies, as it was encountered much in grave excavations.

Unguentariums show different characteristics according to periods. The unguentariums of the early Hellenistic period resemble small-sized amphorae. Towards the mid of 2 century B. C., it reaches the form called spindle-shaped. There are small specimens such as 4-5 cm while there are large scale specimens such as 20-30 cm. There are mostly examples measuring 8-20 cm. Spindle-shaped unguentariums can survive without a boost in the early period. Those produced in the later period cannot stand without support. Although it is known as such, it is pictured standing upright in many depictions (Bilgin, 2003). As liquid fluid materials arecarried, they are usually known to be secured by binding with a support or rope. Figure 7 showsa ceramic unguentarium found in a tomb in Greece. It can stand alone on the ground. There is no cover so it can be thought to be secured by connecting with rope.

Figure 7. Unguentarium, Ceramic, Greece, Found in grave, B.C. 1-3, 16 cm
(Source**.** https://ehive.com/collections/3411/objects/28651/fusiform-unguentarium)

Figure 8. Various ceramics, unguentarium, ceramics, excavation of Parion, (Çanakkkale/Biga Kemer Village)
(Source**.** http://www.parion.biz/index.php/tr/2015-11-27-14-46-33/2016-kazi-sezonu/2016-kazi-sonuc-raporu)

2.Results

Tear bottles made from materials used extensively during the Hellenistic and Roman periods and these vessels, referred to by many different names, were often used to carry liquids. Herbal remedies, fragrances, oils are a few of the ingredients carried. Since ceramic unguentariums provide liquid permeability by considering the porose effect of the soil, very expensive odors are kept in more valuable containers. This is due to the technical properties of soil material. According to the sources, it usually does not have any cover. Therefore, the idea that he was hanged with the help of a rope became important. It is thought that containers made of soil material will have a more positive effect in terms of Health. Ceramic vessels are thought to be an alternative storage container for vegetable oils, fragrances,medicines.

3.References

Bilgin S. (2013) Istanbul University Institute Of Social Sciences, Department Of Archaeology, Classical Archaeology, Stamped Unguentariums Found During Excavations In Perge Master Thesis.

Bilgin S. (2015) Late Roman Stamped Unguentariums Found In Perge, International Meeting of young scientists II, Anatolian Mediterranean Symposium

Baldıran, A. (1998) Unguentariums From Stratonikeia, Selcuk University, Social Science Institute Journal, 4, 335-355.

Ergürer, H. E. (2012) Parion Roman Period Ceramics, Atatürk University, Social Sciences Institute, Department Of Archaeology, Doctoral Thesis

Dündar, E. (2006) Hellenistic and Roman period Patara Unguentariums, Adnan Menderes University, Institute Of Social Sciences, Master's Thesis

Internet References

https://www.yourantiquarian.com/product/roman-terracotta-unguentarium-85mm/

https://www.christies.com/lotfinder/Lot/a-roman-green-glass-unguentarium-circa-4th-5425341-details.aspx

https://tr.pinterest.com/pin/202310208238426430/

https://www.youtube.com/watch?v=4YKGJSEiuwo

https://www.colorado.edu/classics/2018/05/15/20081828-roman-unguentarium

https://www.barnebys.com/auctions/lot/ancient-hellenistic-greek-glass-unguentarium-gtgn-gye-t

https://ehive.com/collections/3411/objects/28651/fusiform-unguentarium

http://www.parion.biz/index.php/tr/2015-11-27-14-46-33/2016-kazi-sezonu/2016-kazi-sonuc-raporu

Medicinal and Aromatic Aspect of Seeds

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Abstract: The first people knew that plants had healing power. By consuming different organs and parts of plants, they tried to determine whether they were medicinal or poisonous by their taste and smell. Human interests have been mainly practical, since seeds provide a major proportion of food in most parts of the world. Today, many plant seeds are used in the field of medicine and cosmetics. Some plant seeds are used directly in pharmaceutical production, while others are used as supplements. Some seeds are used for beauty purposes, others are used for immortal. Of course, the seeds used for medicinal and aromatic purposes are not limited to these. Nature has always offered and continues to offer alternatives to us. Turkey is one of the world's richest countries in terms of biodiversity. Especially in Anatolia, the alternative use of many seeds that have been used for different purposes for centuries is being noticedrecently.

Keywords: Alternative medicine, Aromatic seeds, Medicinal seeds, Seed cure

1.Introduction

Seeds have been the food source of humanity since the beginning of life. Human interests have been mainly practical, since seeds provide a major proportion of food in most parts of the world. While, at present, most of the food for human nutrition is supplied by hardly more than 20 major crops, the number of seeds utilized for their medicinal or aromatic properties is also significant. The use of plants as medicine is as old as human history. It is assumed that folk medicine has begun with the first human who puts the sap of a plant to the wound and sees that this practice has yielded positive results. The first people knew that plants had healing power; for example, by chewing different organs and parts of plants such as flowers, fruits, seeds, petioles, leaves, roots, bark, trying to determine whether they are medicinal or poisonous by their taste and smell, and as a result, we see that plants are the most important source of natural drugs used in traditional treatment methods.

Today, many plant seeds are used in the field of medicine and cosmetics. Some plant seeds are used directly in pharmaceutical production, while others are used as supplements. Some seeds are used for beauty purposes, others are used for immortal. The examples given below represent only a small group.

Basil (*Ocimum basilicum*)**:** Basil seed, which has antioxidant properties, is also rich in beta carotene (Hirasa & Takemasa, 1998). Vitamin A and magnesium content increases body resistance and strengthens muscles. 1 tablespoon (13 grams) basil seed provides 15% of the reference daily value for calcium and 10% for magnesium and iron. It reduces hair loss. It is made by making tea of basil seed and also curing of basil seed tea. Basil tea is good for influenza, as well as very strict protection of the body. It is highly preferred in diet programs. Basil seed, which is a very important plant in terms of heart health, accelerates fat burning and keeps it full for a long time. It is a good source of fiber, especially pectin. A significant amount of fiber of the seeds is soluble fiber. Supports bowel health in this aspect.

Celery (*Apium graveolens*)**:** It contains vitamins and minerals such as A, C, E, K, folate (folic acid), pyridoxine (B6), potassium, pantothenic acid (B5), manganese, riboflavin, calcium, phosphorus. It also contains abundant fiber, beta-carotene, flavanoid and a large amount of antioxidant compounds and enzymes (Bjeldanes & Kim, 1977). It is good for heart health. It reduces inflammation in gout and arthritis. With its anti-inflammatory properties, it helps to reduce muscle spasms and cramps. It has antiseptic properties. Celery seed tablets are used to regulate blood pressure via the oral route. They also prevent urinary tract infections and increase urinary tract health. Celery seed extract is added to perfumes, aromatic oils and soaps to act as a deodorant. Use of celery seeds in pregnant women should be considered, it can cause miscarriage.

Coriander (*Coriandrum sativum*)**:** It is rich in starch, tannins, sugars, fixed and essential oils. The essential oil contains a high proportion of coriandrol and a low proportion of geraniol, borneol, pinene, phelladron and acetic acid. Coriander seeds have a sweet and nutty taste. It has high antioxidant properties. Spices, tea or fresh can be consumed. It use as appetizing. It prevents body swelling and removes bad breath. It is a child-friendly plant (Khan, 2019).

Because the nutritional value of this seed is very high. It has a regulating effect on heart rhythm. It provides support to the nervous system with the vitamin B it contains. It providesfaster

healing of skin problems thanks to its essential fatty acid contains. Coriander seed oil can be used externally for fungal infections such as Tinea pedis due to its antifungal and antibacterial effects. In addition, coriander seed oil has sedative (sleeper) feature can be found in scientific publications. Excessive consumption may cause problems such as diarrhea.

Cucumber (*Cucumis sativus*)**:** It contains high percentage of palmitic acid, stearic acid, oleic acid, linoleic acid and linolenic acid. It also has a rich content of phytosterols. It has a structure rich in tocopherols and tocotrienols, especially Alpha tocopherol. Cucumber seed oil absorbs very fast and has a refreshing structure. Cucumber seed oil, which has a wide range of skin care, is especially effective in maintaining the moisture balance of the skin. They are known to be useful for rapidly discolouring freckles that are caused by exposure to UV rays of the skin, and also for the removal of dark skin and skin blemishes (Gottschalck & Breslawec, 2012). It is also very useful against psoriasis, eczema, acne and bodycracks.

Dill (*Anethum graveolens*)**:** It is rich in essential fatty acids and is rich in antioxidants. Constipation, toxin removal, strengthening the immune system, slimming, sugar and cholesterol lowering, digestive system thanks to its effects is beneficial to the human body (Singh et al., 2005). There is also tea made by dill seed drying or fresh. Tea made from seed provides gas in infants, insomnia and relaxation in adults. By chewing the seeds in the mouth, it has effects such as removing bad breath and relieving breathing. Dill seed also fights against "*Escherichia coli*" bacteria, which causes infections in the excretory system. It is a very rich source of calcium. It was found that the oil called "eugenol" in dill decreases blood sugar level and increases insulin resistance.

Fennel (*Foeniculum vulgare*)**:** Apart from useful minerals such as sodium, calcium, potassium, magnesium and phosphorus, there are plenty of vitamins A and C (Koudela & Petrikova, 2008). It is used to lower cholesterol levels, promote bone health, promote skin health, relieve anemia, help maintain brain function, relieve constipation and flatulence. Also from these seeds are made oil, soap, ointment and syrup. Flavones and essential oils are the raw materials of many herbal medicines. Fennel tea is frequently seen in diet lists. Fennel seed, which is an excellent

antioxidant, has a germicidal effect. Thanks to this effect, it acts as a protective body against free radicals.

Nigella (Black cumin) (*Nigella sativa*): On average, it consists of 38% carbohydrates, 35% vegetable oils and 21% protein. It contains Omega 3 and Omega 6, oleic acid, palmitic acid, calcium, sodium, iron, potassium, copper, zinc, magnesium, phosphorus, vitamin A, vitamin B, vitamin C and vitamin B2. It also contains 58% of essential fatty acids **(**Demirbolat & Kartal, 2019). Therefore, it protects the immune system against infections and allergies and protects cells from viruses and prevents tumor formation. Essential oils in seed seed are effective in eliminating inflammation of articular diseases. It has been observed that it slows down developments of some types of cancer such as prostate, breast, skin cancers. The main active ingredient 'thymokinone' is known for its anticarcinogenic effects.

Okra (*Abelmoschus esculentus*)**:** The fiber content in the seed is quite high as in the plant. It is consumed in order to renew and strengthen the fibers in the body (Xia et al., 2015). It is good for throat burning. When the seeds are crushed and mixed with water, it is good for chest compressions and bronchi. Due to its high fiber content, it is indispensable for dietary programs, as well as diuretic and useful for relieving constipation.

Pumpkin (*Cucurbita moschata*)**:** Contains rich amounts of oils, magnesium, copper, iron and zinc. The world health organization has explained that pumpkin seeds should be consumed especially as they are a good source of magnesium and zinc (Hargono, 1999). It contains antioxidants such as carotenoids and vitamin E. Antioxidants reduce inflammation and protect cells from harmful free radicals.

Stinging nettle (*Urtica dioica*)**:** Nettle seeds contain high levels of iron and vitamin C. It is a natural aphridisiac. Although it is a blood purifier, it is also known to remove red blood cells. The oil from the seed regenerates the skin cells and strengthens the connective tissue (Yarnell, 1998). Helps strengthen the immune system. Those with heart and kidney disease, blood problems and especially by pregnant women should be considered in consumption.

2.Conlusion

Of course, the seeds used for medicinal and aromatic purposes are not limited to these. Nature has always offered and continues to offer alternatives to us. Turkey is one of the world's richest countries in terms of biodiversity.

Especially in Anatolia, the alternative use of many seeds that have been used for different purposes for centuries is being noticed recently. As the medical and cosmetic industry develops, we will be introduced to the new features of many plant seeds.

3.References

Bjeldanes, L.F. & Kim, I. (1977). Phthalide components of celery essential oil. The Journal of Organic Chemistry, 42, 2333-35.

Demirbolat, I. & Kartal, M. (2019). Turkish Pharmacopoeia Black Cumin Seed Oil Monograph. In book: Turkish Pharmacopoeia National Monographs, Chapter,4(1).

Gottschalck, T.E. & Breslawec, H.P. (2012). International Cosmetic Ingredient Dictionary and Handbook. 14 ed. Washington, DC: Personal Care Products Council.

Hargono, D. (1999). Manfaat biji labu (Curcubita sp) untuk kesehatan. Media Penelitian dan Pengembangan Kesehatan, 9(2), 3-7.

Hirasa, K. & Takemasa, M. (1998). Antimicrobial and antioxidant properties of spices. In: Spice Science and Technology, Marcel Dekker inc. Newyork, USA,163-200.

Khan, N.T. (2019). Coriander Seeds in Diet. Journal of Advances in Plant Biology, 1(2), 13-16.

Koudela, M. and Petrikova, K. (2008). Nutritional compositions and yield of sweet fennel culti-vars - *Foeniculum vulgare* Mill. ssp. *vulgare var. azoricum* (Mill.) Thell. Horticultural. Science, 1: 1–6.

Singh, G., Maurya, S. & Catalan, C. (2005). Chemical Constituents, Antimicrobial Investigations, and Antioxidative Potentials of Anethum graveolens L. Essential Oil and Acetone Extract: Part 52. Journal of Food Science, 70, 208-2015.

Xia, F., Zhong, Y., Li, M., Chang, Q., Liao, Y., Liu, X & Pan, R. (2015). Antioxidant and Anti-Fatigue Constituents of Okra. Nutrients, 7, 8846–8858.

Yarnell, E.N.D. (1998). Stinging Nettle: A Modern View of An Ancient Healing Plant. Alternative and Complementary Therapies, 4(3), 180-186.

The Effect of After-ripening Treatments on Seedling Performance of Purslane (*Portulaca oleracea*) Seed Lots

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Abstract: This study was conducted to test the effect of after-ripening on the seedling emergence performance of purslane (*Portulaca oleracea*) under climate chamber. A sample of four open pollinated purslane seed cv. Yesil were obtained from different seed companies. Seeds were stored (after-ripened) at 5 °C with at 9% seed moisture content over 5, 10 and 15 days in the dark in hermetic conditions. After-ripened seeds were tested at 22±2 °C for 21 days in the climatically-controlled chamber with Control group. Results showed that after-ripening significantly ($p < 0.05$) increased emergence rate in four cultivars when after-ripening was tested at 10 days. Cumulative emergence showed that after-ripened seeds emerge faster than control both stored for 5 and 10 days. Results indicated that purslane seedling emergence can be increased through after-ripeningtreatments.

Keywords: **After-ripening, Cumulative emergence, *Portulaca oleracea*, Seed storage duration**

1.Introduction

Purslane *(Portulaca oleracea)* is a leafy vegetable that can be consumed both raw or cooked. Purslane is particularly notable for its high omega-3 content among vegetables. Nowadays it is mostly obtained through collection from nature. But in cultivation, Purslane is directly sowing in the field. In leafy vegetables such as purslane, irregular germination and emergence can be a cause of low yield due to late germinaters and ungerminated seeds. Late germinators are characterized by smaller leaf and plant size (Demir et al., 2008; Mavi et al., 2010).

After-ripening (dry storage after harvest) is considered as a known dormancy breaking treatment (Iglesias-Fernandes et al., 2010) and promoted germination in vegetables seed (Edwards and Sundstrom, 1987). This study was conducted to test the effect of after-ripening on the seedling emergence performance of purslane (*Portulaca oleracea*) under climate chamber.

2.Material and Methods

Four purslane seed lots (*Portulaca oleracea* cv. Yeşil) were obtained from seed suppliers in Igdir. Seeds were kept in hermetic (air and waterproof) packets. All seed lots had been treated with thiram powder. Seed moisture content (mc) was determined using the low temperature oven method (ISTA, 2016) on two replicates of 1 g seeds held at 103 °C for 17 h; the samples were then allowed to cool in a desiccator for half-an hour. Moisture content was expressed on a fresh weight basis. Initial seed moisture content ranged between 8.3 and 10.4%. Control seeds were considered as those that seed moisture was not raised and kept in foil packets at 5 °C and emerged at 22±2 °C. After-ripening treatments were performed at 9% seed moisture content at 5 °C over 5, 10 and 15 days. Two grams of seeds in each lot were weighed (four decimal places) and placed over saturated NaCl solution which provides 72% r.h at 20±1 °C. Seeds were weighed frequently. The seed moisture of aubergine seeds were equilibrated at 9±0.3%.

For controlled room emergence test, seeds (four replicates of 100 seeds/lot) were sown in 2 cm depths in peat moss in seedling trays (40x20x8 cm) and placed in the incubator at 22±2 °C. The number of emerged seedlings (unfolding cotyledons on the surface) was counted daily up to 21 days, and percentages of normally developed seedling were calculated. The mean emergence time (MET) was calculated based on frequent radicle emergence counts using theformula;

$MET = \sum n.t / \sum n$

where n = number of seeds newly emerged (2 mm radicle emerged) at time t; t = days from planting, $\sum n$ = final emergence

After final counts (21 days), the aerial parts of the 20 seedlings (4 replicates x 5 seedlings) were cut and weighed. Seedling fresh weight was calculated for each plant as g/plant. Statistical analysis was conducted using the SPSS by using analyses of variance. Mean separation was made at the 5% level by the Duncan multiple rangetest.

3.Result and Discussion

Emergence percentages (Normal seedling) ranged from 70 to 89% in all experiments. After-ripening treatments significantly increased the normal seedling emergence rate in all seed lots (Table 1). Especially on the 10th day, the highest seedling emergence was observed. Mean germination time ranged between 10.1 and 10.9 days.

We see that statistically after-ripening treatments increase the emergence speed according to the control group. Similar to emergence rates, the lowest mean emergence time was observed in the 10th day after-ripening treatment.

Table 1. Changes in normal Emergence percentages (%) and Mean Emergence Time (day) in 4 commercial seed lots after-ripened and emerged at 25 °C. Capital letter show difference between treated and the control emergence, small letters between show difference between MET.

Lots	**After-ripening Treatments (5°C, 9%)**							
	5 days		10 days		15 days		Control	
	N (%)	MET (day)	N (%)	MET (day)	N (%)	MET (day)	N (%)	MET (day)
1	78B	10.8b	83A	10.5a	77B	10.9b	70C	11.2c
2	79B	10.5ab	85A	10.3a	80B	10.7b	74C	10.8b
3	83B	10.4b	89A	10.1a	80C	10.7c	75D	10.9d
4	81B	10.9b	86A	10.7a	75C	10.9b	71D	11.2c
Mean	80B	10.7b	86A	10.4a	78B	10.8b	73C	11.0c

Means with different letters in the same line denote significant difference at 5% level.

Seedling fresh weight ranged from 4.21 to 8.86 g/plant in all experiments. It was seen that after-ripening treatments increased seedling fresh weights significantly compared to the control group. Seedling weights on average of 50% or more were observed in all seed lots compared to control (Table 2).

Table 2. The effect of After-ripening treatments on seedling fresh weight (g/plant), obtained from under climate chamber conditions after 21 days of sowing

Lots	After-ripening Treatments (5°C, 9%)			
	5 days	10 days	15 days	Control
1	6.45±0.27 b	7.90±0.17 a	6.81±0.31 b	4.90±0.37 c
2	6.67±1.22 b	7.92±0.14 a	7.32±0.46 b	4.21±0.41 c
3	8.86±0.33 a	8.81±0.89 a	8.62±0.14 a	6.13±0.50 b
4	6.88±0.42 b	7.72±0.33 a	6.55±0.42 b	5.11±0.27 c
Mean	7.22 b	8.09 a	7.33 b	5.08 c

Means with different letters in the same line denote significant difference at 5% level.

Results showed that after-ripening significantly ($p < 0.05$) increased emergence rate in four cultivars when after-ripening was tested at 10 days. Cumulative emergence showed that after-ripened seeds emerge faster than control both stored for 5 and 10 days. After-ripening is considered as a germination regulator (Edwards & Sundstrom, 1987). Results indicated that purslane seedling emergence can be increased through after-ripening treatments.

References

Demir, I., Ermis, S., Mavi, K. & Matthews, S. (2008). Mean germination time of pepper seed lots (*Capsicum annuum* L.) predicts size and uniformity of seedlings in germination tests. Seed Science and Technology, 36, 21-30.

Edwards, R.L. & Sundstrom, F.J. (1987). Afterripening and harvest effects on Tabasco pepper seed germination performance. HortScience, 22(3), 473-475.

Iglesias-Fernandez, R. Rodriguez-Gacio, M.C. & Matilla, A.J. (2010). Progress in research on dry afterripening. Seed Science Research, 20, 1-12.

Mavi, K., Demir, I. & Matthews, S. (2010). Mean germination time estimates the relative emergence of seed lots of three cucurbit crops under stress conditions. Seed Science and Technology, 38, 14-25.

Use of Vigor Tests in Coriander (*Coriandrum sativum* L.) Cultivars

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Abstract: In this study, we aimed to test accelerated ageing and mean germination time vigor tests to correlate with seedling emergence of four coriander seed lots. Late and non-uniform emergence of seeds affects seedling quality in vegetable species. As seeds age, (vigor decreases) they emerge later and the seedling quality begins to decline. Therefore, determination of emergence potential of a seed lot before sowing is vitally important. This study was conducted to test accelerated ageing and mean emergence time tests for the discriminating vigour of coriander seeds. Mean germination time (MGT) tests were found to be successful for the ranking of 4 different coriander seed lots. AA (41°C, 72 h, 100% RH) were found to be unsuccessful for the ranking of the seeds. The results show that MET treatments can be used as a vigour test in coriander seeds.

Keywords: **Accelerated ageing, *Coriandrum sativum*, Mean emergence time, Vigour tests**

1.Introduction

Coriander (*Coriandrum sativum* L.) is a salad vegetable which is grown for its flavoury leaves. The leaves and seeds of this crop are used for flavouring foods. The yield of this crop depends on obtaining larger leaves in a shorter period of time. Earlier emergence and faster germination results in larger seedlings in vegetables (Demir et al., 2008). This is important for a high-quality seedling production in those crop. In leafy vegetables like coriander, faster germination is likely to reflect on plant size. Those seedlings which emerge earlier have larger leaf size and higher yield.

One of the prerequisites for successful cultivation is fast seedling emergence, as fast emergence results in higher seedling size, better uniformity. There are a number of different seed vigor tests, including accelerated ageing, mean germination time to estimate seedlingemergence

potential of any seed lot. Late and non-uniform emergence of seeds affects seedling quality in vegetable species (Matthews et al., 2009). As seeds age, (vigor decreases) they emerge later and the seedling quality begins to decline. Therefore, determination of emergence potential of a seed lot before sowing is vitally important. This study was conducted to test accelerated ageing and mean emergence time tests for the discriminating vigour of coriander seeds.

2.Material and Methods

Four different coriander (*Coriandrum sativum* L.) seed lots were obtained from retailer's outlet in Igdir 2018. Seeds were kept at 5 °C in hermetic packets.

The accelerated ageing test was conducted according to procedure described by (Hampton & TeKrony, 1995), according to which 100 seeds of each cultivar were placed on a wire mesh tray (10x10x3 cm) and put in an outer ageing plastic box (11x11x4 cm) containing 40 ml of distilled water. The seeds were aged at 41 °C for 72 h in a water jacketed incubator. The germination test was conducted as described above after three hours of drying at roomtemperature.

Four replicates of 50 seeds were germinated on top of the paper (Whatman no: 42) in Petri dishes at 20 and 25 °C for 21 days in dark. Radicle emergence (2 mm) and total germination was counted every day. In the final count, seedlings were classified as normal and abnormal and expressed as percentages. The mean germination time (MGT) was calculated based on frequent radicle emergence counts using the formula;

$MGT = \sum n.t / \sum n$

where n = number of seeds newly germinated (2 mm radicle emerged) at time t; t = days from planting, $\sum n$ = final germination

Statistical analysis was conducted using the SPSS by using analyses of variance. Mean separation was made at the 5% level by the Duncan multiple range test.

3.Result and Discussion

The initial normal germination percentages of 4 seed lots were all above 75% (Table 1). Mean germination time ranged between 5.3 and 6.1 days. When we compare germination rates, the highest control group was found according to AA in all lots. It was observed that changes in initial viability according to seed lots did not show similar results in AA by statistically. For

example, While the lowest germination in the control group was lot 3, there was no correlation with the results obtained after AA.

Table 1. Normal seedling percentages of coriander seed lots after accelerated ageing, AA (41 °C, 72 h, 100% RH) and Control group at 20 and 25 °C.

Lots	Accerelated Ageing				Control			
	20 °C		25 °C		20 °C		25 °C	
	N	MGT	N	MGT	N	MGT	N	MGT
1	12c	-	15c	-	85b	5.7	80a	5.3
2	57a	8.6	55a	8.6	88a	5.4a	82a	5.2
3	51a	8.8	23b	-	81c	6.1a	76b	5.7
4	20b	-	21b	-	87a	5.5	82a	5.3

Means with different letters are significantly different at 5 % level in each column

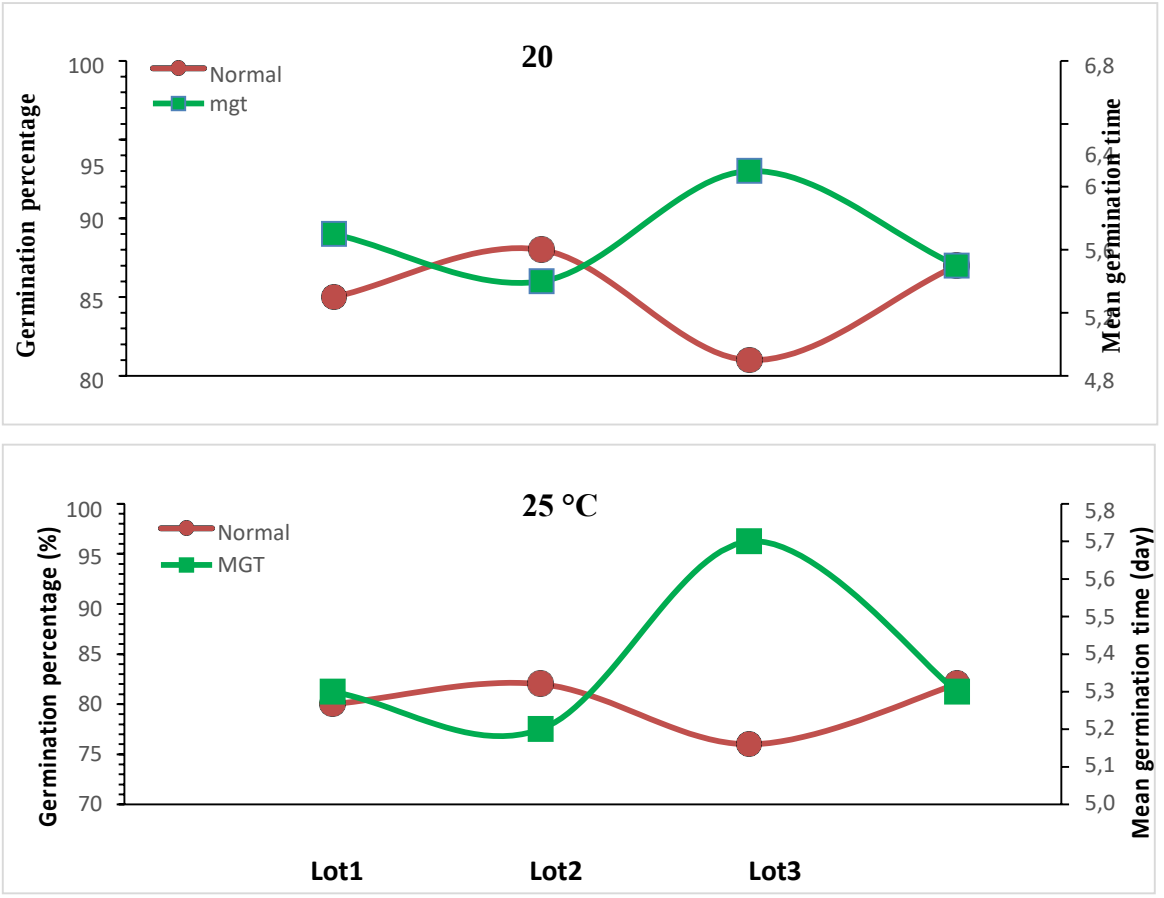

Figure 1. Correlation between normal germination percentage and mean germination time both 20 °C and 25 °C conditions.

Correlation values between initial seed germination tests and mgt indicated several close associations (Figure 1). It is seen that when the germination rate increases, the germination velocity increases in both the control group and AA.

These results are similar to some previous studies on vegetable seeds (Demir *et. al.*, 2008). We observed this study, Mean germination time (MGT) tests were found to be successful for the ranking of 4 different coriander seed lots. Accelerated ageing were found to be unsuccessful for the ranking of the seeds. The results show that MET treatments can be used as a vigor test in coriander seeds.

4.References

Demir, I., Ermis, S., Mavi, K. and Matthews, S. (2008). Mean germination time of pepper seed lots (*Capsicum annuum* L.) predicts size and uniformity of seedlings in germination tests. Seed Science and Technology, 36, 21-30.

Hampton, J. G. & TeKrony, D. M. (1995). Handbook of vigour test methods. ISTA, International Seed Testing Association: Zurich.

Matthews, S., Demir, I., Celikkol, T., Kenanoglu, B.B. and Mavi, K. (2009). Vigour tests for cabbage seeds using electrical conductivity and controlled deterioration to estimate relative emergence in transplant modules. Seed Science and Technology, 37, 736-746.

Cannabis Use in Skin Disorders and Cosmeceutical Products

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Abstract: *Cannabis* (hemp) is one of the first cultivated plants that have been used for thousands of years for various purposes (building-textile material, paper, nutrients, human and animal health), specifically on behalf of its fibers and seeds. Studies on health effects (e.g., antidiabetic, neuroprotective, anticarcinogenic, antitrombotic) of hemp have increased especially in the last decade. Phytocannabinoids such as CBD (cannabidiol), CBC (cannabichromene), CBG (cannabigerol) in hemp oil and terpenoids, sterols, PUFAs especially found in hemp seed oil have different health effects. Studies have shown that hemp seed extract have antiinflammatory activities, additionally, cream, made of the seed oil/extract, reduces sebum secretion and erythema on human face. Hence, hemp is thought to give positive results on inflammatory skin disorders such as atopic dermatitis, acne vulgaris, acne rosacea, uremic pruritus, psoriasis and eczama. Moreover, essential oils in hemp are thought to be used in place of dermacorticoids in the indicated skin conditions. Thanks to its antiinflammatory, antioxidant, moisturizer, sebum regulator and skin barrier booster effects, hemp has been used in cosmeceutical and cosmetic products at the same time. Hemp seed oil is very suitable as an ingredient in body oils, body lotions, lipid-enriched creams, NLC (nano lipid carrier) systems, shampoos, lip balms etc. Hemp has also been increasingly used in antiaging products, which have a significant share in the cosmetic market. In this review, scientific studies on the effects of *Cannabis* extracts, oil and products in some skin disorders, in which mostly inflammatory processes play a significant role (e.g., atopic dermatitis, eczama, acne vulgaris, uremic pruritus) were evaluated. In this context, effective components that responsible for the activity and possible mechanisms of action were also included.

Keywords: Anti-inflammatory, Dermacosmetics, *Cannabis sp.*, Hemp, PUFAs, Terpenoids.

1.Introduction

Hemp, first named as *Cannabis sativa* L. in 1753 by Carlous Linnaeus, is a perennial herbaceous dioic flowering plant belonging to the Cannabinaceae family (Anderson, 1980). The female flowers are often surrounded by leaves and the flowers are rich in trichomes that secrete resin.

Male flowers are infrequent cluster. Seeds 3-6 mm in length, 2-4 mm in width and depending on the type of gray, black, greenish brown colors and thin crust. The plant seeds are shown in figure 1 below.

Figure1. *C.sativa* seeds (Srivastava & Yadav, 2013)

Cannabis (hemp) have been used for thousands of years, specifically on behalf of its fibers and seeds, for various purposes (Schultes et al., 1974). In the 1930s, *Cannabis*, which has remained a banned / restricted plant for many years due to abuse of euphoric use and commercial concerns, has come to the forefront in recent years with scientific researches showing the effects of new generation areas and particularly in human health.

1.1. Phytochemical Content of *Cannabis*

Cannabis is very rich in secondary metabolites. Today, 545 compounds of *C. sativa* have been isolated and it is expected that this number will increase with new studies (Pertwee 2008). 104 phytocannabinoids isolated to date have been collected in 10 chemical subgroups. These are: Δ^9-tetrahydrocannabinol (Δ^9-THC), Δ^8-tetrahidrocannabinol (Δ^8-THC), cannabigerol (CBG), cannabichromene (CBC), cannabidiol (CBD), cannabinodiol, cannabielsoin, cannabicyclol, cannabinol, cannabitriol and the other. Terpenoids, flavonoids, steroids, phenanthrenes, fatty acids, nitrogen compounds and other common plant molecules are other compounds identified in hemp other than cannabinoids (ElSohly & Gul, 2014). The main production sites in hemp are the epidermal secretion hairs on the leaves, flowers, bracteas and stems of the plant (Fairbairn, 1972)

Hemp has been found to be effective in the treatment of many diseases due to many effective compounds such as phytocannabinoids, terpenes, polyunsaturated fatty acids. Scientific studies have shown that *Cannabis* has therapeutic effects in many diseases or symptoms such as cognitive disorders, Alzheimer's (Suliman et al., 2018; Cao et al., 2014), anxiety (Bergamaschi et al., 2011), diabetes (Comelli et al., 2008; Hampson et al., 1998), epilepsy (Aran, Cassuto & Lubotzky, 2018), anorexia, nausea and vomiting associated with chemotherapy, chronic pain (Ulugöl, 2018), colitis (Nallathambi et a., 2017), sleep apnea, and sleep disorders (Babson, Sottile and Morabito, 2017) .

1.2. Effects of *Cannabis* On Skin and Its Use In Skin Disorders

The use of *Cannabis* in skin disorders goes back to traditional Chinese medicine, in which system, hemp has been used frequently in skin disorders such as psoriasis and eczema, where inflammatory mechanisms play a part (Abel, 1980). In addition to its traditional use, the effect of *Cannabis* on various skin disorders has been scientifically proven in recent years. An adult *C. sativa* plant also shown [Figure 2.]. The data on the effects of *Cannabis* on the skin are presented in the table 1 below.

Figure 2. Leaf and stem of an adult *C.sativa*, Ankara University Faculty of Agriculture grown with the permission of Ministry of Agriculture and Forestry for the education purpose.

Table 1. Effects of *Cannabis* on skin

Used part/Compound	Study Design	Effects	Ref.
Hemp seed oil		Antibacterial activity, Antifungal activity, Antiviral activity, Strengthened the skin, Reduce symptoms of: Acne rosacea, Seborrheic dermatitis, Eczema, Dermatitis, Psoriasis, Lichenplanus.	(Abel, 1980; Tabassum and Hamdani, 2014)

Hemp seed oil	Mice skin	Increase moisture content, Increase dermal thickness, Increase dermal collagen fibers and elastic fibers.	(LI et al., 2012)
***C. sativa* extract**		Relieve pain in itchy skin, Control scabies.	(Tabassum & Hamdani, 2014)
Leaves powder		Wound and sore dressing.	(Nasri et al., 2015)
***Cannabis* seeds extract cream 3%**	Human face (cheek)	Reduce erythema content and skin sebum in patients with acne vulgaris, Antioxidant activity.	(Ali & Akhtar, 2015)
Dietary hemp seed oil	Randomized, single-blind crossover study with atopic patients	Reduce skin dryness and itchiness, Reduce usage of dermal medication for itching.	(Callaway et al., 2005)
CBD	Human sebocyte culture	Decrease proliferation of human sebocytes, Normalize lipid synthesis of human sebocytes, Antiacne activity, Antiinflammatory activity.	(Oláh et al, 2014)
***Cannabis sativa* extract (containing CBD, CBDA, CBG)**	Human epidermal keratinocyte culture	Stimulate synthesis of GAGs (glycosaminoglycans), Stimulate proliferation of human epidermal keratinocytes.	(Siurkus, Peciura & Klimaitiene, 2017).
Hemp seed oil in NLC (nanolipid complex)	Topical application on atopic skin	Repair damaged areas of the stratum corneum, Hydrate atopic skin, Reinforce thin areas, Support epidermal cells like keratinocytes and corneocytes.	(Keck & Schwabe, 2009)
Hemp seed oil	Cutaneous canine fibroblast and keratinocyte culture	Strengthened basal membran, Increase number of keratinocyte layer.	(Cerrato et al., 2013)
CBD enriched ointment	Patients with psoriasis, atopic dermatitis and resulting outcome scars	Increase hydration, Increase elasticity, Reduce the numbers of papules and pustules, Improve PASI index score.	(Palmieri, Laurino & Vadalà, 2019
Volatile components (Myrcene, ocimene, terpinolene, caryophyllene, caryophyllene oxide)	*In vitro*	Inhibite 5-lipooxygenase, Antiinflammatory activity.	(Baylac & Racine, 2004)

1.3. Use of *Cannabis* In Cosmetics And Cosmeceutics

The use of cold-pressed seed oil is the most common use of *Cannabis* in cosmetic/dermacosmetics is due to its rich nutritional content. Exclusively in recent years with the consumer preferences towards more and more natural products in cosmetics and dermacosmetics, significant increase has been experienced in the use of natural plant oils. Hemp seeds are very suitable for use in the green cosmetics industry due to their high PUFA content (Vogl et al., 2004).

Hemp seed oil consists of 25-35% fatty acids, 20-25% protein, 20-30% carbohydrate, 10-15% fiber and many trace elements (Deferne & Pate, 1996). It is very valuable because it contains all essential amino acids and essential fatty acids. The major component of its fat consists of polyunsaturated fatty acids, linoleic acid (LA) and α-linolenic acid (ALA). Moreover, the LA/ ALA ratio is 3:1, which corresponds to the ideal omega6 / omega 3 ratio (Deferne & Pate, 1996; Callaway et al., 1996; Erasmus 1993).

In vivo topical experiments of hemp seed oil demonstrated no skin allergies, moreover, good absorption, ease of release and repair of the hydrolipid layer of the skin, especially with the PUFAs in its content, has made widespread use of hemp seed oil in cosmetics and cosmeceuticals (Ligęza et al., 2016). Hemp seed oil is very suitable for the formulations as an ingredient in body oils, body lotions, lipid-enriched creams, NLC (nano lipid carrier) systems, shampoos, lip balms etc. Besides its strong moisturizing feature, it is suitable for acne-prone skin with its anti-inflammatory, antioxidant, antimicrobial and sebum-regulating effects.

In vitro experiments with hemp extracts containing CBD, CBG and CBDA have shown that extracts increase GAG synthesis and proliferation of human epidermal keratinocytes, one of the most important components of the connective tissue of the skin. These effects have enabled *Cannabis* to be included in the formulation of antiaging products in recent years. These products include many antiaging day-night cream, eye cream, hand-nail care cream and body lotion. Furthermore, thanks to the terpene derivatives, hemp is added as a fragrance to the formulation of many cosmetic / dermacosmetic products. Additionally, there are a lot of different cosmetic or cosmeceutical products such as antipruritic lotion, sunscreen, soap etc. that includes phytocannabinoids (mostly CBG and CBC) (Siurkus, Peciura & Klimaitiene,2017).

2.Results and Discussion

Phytocannabinoids such as CBD, CBC, CBG in hemp and terpenoids, sterols, PUFAs especially found in hemp seed oil have antiinflammatory effects. Dietary hempseed oil changes plasma fatty acid profiles and improves clinical symptoms of atopic dermatitis like itching, dryness (Callaway et al., 2005). Studies have shown that preperation made of hemp seeds extract, reduces sebum secretion and erythema on human face (Ali and Akhtar, 2015) and *Cannabis sativa* extract stimulates synthesis of glycoaminoglycans and proliferation of human epidermal keratinosytes (Siurkus and Peciura, 2017). Hence, hemp gives positive results on inflammatory

skin disorders such as atopic dermatitis, acne vulgaris, acne rosacea, uremic pruritus, psoriasis, eczama. Moreover, essential oils in hemp are thought to be used in place of dermacorticoids in the indicated skin conditions. Due to its antiinflammatory, antioxidant, moisturizer, sebum regulator and skin barrier booster effects, hemp has been used in cosmeceutical and cosmetic products at the same time. Hemp has also been increasingly used in antiaging products, which have a significant share in the cosmetic market.

3.References

Anderson, L. C. (1980). Leaf variation among *Cannabis* species from a controlled garden. Botanical Museum Leaflets, Harvard University, 28(1), 61-69.

Srivastava, A., & Yadav, V. K. (2013). Microscopical and chemical study of *Cannabis sativa*. J Forensic Res, 5(1), 210.

Schultes, R. E., Klein, W. M., Plowman, T., Lockwood, T. E. (1974). *Cannabis*: an example of taxonomic neglect. Botanical Museum Leaflets, Harvard University, 23(9), 337-367.

Pertwee, R. G. (2008). The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: Δ9-tetrahydrocannabinol, cannabidiol and Δ9-tetrahydrocannabivarin. British journal of pharmacology, 153(2), 199-215.

ElSohly, M., Gul, W. (2014). Constituents of *Cannabis sativa*. Handbook of *Cannabis*, 3, 1093.

Fairbairn, J. W. (1972). The trichomes and glands of *Cannabis* sativa L. Bull. Narc, 23, 29-33.

Suliman, N. A., Taib, C. N. M., Moklas, M. A. M., Basir, R. (2018). Δ9-tetrahydrocannabinol (Δ9-THC) induce neurogenesis and improve cognitive performances of male sprague dawley rats. Neurotoxicity research, 33(2), 402-411.

Cao, C., Li, Y., Liu, H., Bai, G., Mayl, J., Lin, X., Cai, J. (2014). The potential therapeutic effects of THC on Alzheimer's disease. Journal of Alzheimer's Disease, 42(3), 973-984.

Bergamaschi, M. M., Queiroz, R. H. C., Chagas, M. H. N., De Oliveira, D. C. G., De Martinis, B. S., Kapczinski, F., Martín-Santos, R. (2011). Cannabidiol reduces the anxiety induced by simulated public speaking in treatment-naive social phobia patients. Neuropsychopharmacology, 36(6), 1219.

Comelli, F., Giagnoni, G., Bettoni, I., Colleoni, M., Costa, B. (2008). Antihyperalgesic effect of a *Cannabis sativa* extract in a rat model of neuropathic pain: mechanisms involved. Phytotherapy research, 22(8), 1017-1024.

Hampson, A. J., Grimaldi, M., Axelrod, J., Wink, D. (1998). Cannabidiol and (−) Δ9-tetrahydrocannabinol are neuroprotective antioxidants. Proceedings of the National Academy of Sciences, 95(14), 8268-8273.

Aran, A., Cassuto, H., Lubotzky, A. (2018). Cannabidiol based medical *Cannabis* in children with autism-a retrospective feasibility study (P3. 318).

Ulugöl, A. (2018). Kannabinoidlerin klinikte kullanılışı ve terapötik hedefler. Turkiye Klinikleri Pharmacology-Special Topics, 6(1), 42-50.

Nallathambi, R., Mazuz, M., Ion, A., Selvaraj, G., Weininger, S., Fridlender, M., Mendelovitz, M. (2017). Anti-inflammatory activity in colon models is derived from δ9-tetrahydrocannabinolic acid that

interacts with additional compounds in *Cannabis* extracts. *Cannabis* and cannabinoid research, 2(1), 167-182.

Babson, K. A., Sottile, J., Morabito, D. (2017). *Cannabis*, cannabinoids, and sleep: a review of the literature. Current psychiatry reports, 19(4), 23.

Abel, E. L. (1980). Marijuana the first twelve thousand years Plenum Press. New York, New York, USA.

Nasri, H., Bahmani, M., Shahinfard, N., Nafchi, A. M., Saberianpour, S., & Kopaei, M. R. (2015). Medicinal plants for the treatment of acne vulgaris: A review of recent evidences. Jundishapur journal of microbiology, 8(11).

Tabassum, N., & Hamdani, M. (2014). Plants used to treat skin diseases. Pharmacognosy reviews, 8(15), 52.

Li, H. B., Ma, Y. J., Miao, J. J., Zhang, J., Ren, H. Y., & Li, G. L. (2012). The Influence of the Hemp Seed Oil on the Related Parameters of the Skin in Aging Mice [J]. Chinese Journal of Experimental Traditional Medical Formulae, 9.

Ali, A., & Akhtar, N. (2015). The safety and efficacy of 3% *Cannabis* seeds extract cream for reduction of human cheek skin sebum and erythema content. Pakistan journal of pharmaceutical sciences, 28(4).

Callaway, J., Schwab, U., Harvima, I., Halonen, P., Mykkänen, O., Hyvönen, P., & Järvinen, T. (2005). Efficacy of dietary hempseed oil in patients with atopic dermatitis. Journal of Dermatological Treatment, 16(2), 87-94.

Oláh, A., Tóth, B. I., Borbíró, I., Sugawara, K., Szöllõsi, A. G., Czifra, G., ... & Ludovici, M. (2014). Cannabidiol exerts sebostatic and antiinflammatory effects on human sebocytes. The Journal of clinical investigation, 124(9), 3713-3724.

Siurkus, J., Peciura, R. & Klimaitiene, O. (2017). The topical composition with active compounds from *Cannabis sativa* and *Calendula officinalis* for reduction of skin lesions.

Keck, C. M., & Schwabe, K. (2009). Silver-nanolipid complex for application to atopic dermatitis skin: rheological characterization, in vivo efficiency and theory of action. Journal of biomedical nanotechnology, 5(4), 428-436.

Cerrato, S., Ramió-Lluch, L., Fondevila, D., Rodes, D., Brazis, P., & Puigdemont, A. (2013). Effects of essential oils and polyunsaturated fatty acids on canine skin equivalents: skin lipid assessment and morphological evaluation. Journal of veterinary medicine, 2013.

Palmieri, B., Laurino, C., & Vadalà, M. (2019). A therapeutic effect of cbd-enriched ointment in inflammatory skin diseases and cutaneous scars. La Clinica Terapeutica, 170(2), e93-e99.

Baylac, S., & Racine, P. (2004). Inhibition of human leukocyte elastase by natural fragrant extracts of aromatic plants. International Journal of Aromatherapy, 14(4), 179-182.

Vogl, C. R., Mölleken, H., Lissek-Wolf, G., Surböck, A., & Kobert, J. (2004). Hemp (*Cannabis* sativa L.) as a resource for green cosmetics: Yield of seed and fatty acid compositions of 20 varieties under the growing conditions of organic farming in Austria. Journal of Industrial Hemp, 9(1), 51-68.

Deferne, J. L., Pate, D. W. (1996). Hemp seed oil: A source of valuable essential fatty acids. Journal of the International Hemp Association, 3(1), 4-7.

Callaway, J. C., Tennilä, T., Pate, D. W. (1996). Occurrence of "omega-3" stearidonic acid (cis-6, 9, 12, 15-octadecatetraenoic acid) in hemp (*Cannabis sativa* L.) seed. Journal of the International Hemp Association, 3(2), 61-64.

Erasmus, U. (1993). Fats that heal, fats that kill: the complete guide to fats, oils, cholesterol, and human health. Book Publishing Company.

Ligęza, M., Wyglądacz, D., Tobiasz, A., Jaworecka, K., & Reich, A. (2016). Natural cold pressed oils as cosmetic products. Family Medicine & Primary Care Review, (4), 443-447.

Synthesis of Hybrid Nanoflowers with Plant Extracts Traditionally Utilized In Skin Problems and Their Activity Profile

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Abstract: Increasing age, acute and chronical wounds, environmental factors such as sun and wind, destroy the natural structure of the skin. In this study, our aim is to investigate the *in vitro* activity of the plant extracts, which are used for preventing skin problems in folk medicine, and their synthesized hybrid nanoflower forms. The selected plant materials *Asplenium ceterach*, *Persea americana* and *Portulaca oleracea* collected from Mediterranean and Central Anatolia Region**.** Organic-inorganic hybrid nanoflowers were synthesized using the plant methanolic extracts as organic and copper (Cu^{2+}) or zinc ions (Zn^{2+}) as inorganic components. The synthesized organic-inorganic hybrid nanoflowers were characterized by Scanning Electron Microscopy (SEM), and different physicochemical methods. The method of diphenyl picrylhydrazyl (DPPH) was utilized to determine *in vitro* radical scavenging activity. Total phenolic contents of the extracts and the nanoflowers were determined by using Folin-Ciocalteau Method. These initial studies are promising for the synthesis of hybrid nanoflowers containing plant extracts that might strongly have commercial applications in dermo-cosmetics.. Although there is a number of plant-derived dermo-cosmetic preparations, hybrid nanoflowers might increase the effect of the individual plant extract that might affect the result of the whole formulation, and the dosage.

Keywords: Dermo-Cosmetics, Medicinal Plants, Nanoflower, Tyrosinase Enzyme Inhibition, Skin Disorders.

1. Introduction

Organic-inorganic hybrid nanoparticles, a class of flower-like hybrid nanoparticles synthesized in recent years, has attracted attention due to their simple synthesis, high yields and ability to stabilize enzymes (Lee et al., 2015).

Different kinds of nanoflowers are available such as Gold Nanoflowers, Copper Nanoflowers, Zinc Nanoflowers, Calcium Nanoflowers, Aluminium Nanoflowers, Magnesium Nanoflowers, have applications in biotechnology, biomedical and environmental chemistry. The drug delivery system also has great potential for the use of nanoflower based biosensors (Jena & Raj, 2008; Wei et al., 2012; Sun et al., 2014; Bai et al., 2008). Nanoflower structers exhibit wide surface area to volume rate to increase adsorption for expediting the kinetics of reactions. The efficiency of surface reaction is enhanced in the 3D structure of nanoflowers, enhanced number of adsorption sites increase the efficiency (Shende, Kasture & Gaud, 2018).

The preparation of nanoflower structures is very simple, non-toxic and inexpensive (Wang et al., 2014). Immobilization of proteins and enzymes by using the metal enhances the stability (Altınkaynak, Taylasoğlu & Ocsoy, 2016). However, structural properties of nanoflowers like its petals and dimensions are quite troublesome to control during and end of reaction. In synthetic reactions, nanoflower forms are prepared in extreme circumstances (80–550 °C) toxic elements or by products may be formed (Lee et al., 2015; Jena & Raj, 2008; Yan et al., 2017; Mao et al., 2011; Wei et al., 2012; Sun et al., 2014; Lakkakula et al., 2017; Bai et al., 2008; Shende, Kasture & Gaud, 2018; Wang et al., 2014; Altınkaynak, Taylasoğlu & Ocsoy, 2016; Kharisov, 2008).

In our previous studies, novel inorganic hybrid nanoflowers (nfs) using plant extracts as the organic constituents and Cu^{2+} as the inorganic constituent were established and their structures and their activities were analyzed (Koca-Çalışkan et al., 2017; 2018). *Asplenium ceterach, Portulaca oleracea, Persea Americana* plants have been utilized in folk medicine were selected for the nanoflower synthesis. *Asplenium ceterach* (Aspleniaceae) is a perennial herbaceous plant with pinnate-shaped leaves (3-12 cm) growing on the edges of rock crevices and stony walls. The lower part of the leaves has rust-brown tones, while the upper part is a small and common fern (sporophyte) with green color and has short rhizomes under the ground. It contains various phytochemical compounds such as phenolic acid, xanthine, catechin, flavonoids. Also ıt has traditionally been used in various fields such as kidney stone, diuretic, itching hair skin, wound healing in various countries (Živković et al., 2010; Živković et al.,

2017; Leporatti & Impieri, 2007; Baharvand Ahmadi et al., 2015). *Portulacea oleracea* (Portulacea) is a perennial, herbaceous and green colored plant. It has small and fleshy leaves. Its roots can advance up to 20 cm in the soil, and also reachs about 20 cm size over the soil. It contains various phytochemical compounds such as mucilage, phenolic compount, omega-3, ascorbic acid, anthocyanin, flavonoids. It has traditionally been used in folk medicine for infection, diarrhea, wound burn, acne, eczema, insect bites (Davis, 1967; Oliveira et al., 2009; Yazıcı et al., 2007; Dweck, 2001; Ezekwe, Omara-Alwala & Membrahtu, 1999; Dillard & German, 2000; Odhayet al., 2007; Peksel, Arisan-Atac & Yanardağ, 2006). *Persea americana* (Lauraceae) is a perennial tree with green leaves in all seasons and it can grow up to about 20 meters. The leaves vary in size and shapes ranging from 7-41 cm (elliptical, oval or lanceolate). Avocado fruit has a very fleshy and oily structure around a single large seed. It contains flavonoids, phenolic compounds, saponins, tannins, various alkaloids and steroids, fatty acids, coumarin, stilbenes. Both fruit and leaves were used in folk medicine, such as stomach spasm, biliary and liver diseases, skin rash, wound and burn treatment as traditionally (Yasir, Das & Kharya, 2010; Arukwe et al., 2012; Roig, 1998).

These plants are traditionally used for skin problems in folk medicine. In addition, the various phytochemical compounds and minerals in these plants are known to have positive effects on human health. The goal of this study to prove the effect of methanol extracts scientifically. In addition, the effect of nanoflower structures on activity has been investigated in recent years.

2. Materyal and Method

2.1. Plant materials and extraction of the plants:

The plants collected in the selected places (Ankara and Mersin, Turkey) in summer 2017. They were air dried at room temperature and in the shade. Voucher specimens were identified by Dr. Mecit Vural and they were deposited in the Herbarium of Faculty of Pharmacy, Gazi University (Ankara, Turkey). The dried plant samples were powdered with a laboratory mill. Each powdered plants were separately extracted by methanol and the plant extracts were filtered below 40 °C using a rotary evaporator till dryness. Then, approximately 1000 mL methanol was added to the remaining plant material and macerated for one week, and again evaporized (It took 4 – 6 weeks).

2.2. Synthesis of Nanoflowers

Cu nanoflowers: For the synthesis of the protein–inorganic hybrid nanoflowers, 333 µl of aqueous $CuSO_4$ solution (120 mM) in molecular-biology-grade water was added to 10 mM of

PBS (pH 5-6-7.4-8-9) containing plant extracts with varied concentrations, followed by incubation at 30°C for 3 days (30). The final products which calls hybrid were dried and they were characterized using SEM. The obtained SEM Figures of Cu nanoflowers are given in Figure 4.

Zn nanoflowers: 0.016 g of plant extract was dissolved in 20 mL of PBS buffer. The mixture was added into a 50 mL falcon tube. Under magnetic stirring, 1.6 mL of zinc acetate solution with the concentration of 0.05 g/mL was added into the flask. After being stirred for 3 h, plant extract/$Zn(CH3CO2)_2$ hybrid particles were separated by centrifugation. The final products were dried at 30ºC and the hybrids were characterized using SEM (Zhang et al., 2016). The obtained SEM Figures of Zn nanoflowers are given in Figure 5.

2.3. Determination of antioxidant activity

Antioxidant activities of plant extracts were determined by 2,2-diphenyl-1-picrilhydrazil (DPPH) free radical scavenging method. 1 mg mL-1, 0.5 mg mL-1, 0.25 mg mL-1, 0.125 mg mL-1, 0.0625 mg mL-1 of extracts and ascorbic acid reference were prepared in methanol. 1 mL of each extract and ascorbic acid were mixed with 2 mL of DPPH (0.1 mM in 70% methanol) and incubated for 30 minutes in the dark, at room temperature and their absorbances were measured at 517 nm ELISA microplate reader. Free radical scavenging activity was calculated as follows:

Scavenging activity (%) = $[(A_0 - A_1) / A\ 0] \times 100$

A_0 = Absorbance of control at 517 nm wavelength

A_1 = Absorption of sample at 517 nm wavelength (Burda & Oleszek, 2001).

The antioxidant activity results of the plant extracts are shown in Table 2. The results of Cu and Zn nanoflowers are given in Table 3 and Table 4respectively.

2.4. Determination of Total Phenol

Total phenolic content of three extracts was determined by Folin-Ciocalteau Method. From each extract, 2 mg mL-1 sample was weighed and dissolved in 75% ethanol. 20 uL reference gallic acid dilutions and 20 uL each extract samples were mixed with 100 µL Folin-Ciocalteau reagent, 300 uL of sodium carbonate (20%) and 1580 uL distilled water. All prepared solutions are placed in vials and incubated at 40 ° C for 30 minutes. At the end of this time, each sample is applied to the microplates and their absorbance at the 765 nm wavelength is measured in the ELISA microplate reader. According to the calibration curve, the total phenolic grade was calculated with gallic acid equivalent (Singleton & Rossi, 1965). And the calculated results isshown in Table 5.

3. Results and Discussion

The collected, dried plant samples were powdered and separately extracted with methanol. Calculated yields were indicated in the Table 1.

Table 1. Information about prepared plant extracts.

Plant Name	Plant Photos	Used Part	Dry Weight	Total Extract (g)	Yield %
Asplenium ceterach		Herba	70 gr	18,5696	%26.53
Portulaca oleracea		Herba	250 gr	30,1727	%12.07
Persea americana		Folium	240 gr	44,0806	%18.37

The nanoflowers of different plant extracts were examined by SEM analysis. In this study, SEM Figures of nanoflowers synthesized at pH values between 5 and 9 were examined. Then best Figures were obtained at pH 7.4 as shown is Figure 4 and Figure5.

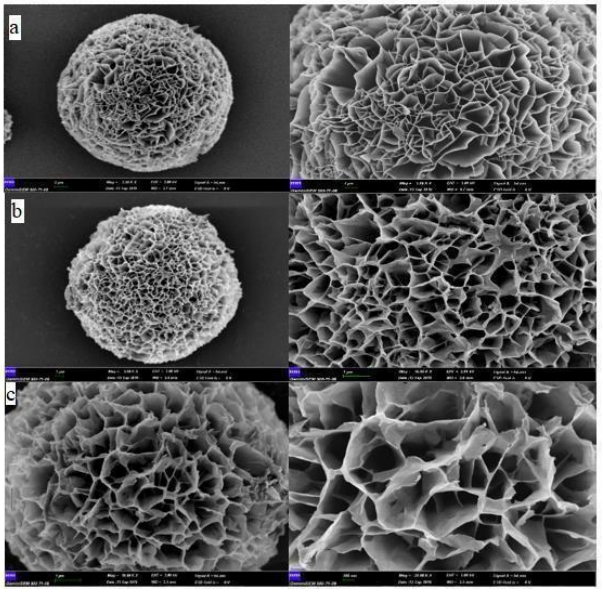

Figure 4. 2.50 KX – 20.00 KX SEM Figures of (a) *Portulacea ole*racea, (b) *Asplenium ceterach* and (c) *Persea americana of* Cu hybrid Nanoflower (pH 7.4)

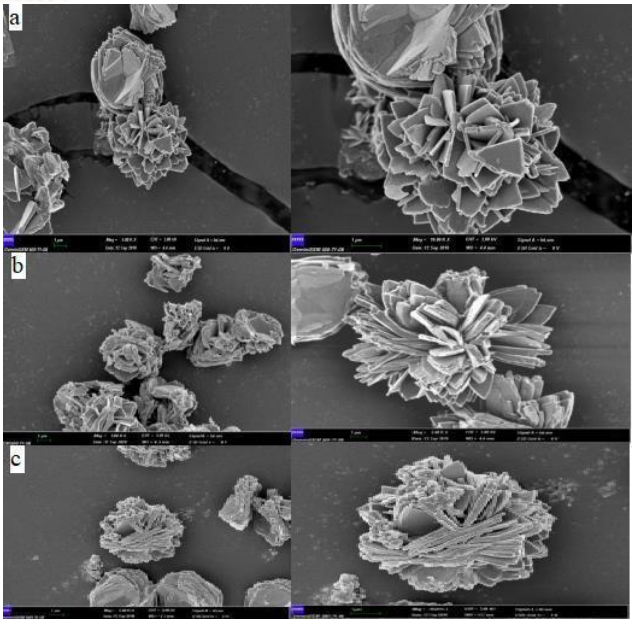

Figure 5. 5.00 KX – 10.00 KX SEM Figures of (a) *Portulacea oleracea,* (b) *Asplenium ceterach* and (c) *Persea americana* Zn hybrid Nanoflowers (pH 7.4) at

Antioxidant activities were examined at various concentrations (1mg / ml, 0.5mg / ml, 0.25mg / ml, 0.125mg / ml and 0.0625mg / ml). Activity at lower concentrations was found to be higher, so studies were continued at low concentration.

Table 2. Antioxidant activity of plant extracts.

Plant name	**0,25 mg/ml**	**0,125mg/ml**	**0,0625 mg/ml**
PA (Persea americana)	63,79 ± 0,16	38,17 ± 0,20	27,06 ±1,22
PO (Portulaca oleracea)	44,44±3,22	39,87±4,22	23,66 ±5,22
ASP (Asplenium ceterach)	**88,24±0,19**	87,75 ± 0,20	86,59 ±0,23
Ascorbic acids	94,51±1,20	87,62 ± 0,45	85,75± 0,46

Table 3. Antioxidant activity of Cu nanoflowers

Plant Names	**0,25 mg/ml**	**0,125 mg/ml**	**0,0625 mg/ml**
PA (Persea americana) Cu Nfs	37,5 ± 0,21	**57,14 ± 4,73**	48,43 ± 10,75
PO (Portulaca oleracea) Cu NFs	**57,75±2,89**	36,57 ± 4,81	**36,02 ± 5,80**
ASP (Asplenium ceterach) Cu NFs	26,54 ± 0,17	31,00 ± 1,29	31,00 ± 0,43
Copper Sulfate	-	42,81±3,23	42,91±4,99
Ascorbic acids	92,81 ± 1,20	91,86 ± 0,45	90,59 ± 0,39

Table 4. Antioxidant activity of Zn nanoflowers

Plant Names	**0,25 mg/ml**	**0,125 mg/ml**	**0,0625 mg/ml**
PA (Persea americana) Zn NFs	**77,62 ±2,80**	**69,48 ± 1,05**	**58,72 ± 2,10**
PO (Portulaca oleracea) Zn Nfs	44,67 ± 7,74	42,15 ± 2,66	**38,47 ± 3,47**
ASP (Asplenium ceterach)Zn NFs	39,44 ± 7,24	37,11 ± 4,73	59,50 ± 3,44
Zinc Acetate	46,04 ±3,94	45,45 ±5,81	40,17±3,76
Ascorbic acids	92,81 ±1,20	91,86 ±0,45	90,59 ± 0,39

Table 5. Total phenol content of plants extracts and their nanoflowers.

Plant names	**Total Phenol %**
PA (Persea americana)	2,09 ± 0,006
PO (Portulaca oleracea)	6,79 ± 0,0005
ASP (Asplenium ceterach)	**11,86 ± 0005**
PA (Persea americana) Cu Nfs	1,47 ± 0,004
PO (Portulaca oleracea) Cu Nfs	2,34 ± 0,002
ASP (Asplenium ceterach) Cu Nfs	**0,73 ± 0,004**

A ceterach showed the highest antioxidant effect among the plant extracts as presented in Table 2. Antioxidant activities of copper (Cu^{2+}) and zinc (Zn^{2+}) nanoflowers synthesized from these plants were re-examined. Owing to these nanoflower structures, increase or decrease in antioxidant activity of plant samples were observed.

It was concluded that the highest antioxidant effect in copper (Cu^{2+}) hybrid nanoflowers structure was seen in *Portulaca oleracea* (Table3). Moreover, the highest antioxidant effect in zinc (Zn^{2+}) hybrid nanoflowers structure was in *Persea americana* (Table 4). As a result, *Asplenium ceterach* plant extract has a higher antioxidant effect than its nanoflower structures. However, *Portulaca oleracea* and *Persea americana* hybrid nanoflowers have showed higher effective antioxidant activities than their plant extracts in different dilutions.

In conclusion, the antioxidant activity of *A. ceterach* decreased in all nanoflower structures. On the contrary, the highest antioxidant activity observed in *P. americana* was in zinc (Zn^{2+}) hybrid nanoflowers at a concentration of 0.25 mg/ ml. The highest antioxidant activity *P. oleracea* was observed in copper (Cu^{2+}) hybrid nanoflowers at a concentration of 0.25mg /ml.

In addition, when the total phenol content was investigated, *A. ceterach* has the richest phenolic compounds (Table 5). Total phenolics rate decreased in nanoflowers compared to the plant

extracts. Due to the binding effect of copper functional group, total phenol content in nanoflowers decreased. Due to the possible toxic effect of copper at higher concentrations property, we will continue to synthesize Zinc nanoflowers.

We aim to obtain an effective and reliable product that can be used in skin problems.

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4.References

Lee, S. W., Cheon, S. A., Kim, M. I., & Park, T. J. (2015). Organic–inorganic hybrid nanoflowers: types, characteristics, and future prospects. *Journal of nanobiotechnology*, *13*(1), 54.)

Jena, B. K., & Raj, C. R. (2008). Seedless, surfactantless room temperature synthesis of single crystalline fluorescent gold nanoflowers with pronounced SERS and electrocatalytic activity. *Chemistry of Materials*, *20*(11), 3546-3548.

Yan, T., Cheng, F., Wei, X., Huang, Y., & He, J. (2017). Biodegradable collagen sponge reinforced with chitosan/calcium pyrophosphate nanoflowers for rapid hemostasis. *Carbohydrate polymers*, *170*, 271-280.

Mao, C. J., Wang, D. C., Pan, H. C., & Zhu, J. J. (2011). Sonochemical fabrication of 8-hydroxyquinoline aluminum nanoflowers with high electrogenerated chemiluminescence. *Ultrasonics sonochemistry*, *18*(2), 473-476.

Wei, Y., Yang, R., Yu, X. Y., Wang, L., Liu, J. H., & Huang, X. J. (2012). Stripping voltammetry study of ultra-trace toxic metal ions on highly selectively adsorptive porous magnesium oxide nanoflowers. *Analyst*, *137*(9), 2183-2191.

Sun, J., Ge, J., Liu, W., Lan, M., Zhang, H., Wang, P., & Niu, Z. (2014). Multi-enzyme co-embedded organic–inorganic hybrid nanoflowers: synthesis and application as a colorimetric sensor. *Nanoscale*, *6*(1), 255-262.

Lakkakula RJ, Matshaya T, Mac¸edo RW, et al. Cationic cyclodextrin/ alginate chitosan nanoflowers as 5-fluorouracil drug delivery system. Mater Sci Eng C Mater Biol Appl. 2017; 70:169–177.

Bai, H. P., Lu, X. X., Yang, G. M., & Yang, Y. H. (2008). Hydrogen peroxide biosensor based on electrodeposition of zinc oxide nanoflowers onto carbon nanotubes film electrode. *Chinese Chemical Letters*, *19*(3),314-318.

Shende, P., Kasture, P., & Gaud, R. S. (2018). Nanoflowers: The future trend of nanotechnology for multi-applications. *Artificial cells, nanomedicine, and biotechnology*, *46*(sup1), 413-422.

Wang X, Shi J, Li Z, et al. Facile one-pot preparation of chitosan/ calcium pyrophosphate hybrid microflowers. Acs Appl Mater Interfaces. 2014; 6:14522–14532.

Altinkaynak, C., Tavlasoglu, S., & Ocsoy, I. (2016). A new generation approach in enzyme immobilization: Organic-inorganic hybrid nanoflowers with enhanced catalytic activity and stability. *Enzyme and microbial technology*, *93*, 105-112.

Kharisov IB. A review for synthesis of nanoflowers. Recent Pat Nanotechnol. 2008; 2:190–200.

Koca Çalışkan U., Özdemir N., Altinkaynak C., AKA C. Novel Nanobiocatalyst of Hybrid Nanoflowers Comprising Medicinal Plant Extracts for potential Applications in Medicine and Cosmetics. *6th International Phytocosmetics and Phytotherapy Congress (IPPC-Brazil), Sau Paulo, Brezilya, 27 - 29 November2017.*

Koca Çalışkan U., Altınkaynak C., Dönmez C., Eruygur N., Özdemir N. Synthesis and Evaluation of Copper-Sericin Hybrid Nanoflowers: Novel Products for Drug and Dermocosmetic Industry with Enhanced Enzyme Inhibitory Features. 2nd International Cosmetic Congress, 28-30 October, 2018, Antalya- Turkey.

Živković, S., Popović, M., Dragišić-Maksimović, J., Momčilović, I., & Grubišić, D. (2010). Dehydration-related changes of peroxidase and polyphenol oxidase activity in fronds of the resurrection fern Asplenium ceterach L. *Archives of Biological Sciences*, *62*(4), 1071-1081.

Živković, S., Skorić, M., Šiler, B., Dmitrović, S., Filipović, B., Nikolić, T., & Mišić, D. (2017). Phytochemical characterization and antioxidant potential of rustyback fern (Asplenium ceterach L.). *Lekovite sirovine*, *37*, 15-20.

Leporatti, M. L., & Impieri, M. (2007). Ethnobotanical notes about some uses of medicinal plants in Alto Tirreno Cosentino area (Calabria, Southern Italy). *Journal of Ethnobiology and Ethnomedicine*, *3*(1), 34.

Baharvand Ahmadi, B., Bahmani, M., Naghdi, N., Saki, K., Baharvand Ahmadi, S., & Rafieian Kopaei, M. (2015). Medicinal plants used to treat infectious and non-infectious diseases of skin and skin appendages in city of Urmia, northwest Iran. *Der Pharmacia Lettre*, *7*(11),189-196.

Davis, P. H., 1967. Flora of Turkey and the East Aegean Islands, Edinburgh at the University press, Printed in Great Britain by Robert Cunningham and Sons Limited, Alva, p. 13-14.

Oliveira, I., Valentão, P., Lopes, R., Andrade, P. B., Bento, A., & Pereira, J. A. (2009). Phytochemical characterization and radical scavenging activity of Portulaca oleraceae L. leaves and stems. *Microchemical Journal*, *92*(2), 129-134.

Yazici, I., Türkan, I., Sekmen, A. H., & Demiral, T. (2007). Salinity tolerance of purslane (Portulaca oleracea L.) is achieved by enhanced antioxidative system, lower level of lipid peroxidation and proline accumulation. *Environmental and Experimental Botany*, *61*(1), 49-57.

Dweck, A. C. (2001). Purslane (Portulaca oleracea) - the global panacea. *Personal Care Management*, *2*, 7-15.

Ezekwe, M. O., Omara-Alwala, T. R., & Membrahtu, T. (1999). Nutritive characterization of purslane accessions as influenced by planting date. *Plant Foods for Human Nutrition*, *54*(3), 183-191.

Dillard, C. J., & German, J. B. (2000). Phytochemicals: nutraceuticals and human health. *Journal of the Science of Food and Agriculture*, *80*(12), 1744-1756.

Odhav, B., Beekrum, S., Akula, U. S., & Baijnath, H. (2007). Preliminary assessment of nutritional value of traditional leafy vegetables in KwaZulu-Natal, South Africa. *Journal of Food Composition and Analysis*, *20*(5), 430-435.

Peksel, A., Arisan-Atac, I., & Yanardag, R. (2006). Antioxidant Activities of Aqueous Extracts Of Purslane (*Portulaca oleracea* subsp. *sativa* L.). *Italian journal of food science*, *18*(3).

Yasir, M., Das, S., & Kharya, M. D. (2010). The phytochemical and pharmacological profile of Persea americana Mill. *Pharmacognosy reviews*, *4*(7), 77.

Arukwe, U., Amadi, B. A., Duru, M. K. C., Agomuo, E. N., Adindu, E. A., Odika, P. C., Leke, K.C., Egejuru, L., & Anudike, J. (2012). Chemical composition of Persea americana leaf, fruit and seed. *IJRRAS*, *11*(2), 346-349.

Roig, J.T. (1998). Plantas medicinales, aromáticas o venenosas de Cuba. Ed Ciencia Técnica, Habana, Cuba.

Ge, J., Lei, J., & Zare, R. N. (2012). Protein–inorganic hybrid nanoflowers. *Nature nanotechnology*, *7*(7), 428.

Zhang, B., Li, P., Zhang, H., Li, X., Tian, L., Wang, H., ... & Zhang, Q. (2016). Red-blood-cell-like BSA/Zn3 (PO4) 2 hybrid particles: preparation and application to adsorption of heavy metal ions. *Applied Surface Science*, *366*, 328-338.

Burda, S., & Oleszek, W. (2001). Antioxidant and antiradical activities of flavonoids. *Journal of agricultural and food chemistry*, *49*(6), 2774-2779.

Singleton, V. L., & Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *American journal of Enology and Viticulture*, *16*(3), 144-158.

Determination of Phenolic Contents of *Echinophora tennuifolia* L. subsp. *sibthorpiana* (Guss) Tutin Subspecies

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Abstract: *Echinophora* (Apiaceae) genus, including five species and one subspecies, consists of six taxa in Turkey. Three of these taxa are endemic. *Echinophora tennuifolia* L. subsp. *sibthorpiana* (Guss) Tutin plant is two or perennial, 20-50 cm in height, thornless, soft hairy, yellow flowers and flavored plant. The plant blooms between June and September. It is an edible plant and has been used for therapeutic purposes since very old years. The plants of the genus *Echinophora* are used for healing wounds among the people, to treat stomach ulcersdue to their antifungal, carminative and digestive properties. Studies have shown that the genus *Echinophora* contains strong antioxidant activity with phenolic content.

In the study, chromatographic analysis of flvonoid content of *Echinophora tennuifolia* L. subsp. *sibthorpiana* (Guss) Tutin subspecies, was conducted using the method developed by Zu et al., (2006). Naringin (103,4 µg/g), Quercetin (36,8 µg/g), Resveratrol (19,0 µg/g), myricetin (6,6 µg/g), rosmarinic acid (767.0 µg/g) and vanillic acid (581.6 µg/g) contents were determined in *Echinophora tennuifolia* L. subsp. *sibthorpiana* (Guss) Tutin subspecies.

Keywords: **Apiaceae, *Echinophora tennuifolia* L. subsp. *sibthorpiana* (Guss) Tutin, Flavonoid.**

1.Introduction

Phenolic substances in one or more aromatic rings more hydroxyl group containing compounds (Shahidi & Naczk, 1995). Phenolic substances are divided into two groups as simple phenolic substances and polyphenols, but phenolic substances are examined in three parts as

hydroxybenzoic acids, hydroxycinamic acids and flavonoids. Flavonoids are divided into five subgroups as catechins, anthocyanidins, flavonols, flavanones and proanthocyanidins (Cemeroğlu & Acar, 1986).

Phenolics are compounds found in the fruit, seed, flower, leaves, branches and stems of plants (Balasundram, Sundram & Samman, 2006; Harborne & Williams, 2000) It is the most common group of substances found in plants and nowadays, the structure of approximately 4000 plant phenolic compounds is illuminated (Harborne & Williams, 2000). Phenolic compounds play an important role in the growth and development of plants, in protecting plants against pests and gives color and taste properties of fruit and vegetables (Alasalvar et al., 2001).

In recent years, natural products and medical use of plants is becoming more widespread in order to prevent and treat diseases and to protect the general health status of individuals. The fact that plant products are easily accessible and cheap and at the same time the idea that "what is obtained from nature will not be harmful" in means increase the conscious or unconscious use of plants in various diseases. Nowadays it has antimicrobial, antidiabetic, antiinflammatory and antioxidant properties allegedly a large number of herbal ingredients, a variety of used in the treatment of diseases (Balasundram, Sundram & Samman, 2006). *Echinophora* species are medicinal and aromatic plants that are belong to Apiaceae family is including five species and one subspecies, consists of six taxa in Turkey. Three of these taxa are endemic. *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin plant is two or perennial, 20-50 cm in height, thornless, soft hairy, yellow flowers and flavored plant. The plant blooms between June and September.The existence of valuable phytochemicals purpose *Echinophora* species as novel candidate to isolation and drug discovery of natural medicines such as antibiotic, analgesics, and anticancer drugs(Hosseini et al., 2017).

The aim of this study was to investigate the phenolic contents of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin subspecies and to give information about the importance of human health.

2.Material and Methods

Plant materials collected from natural habitats and deopsited in FUH (Firat University Herbarium).

2.1. Extraction of plant materials for phenolics

One-gram material used to obtain the phenolics in this study. Homogenisation was conducted by using 5 ml 80% methanol to measure phenolic acids. The samples were centrifuged at 5000 rpm at +4ºC and dimethyl sulphoxide was used to provide a reserve solution.

2.2. Chromatographic conditions for flavonoids

Chromatographic analysis was done method offered by Zu et al. (Zu et al., 2006) Column was reversed-phase column (15x4.6 mm, 5µm, USA) and mobile phase was methanol /water/acetonitrile (46/46/8, v/v/v) comprisng 1.0% acetic acid (Zu et al., 2006) It was used 1.0 ml/min. as flow ratio and chromatographic peaks were confirmed by determining retention times with those of the standards. Resveratrol, quercetin, naringenin, naringin, catechin, myricetin, morin, rutin, kaempferol and vanillic acid, cinnamic acid, caffeic acid, ferulic acid and rosmarinic acid were measured by DAD following RP-HPLC. Chromatographic studies were done at 25°C.

3.Results

Present study in table 1 showed that Rutin, Morin, Kaempherol, Catechin and Naringenin contents of *Echinophora* were absent. However, the naringin amount of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin was found highest (103.4 µg/g). Also, it was found that Quercetin (36.8µg/g) and Resveratrol (19.0 µg/g) amounts of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin were high. The myricetin content of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin was determined as 6.6 µg/g.

Table 1. Flavanoid contents of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin

Flavonoids	Amounts (µg/g)
Rutin	0
Myricetin	6.6
Morin	0
Quercetin	36.8
Kaempherol	0
Catechin	0
Naringin	103.4
Naringenin	0
Resveratrol	19.0

Table 2. Phenolic acid contents of *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin

Phenolic acids	**Amount (µg/g)**
Vanillic acid	581.6
Cinnamic acid	26.2
Caffeic acid	0
Ferulic acid	151.6
Rosmarinic acid	767.0

It was found that *Echinophora tennuifolia* L. subsp. *sibthorpiana (Guss)* Tutin has low cinnamic acid (26.2 µg/g) and caffeic acid was absent. However, it has high rosmarinic acid (767.0 µg/g), vanillic acid (581.6 µg/g) and ferulic acid (151.6 µg/g) contents.

4.Discussion

Present study showed that *Echinophora tennuifolia* L. subsp. *sibthorpiana* (*Guss*) Tutin has highest naringin content (103.4 µg/g). Flavonoids are important natural compounds with diverse biologic activities. Naringin and its aglycone naringenin belong to series of flavonoids and were found to display strong anti-inflammatory and antioxidant activities. Several lines of investigation suggest that naringin supplementation is beneficial for the treatment of obesity, diabetes, hypertension, and metabolic syndrome (Alam et al., 2014).

Also, this study found that quercetin (36.8 µg/g) and resveratrol (19.0 µg/g) contents of Echinophora tennuifolia L. subsp. sibthorpiana (Guss) Tutin were high. The best described property of Quercetin is its ability to act as antioxidant. Quercetin seems to be the most powerful flavonoids for protecting the body against reactive oxygen species, produced during the normal oxygen metabolism or are induced by exogenous damage (De Groot, 1994; Grace, 1994). Quercetin acting as free radical scavengers was shown to exert a protective effect in reperfusion ischemic tissue damage(Santos, Vyemura & Lopes, 1998; Halliwell, 1994; Fraga, Mactino & Ferraro, 1987). Quercetin prevents free radical induced tissue injury by various ways. One way is the direct scavenging of free radicals. By scavenging free radicals, Flavonoid; particularly Quercetin can inhibit LDL oxidation in vitro (Kerry & Abbey, 1997). This action protects against atherosclerosis.

Resveratrol protective effect was shown to improve cardiovascular function in diabetic rats (Yan, Sun . & Xu, 2018; Delucchi et al., 2012) by preserving the functional abilities of

cardiac stem/progenitor cell compartments and mature cardiac cells, improved cardiac environment by reducing inflammatory state and decreased unfavorable ventricular remodeling of the diabetic heart, leading to a marked recovery of ventricular function (Delucchi et al., 2012). Resveratrol has several neuroprotective roles in various neurodegenerative impairments, such as Alzheimer's, Huntington's and Parkinson's diseases, amyotrophic lateral sclerosis and alcohol-induced neurodegenerative disorders (Rauf et al., 2017; Wahab et al., 2017). Besides the cardioprotective, antioxidant, anticancer, neuroprotective, anti-inflammatory, anti-dyslipidemia, and antidiabetic effects of resveratrol, it also exhibits antiproliferative and androgen-lowering effects on theca-interstitial cells of ovary (Gliemann, Nyberg & Hellsten, 2016). These effects are very important for humanhealth.

The anti-oxidation and anti-inflammation effects of rosmarinic acid protect the skin against injury caused by exposure to solar ultraviolet (UV) radiation (Vostalova, Zdarilova & Svobodova, 2010). Anti-oxidant effects of rosmarinic acid are mainly associated with free radical scavenging that induces membrane stabilization and protection against oxidative damage (Perez-Fons, Garzon & Micol, 2010). In the analyzes, rosmarinic acid was found to be quite high in *Echinophora tennuifolia* L. subsp. *sibthorpiana* (*Guss*) Tutin plant (767.0 µg / g). However, it has high vanillic acid (581.6 µg/g) content in *Echinophora tennuifolia* L. subsp. *sibthorpiana* (*Guss*) Tutin plant. Vanillic acid is the oxidized form of vanillin and found at high concentrations in vanilla beans (Sinha, Sharma & Sharma, 2008; Sostaric, Boyce & Spickett, 2000) and in Angelica sinensis, a plant used in traditional Chinese medicine(Huang & Sheu, 2006). Vanillic acid has been associated with a variety of pharmacologic activities such as inhibiting snake venom activity (Dhananjaya et al., 2009; Dhananjaya et al., 2006), carcinogenesis (Vetrano et al., 2005), apoptosis (Huang et al., 2008 a;b) and inflammation (Itoh et al., 2009).

In this study, the phenolic contents of *Echinophora tennuifolia* L. subsp. *sibthorpiana* (*Guss*) Tutin plant were examined and it is thought that the plant has a content that will make positive contributions to human health and it would be beneficial to give more place in human nutrition.

5.References

Shahidi, F. & Naczk, M. (1995). *Food Phenolics, Chemistry, Effects, Applications*. Technomic, USA

Cemeroğlu, B. & Acar, J. (1986). *Meyve ve Sebze İşleme Teknolojisi. Gıda Teknolojisi Derneği Yayın* No:6, Ankara.

Balasundram N., Sundram, K. & Samman, S. (2006). Phenolic compounds in plants and agri-industrial by-products: antioxidant activity, occurrence, and potential uses. *Food Chem*, *99(1),* 191-203.

Harborne, JB. & Williams CA. (2000). Advances in flavonoid research since 1992. *Phytochemistry, 55(6),* 481-504.

Alasalvar, C., Grigor, JM., Zhang, D., Quantick, PC. & Shahidi F. (2001). Comparison of volatiles, phenolics, sugars, antioxidant vitamins, and sensory quality of different colored carrot varieties. *J Agric Food Chem*, 9(3), 1410-6.

Hosseini, Z., Lorigooini Z., Rafieian-Kopaei, Hamzeh M., Shirmardi, A. & Solati K.(2017). A Review of Botany and Pharmacological Effect and Chemical Composition of Echinophora Species Growing in Iran. *Pharmacognosy Res, 9(4),* 305–312.

Zu, Y.G., Li, C.Y., Fu, Y.J. & Zhao, C.J. (2006). Simultaneous determination of catechin, rutin, quercetin kaempferol and isorhamnetin in the extract of sea buckthorn (*Hippophae rhamnoides* L.) leaves by RP-HPLC with DAD. *Journal of Pharmaceutical and Biomedical Analysis*, *41,* 714–719.

Alam, M. A., Subhan, N., Rahman, M. M., Uddin, S.J., Reza, H. M., & Sarker, S. D. (2014). Effect of Citrus Flavonoids, Naringin and Naringenin, on Metabolic Syndrome and Their Mechanisms of Action. *Adv Nutr. Jul., 5,* 404–417.

De Groot, H. (1994). Reactive oxygen species in tissue injury. *Hepatogastroentrology,* 41:328-32.

Grace, PA. (1994). Ischemia-reperfusion injury. *Br J surg*, *81,* 637-647.

Santos, A.C., Vyemura, S.A., & Lopes, JL. (1998). Effect of naturally occurring flavonoids on lipid peroxidation and membrane permeability transition in mitochondria. *Free Radic Biol Med*, *24,* 1455-61.

Halliwell, B. (1994). Free radicals, antioxidants and human disease: curiosity, cause or constipation. *Lancet, 344,* 721-724.

Fraga, C.G., Mactino, U.S. & Ferraro, G.E. (1987). Flavonoids as antioxidants evaluated by in vitro and insitu liver chemiluminescence. *Biochem Med Metabol BioI, 36,* 717-20.

Kerry, N.L. & Abbey, M. (1997). Red wine and fractionated phenolic compounds prepared from red wine inhibits low density lipoprotein oxidation in vitro. *Atherosclerosis, 135,* 93-102.

Yan, F., Sun, X. & Xu, C. (2018). Protective effects of resveratrol improve cardiovascular function in rats with diabetes. Exp. *Ther. Med., 15,* 1728–1734.

Delucchi, F., Berni, R., Frati, C., Cavalli, S., Graiani, G., Sala, R., Chaponnier, C., Gabbiani, G., Calani, L. & Rio, D.D. (2012). Resveratrol treatment reduces cardiac progenitor cell dysfunction and prevents morpho-functional ventricular remodeling in type-1 diabetic rats. *PLoS ONE, 7,* e39836.

Rauf, A., Imran, M., Suleria, H.A.R., Ahmad, B., Peters, D.G. &Mubarak, M.S. (2017). A comprehensive review of the health perspectives of resveratrol. *Food Funct., 8,* 4284–4305.

Wahab, A., Gao, K., Jia, C., Zhang, F., Tian, G., Murtaza, G.& Chen, J. (2017). Significance of resveratrol in clinical management of chronic diseases. *Molecules, 22,* 1329.

Gliemann, L., Nyberg, M.& Hellsten, Y. (2016). Effects of exercise training and resveratrol on vascular health in aging. Free Radic. *Biol. Med. 98,* 165–176.

Vostalova, J., Zdarilova, A. & Svobodova, A. (2010) Prunella vulgaris extract and rosmarinic acid prevent UVB-induced DNA damage and oxidative stress in HaCaT keratinocytes. *Arch Dermatol Res, 302,* 171–181.

Perez-Fons, L., Garzon, MT. & Micol, V. (2010). Relationship between the antioxidant capacity and effect of rosemary (Rosmarinus officinalis L.) polyphenols on membrane phospholipid order. *J Agric Food Chem, 58,* 161–171.

Sinha, A.K., Sharma, U.K. & Sharma,N. (2008). A comprehensivereview on vanilla flavor: extraction, isolation and quantificationof vanillin and others constituents. Int. *J. Food Sci. Nutr.*,59, 299–326.

Sostaric, T., Boyce, M.C. & Spickett, E.E. (2000) Analysis of thevolatile components in vanilla extracts and flavorings bysolid-phase microextraction and gas chromatography.*J. Agric. Food Chem.,48,* 5802–5807.

Huang, W.Y. & Sheu, S.J. (2006). Separation and identification ofthe organic acids in Angelicae Radix and Ligustici Rhizoma byHPLC and *CE. J. Sep. Sci*.,29:2616–2624.

Dhananjaya, B.L., Nataraju, A., Raghavendra Gowda, C.D., Sharath, B.K. & D' Souza,C.J. (2009). Vanillic acid as a novelspecific inhibitor of snake venom 50-nucleotidase: apharmacological tool in evaluating the role of the enzyme insnake envenomation. *Biochemistry,74,* 1315–1319.

Dhananjaya, B.L., Nataraju, A., Rajesh, R., Raghavendra Gowda, C.D., Sharath, B.K., Vishwanath,B.S. & D'Souza,C.J. (2006). Anticoagulant effect of Naja naja venom 5'nucleotidase: demonstration through the use of novel specific inhibitor, vanillicacid. *Toxicon,48,* 411–421.

Vetrano, A.M., Heck, D.E., Mariano, T.M., Mishin, V., Laskin, D.L. & Laskin, J.D. (2005) Characterization of the oxidase activity inmammalian catalase. *J. Biol. Chem.,280*, 35372–35381.

Huang, S.M., Chuang, H.C., Wu, C.H. & Yen, G.C. (2008a) Cytoprotective effects of phenolic acids on methylglyoxal-inducedapoptosis in Neuro-2A cells. *Mol. Nutr. Food Res.,52*, 940–949.

Huang, S.M., Hsu, C.L., Chuang, H.C., Shih, P.H., Wu, C.H. & Yen, G.C. (2008b). Inhibitory effect of vanillic acid onmethylglyoxal-mediated glycation in apoptotic Neuro-2A cells. *Neurotoxicology, 29*, 1016–1022.

Itoh, A., Isoda, K., Kondoh, M., Kawase, M., Kobayashi, M., Tamesada, M. & Yagi, K. (2009) Hepatoprotective effect ofsyringic acid and vanillic acid on concanavalin a-induced liverinjury. *Biol. Pharm. Bull.,32*, 1215–1219

Investigation of The Phenolic Contents of *Salvia syriaca* L. Taxon

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Abstract: *Salvia* one of the largest genera of the Lamiaceae family, has about 1000 species and is represented by 99 species in our country. The plant, which is a pharmaceutical raw material, is also available in various types of fragrant and essential oils used in industry. It is widely used in the treatment of colds, sore throat and stomach pain among the people in our country. Many studies have been reported on the antioxidant properties of the plant. The aim of this study was to determine the flavonoid content of *Salvia syriaca* L. plant collected from natural habitats in Baskil district of Elazig province. In the study, when the phenolic contents of *Salvia syriaca* L. taxone were examined, the highest amount of ferrulic acid (1740.2 µg/g) was found, while rutin (1632.8 µg/g), and Rosmarinic acid (1480 µg/g), catesin (374.8 µg/g) and kaempferol (249.6 µg/g), were detected in other high amounts of phenolic substances. In addition to these substances, small amounts of quercetin, naringin, naringenin, myricetin and morin were found.

Keywords: Flavonoids, Lamiaceae, *Salvia syriaca* L.

1.Introduction

The name *Salvia* comes from the Latin word Salvare, the healer (Baytop, 1999; Ulubelen & Topçu, 1998). The genus *Salvia* is the largest member of the Lamiaceae family and comprises over 1000 species (Wu et al., 2012). *Salvia* species are traditionally used for medicinal purposes worldwide (Farimani et al., 2012; Bahadori & Mirzaei, 2015). Since ancient times species

of *Salvia* have been used as a folk medicine for the treatment of stomach ailments and the common cold. The volatile oils of several species are used as antiseptic, the tannin as a local anti-inflammatory agent, and the bitter taste produces a pleasant sensory feeling in the mouth and throat (Baytop, 1999; Ulubelen & Topçu, 1998).

Various biological activities such as antimicrobial, cytotoxicity, anti-protozoal, anti-HIV, antioxidant and anti- inflammatory activities have been reported for the genus (Topcu, 2006). In addition, *Salvia* species are used for central nervous system disorders (Bahadori & Mirzaei, 2015). Several species from the genus are used in perfume, food and pharmaceutical industries (Bahadori et al., 2015). A broad spectrum of natural compounds such as terpenoids and phenolics are found in *Salvia* species (Lu & Foo, 2002; Bautista et al., 2013).

Sages (*Salvia* L.) have been considered as important medicinal plants since ancient times. Most of the sages have been considered for their popular application in folk- and modern- medicine in different regions and cultures (Kintzios et al., 2000). However, they all differ in their biological and medicinal activities. For example, the traditional Chinese herbal drug, has been widely used to promote blood flow and treat vascular diseases. Prevention and treatment of cerebral infarction by Danshen involves multiple pathways, including anti-atherosclerosis, anti-hypertension, anti-platelet aggregation, anti-inflammatory and anti-oxidative effects (Lin & Hsieh, 2010).

Phenolics, including phenolic acids, are secondary metabolites from plants and fungi. These compounds possess an aromatic ring bearing one or more hydroxyl groups and their structures may range from that of a simple phenolic molecule to that of a complex high-molecular weight polymer (Balasundram, Sundram & Samman, 2006). Phenolic substances are divided into two groups as simple phenolic substances and polyphenols, but phenolic substances are examined in three parts as hydroxybenzoic acids, hydroxycinamic acids and flavonoids. Flavonoids are divided into five subgroups as catechins, anthocyanidins, flavonols, flavanones and proanthocyanidins (Cemeroğlu & Acar, 1986). Phenolics are compounds found in the fruit, seed, flower, leaves, branches and stems of plants (Balasundram, Sundram & Samman, 2006; Harborne & Williams, 2000). Phenolic compounds play an important role in the growth and development of plants, in protecting plants against pests and gives color and taste properties of fruit and vegetables (Alasalvar et al., 2001).

The aim of this study was to investigate the phenolic contents of *Salvia syriaca* L. subspecies and to give information about the importance of human health.

2.Material and Methods

Plant materials collected from natural habitats and deopsited in FUH (Firat University Herbarium).

2.1. Extraction of plant materials for phenolics

One gram material used to obtain the phenolics in this study. Homogenisation was conducted by using 5 ml 80% methanol to measure phenolic acids. The samples were centrifuged at 5000 rpm at +4ºC and dimethyl sulphoxide was used to provide a reserve solution.

2.2. Chromatographic conditions for flavonoids

Chromatographic analysis was done method offered by Zu et al. (2006) Column was reversed-phase column and mobile phase was methanol /water/acetonitrile (46/46/8, v/v/v) comprising 1.0% acetic acid (Zu et al., 2006). It was used 1.0 ml/min. as flow ratio and chromatographic peaks were confirmed by determining retention times with those of the standards. Resveratrol, quercetin, naringenin, naringin, catechin, myricetin, morin, rutin, kaempferol and vanillic acid, cinnamic acid, caffeic acid, ferulic acid and rosmarinic acid were measured by DAD following RP-HPLC. Chromatographic studies were done at 25°C.

3.Results

Salvia syriaca L. findings are given in Table 1 and Table 2.

Table 1. Flavanoid contents of *Salvia syriaca* L.

Flavonoids	**Amounts (µg/g)**
Rutin	1632.8
Myricetin	4.8
Morin	0.6
Quercetin	58.6
Kaempherol	249.6
Catechin	374.8
Naringin	45.8
Naringenin	10.6
Resveratrol	0

Present study in table 1 showed that resveratrol contents of *Salvia syriaca* L. were absent. However, the rutin amount *Salvia syriaca* L.was found highest (1632.8 µg/g). Also, it was found that Catechin (374.8 µg/g) and Kaempherol (249.6µg/g) amounts of *Salvia syriaca L.*

were high. The Quercetin content of *Salvia syriaca L.* was determined as 58.6 µg/g. In addition to these results, small amounts of Naringin, Myricetin and Morin contents were determined in the plant.

Table 2. Phenolic acid contents of *Salvia syriaca* L.

Phenolic acids	**Amount (µg/g)**
Vanillic acid	387.8
Cinnamic acid	0
Caffeic acid	16.4
Ferulic acid	1740.2
Rosmarinic acid	1480

It was found that *Salvia syriaca* L.has low Cinnamic acid was absent. However, it has high Ferulic acid (1740.2 µg/g), Rosmarinic acid (1480 µg/g) and Vanillic acid (387.8 µg/g) contents.

4.Discussion

Flavonoids, polyphenolic compounds present in the plant extracts from the heterogeneous family, are functionally related. Plants containing fl avonoid derivatives have been found to be active as a disease preventive and therapeutic agent, present in folk medicine preparations that have been used for thousands of years (Havsteen, 2002; Chung et al., 2003).

In the present study, the highest flavonoid content was determined as Rutin. Rutin is a flavonoid of the flavonol-type found in many typical plants, such as buckwheat, passion flower, apple, and tea. It is an important dietary constituent of food and plant-based beverages (Fabjan et al., 2003; Kreft, Knapp & Kreft, 1999; Kuntić, Pejić & Ivković, 2007; Gülpınar et al., 2012). Furthermore, it is known as vitamin P and quercetin-3-O-rutinoside (Ghiasi, Taheri & Tafazzoli, 2010; Kröner et al., 2012). Rutin is the main glycoside form of quercetin, which is the most abundant flavonol in vegetables and fruits (Manach, Morand & Texier, 1995). Rutin appears to be a potent component that could be considered in the treatment of several diseases including hepatotoxicity and gastrointestinal diseases as well as diabetes and protect organs against any agents that produce free radicals (Hosseinzadeh & Nassiri-Asl, 2014).

However, the value of Catechin was found to be high in the study. Catechins are present in many dietary products, plants, fruits (such as apples, blueberries, gooseberries, grape seeds, kiwi, strawberries), green and black tea, red wine, beer, cacao liquor, chocolate and cocoa. There is increasing interest in the beneficial health effects of compounds present in food and beverages. Numerous studies have been devoted to the antioxidant properties of flavonoids, including catechins. Catechins proved to be among the best antioxidants studied against hemolytic membrane damage and intracellular generation of free radicals (Grzesik et al., 2018). High Ferulic acid value is also a remarkable result. Ferulic acid is a monophenolic phenylpropanoid occurring in plant products such as rice bran, green tea and coffee beans (Zhao & Moghadasian, 2008). Ferulic acid acts as a well-known antioxidant, effective in scavenging peroxyl radicals and other active oxygen species like superoxide and hydroxyl radical (Kikuzaki et al., 2003). Due to these properties, it is very important that ferulic acid is present in high content *Salvia syriaca* L.

Another phenolic acid with high content is Rosmarinic acid in study. Rosmarinic acid is a major polyphenolic compound in Lamiaceae family. It has different biological activities including antioxidant, anti-inflammatory, anti-tumor, anti-angiogenic, anti-viral and anti-bacterial functions (Petersen, 2013).

Phenolic content of *Salvia syriaca* L. was investigated and important findings were found. These findings are explained in the study. When these findings are taken into consideration, it is believed to contribute to public health.

5.References

Baytop, T. (1999). Therapy with Medicinal Plants in Turkey (Past and Present), vol. 2, Nobel Tıp Kitabevleri, Istanbul.

Ulubelen, A. & Topçu, G. (1998). Chemical and biological investigations of *Salvia* species growing in Turkey. Atta-ur-Rahman (Ed.), Structure and Chemistry, Part F, Studies in Natural Product Chemistry, vol. 20, *Elsevier Science*, 659-718.

Wu, Y.B., Ni, Z.Y., Shi, Q.W., Dong, M., Kiyota, H., Gu, Y.C. & Cong B. (2012). Constituents from *Salvia* species and their biological activities, *Chem. Rev.*, *112*, 5967-6026.

Farimani, M.M., Taheri, S., Ebrahimi, S.N., Bahadori, M.B., Khavasi, H.R., Zimmermann, S., Brun, R. & Hamburger, M. (2012). Hydrangenone, a new isoprenoid with an unprecedented skeleton from *Salvia* hydrangea. *Org. Lett., 14*, 166-169.

Bahadori, M.B. & Mirzaei. M. (2015). Cytotoxicity, antioxidant activity, total flavonoid and phenolic contents of *Salvia urmiensis Bunge and Salvia hydrangea DC*. Ex Benth. *RJP*, *2*, 27-32.

Topcu, G. (2006). Bioactive triterpenoids from *Salvia* species. *J. Nat. Prod.*, *69*, 482-487.

Bahadori, M.B., Valizadeh, H., Asghari, B., Dinparast, L., Farimani, M.M. & Bahadori. S. (2015). Chemical composition and antimicrobial, cytotoxicity, antioxidant and enzyme inhibitory activities of *Salvia spinosa* L. *J. Funct. Foods, 18,* 727-736.

Lu, Y. & L.Y. Foo. (2002). Polyphenolics of *Salvia* — a review. *Phytochemistry, 59,* 117-140.

Bautista, E., Toscano, R.A., Calzada, F., Diaz, E., Yepez,L. (2013).Mulia, A. OrtegaHydroxyclerodanes from *Salvia shannoni*. *J. Nat. Prod., 76,* 1970-1975.

S.E. Kintzios, E. Panagiotopoulos, C. Kapetanos, M. Skapeti. Production of Secondary Metabolites Using Liquid Culture of *Salvia* Plants, Sage: The Genus *Salvia*. Harwood Academic Publishers, Amsterdam (2000), pp. 251-262.

Lin, T. H. & . Hsieh. C. L (2010). Pharmacological effects of *Salvia miltiorrhiza* (Danshen) on cerebral infarction China Med., 5.

Balasundram, N., Sundram, K. & Samman., S. (2006). Phenolic compounds in plants and agri-industrial by-products: antioxidant activity, occurrence, and potential uses. *Food Chem., 99,* 191-203.

Cemeroğlu, B. & Acar, J., (1986). Meyve ve Sebze İşleme Teknolojisi. Gıda Teknolojisi Derneği Yayın No:6, Ankara.

Balasundram, N., Sundram, K. & Samman., S. (2006). Phenolic compounds in plants and agri-industrial by-products: antioxidant activity, occurrence, and potential uses. *Food Chem., 99,* 191-203.

Harborne, JB. & Williams CA. (2000). Advances in flavonoid researchsince 1992. *Phytochemistry, 55(6),* 481-504.

Alasalvar, C., Grigor, JM., Zhang, D., Quantick, PC. & Shahidi, F. (2001). Comparison of volatiles, phenolics, sugars, antioxidant vitamins, and sensory quality of different colored carrot varieties. *J Agric Food Chem., 9,* 1410-6.

Zu, Y.G., Li, C.Y., Fu, Y.J. & Zhao C.J. (2006). Simultaneous determination of catechin, rutin, quercetin kaempferol and isorhamnetin in the extract of sea buckthorn (Hippophae rhamnoides L.) leaves by RP-HPLC with DAD. *Journal of Pharmaceutical and Biomedical Analysis, 41,* 714–719.

Havsteen, BH. (2002). The biochemistry and medical significance of the flavonoids. *Pharmacol Ther, 96,* 67-202.

Chung, FL., Schwartz, J., Herzog, CR. & Yang, YM. (2003). Tea and cancer prevention: studies in animals and humans. *J Nutr., 133,* 3268-3274.

Fabjan, N., Rode, J., Kosir, IJ., Wang, Z., Zhang, Z. & Kreft, I. (2003). Tartary buckwheat (Fagopyrum tataricum Gaertn.) as a source of dietary rutin and quercitrin. *J Agric Food Chem, 51,* 6452–6455

Kreft, S., Knapp, M. & Kreft, I. (1999). Extraction of rutin from buckwheat (Fagopyrum esculentum Moench) seeds and determination by capillary electrophoresis. *J Agric Food Chem 47,*4649–4652

Kuntić, V., Pejić, N. & Ivković, B. (2007). Isocratic RP-HPLC method for rutin determination in solid oral dosage forms. *J Pharm Biomed Anal 43,* 718–721

Gulpinar, AR., Orhan, IE., Kan, A., Senol, FS., Celik, SA & Kartal, M. (2012). Estimation of in vitro neuroprotective properties and quantification of rutin and fatty acids in buckwheat (Fagopyrum esculentum Moench) cultivated in Turkey. *Food Res Int 46,* 536–543

Ghiasi, M., Taheri, S. & Tafazzoli, M., (2010). Dynamic stereochemistry of rutin (vitamin P) in solution: theoretical approaches and experimental validation. *Carbohydr Res, 345,* 1760–1766

Kröner, A., Marnet, N., Andrivon, D. & Val, F. (2012). Nicotiflorin, rutin and chlorogenic acid: phenylpropanoids involved differently in quantitative resistance of potato tubers to biotrophic and necrotrophic pathogens. *Plant Physiol Biochem 57,* 23–31.

Manach, C., Morand, C. & Texier, O. (1995) Quercetin metabolites in plasma of rats fed diets containing rutin or quercetin. *J Nutr., 125,* 1911–1922

Hosseinzadeh, H., & Nassiri-Asl, M., (2014). *Review of the protective effects of rutin on the metabolic function as an important dietary flavonoid. Journal of Endocrinological Investigation*, Volume 37, Issue 9, pp 783–788.

Grzesik, M., Naparło, K., Bartosz, G. & Sadowska-Bartosz. I. (2018). *Antioxidant properties of catechins: Comparison with other antioxidants. Food Chemistry,* Volume 241, 15, pp 480-492.

Zhao, Z. & Moghadasian, M.H. (2008). Chemistry, natural sources, dietary intake and pharmacokinetic properties of ferulic acid: a review. *Food Chem., 109,* 691-702.

Kikuzaki, H., Hisamoto, M., Hirose, K., Akiyama, K. & Taniguchi, H. (2003). Antioxidant properties of ferulic acid and its related compounds. *J. Agric. Food Chem.,* 5*0,* 2161-2168.

Petersen, M. (2013). Rosmarinic acid: new aspects. *Phytochem. Rev., 12,* 207-227.

Natural Sun Protection Effect of Silk Peptides

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Abstract: In current years, the harmful effects of the UVA wavelengths of sunlight have been causing more serious conditions such as dermological problems and moreover skin cancers. Sun protection products have been the focus of human being, especially for kids. Many Sun protection products have long been used to protect against sun light induced erythema with the performance indicated by the sun protection factor (SPF). Silk, is one of the natural material having SPF, which originally came from China, known as a luxury fabric in the whole world. Scientists had been very curious about the silk structure, recently, silk fiber and silk amino acids became the center of an important research topic for biotechnology. Silk is made of two peptides that are sericin and fibroin. Sericin appears to beneficially affect the skin as a protective (anti-oxidation, anti-UV radiation) and as a rich moisturizer agent. These effects may be seen with both oral and topical applications. In this study, we aim to demonstrate the UV efficacy of silk peptides by using two SPF creams with same formulas except, one of them is enriched with silk peptides. As a result, SPF cream with '**silk peptide'** scan was recorded as **SPF 50.87**, T(UVA) 8.68%, T(UVB) 1.52%, lambda critical 378.92 (number of scans :12, UVA/UVB ratio= 0.699). Whereas, scan results of the SPF cream without silk peptide were **SPF 39.31**, T(UVA) 6.71%, T(UVB) 2.27%, lambda critical 382.08 (number of scans :12, UVA/UVB ratio= 0.795) It was observed that the silk peptides have a strong protective property, especially in terms of UVA activity. UVA radiation is the main concomitant cause of skin photosensitization and phototoxicity, whereas, UVB radiation has been known for immediate and evident skin damages. Therefore, besides all these benefits of silk peptides in cosmetics, it can also be used as a natural UV protectant.

Keywords: Active substance, Cultivating, Medicinal and Aromatic Plants, Iğdır.

1.Introduction

Due to the damage on the ozone layer, sun lights are causing more and more serious conditions such as dermalogical problems and variety of skin cancers. Sun protection products have been the focus of human being, especially for kids.

The sun emits three different types of UV radiation: UVA UVB and UVC. Although all types of the UV radiation have potentials to damage the skin, each type have effects on human skin different ways. UVC, the shortest of all UV rays, never reaches the earth, since it was absorbed by ozone. UVB, the chief cause of skin reddening and sunburn, tends to damage the top layers of the skins. UVA, accounts for 95% of the UV radiation that reaches the earth. Plays a major part in skin agining and wrinkling since penetrates the skins' secondlayer.

Various sun protection products have long been used to protect against sun light induced erythema with the performance indicated by the sun protection factor (SPF). Sunscreen products contain active ingredients that can absorb, reflect or scatter the sun light, depending on their nature.

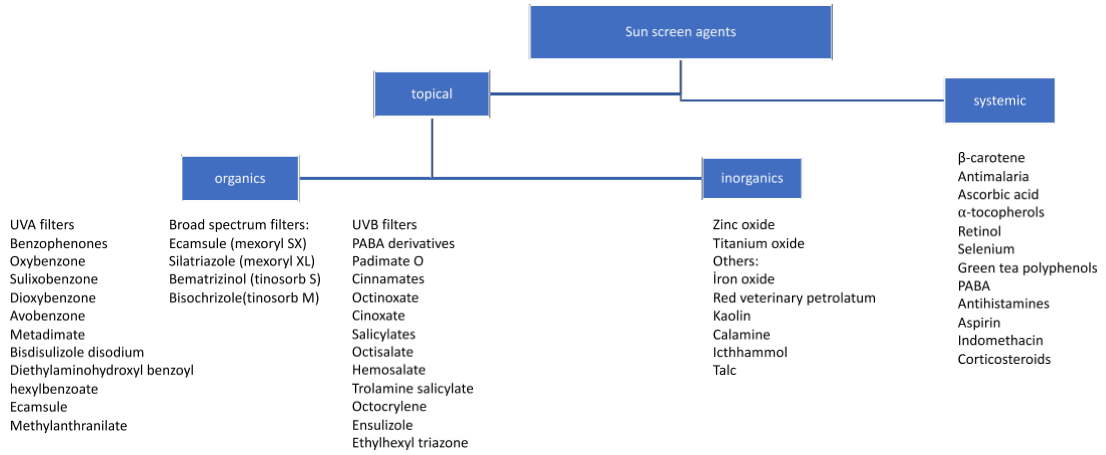
UVA radiation damages skin cells and DNA, being responsible for photo aging and photo carcinogenesis. Both UVA and UVB can cause sunburn, photoageing, erythema and inflammation (Wang 2001). The effects of UVA only manifest after a long period of exposure, even if the doses are low. UVA contribute for reduction of skin elasticity, increase of wrinkling and production of reactive oxygen that leads to acute and chronic changes on the skin. Moreover, they cause aggravation of cutaneous lupus erythematosus and also cause immunosuppression that contributes to the growth of skin cancer UVB radiation causes some changes, such as pigmentation and sunburn, as well as chronic changes, such as immune suppression and photo carcinogenesis.

Each year, further new cases of skin cancers are diagnosed in the U.S. than new cases of breast, prostate, lung, and colon cancer combined. One in five Americans will develop skin cancer in their lifetime. According to literature one American dies from skin cancer every hour (www.aad.org) Unprotected exposure to UV radiation is the most preventable risk factor for skin cancer. To protect the skin from the sun, sun screen products are applied mostly on skins to avoid all of the aforementioned damaging effects (Svobodová and Vostálová 2010).

Sunscreens have an individual sun protection factor (SPF) value, that is defined as the ratio of the minimal erthemal dose on sunscreen protected skin (MEDp) to the minimal erythemal dose (MEDu) on unprotected skin, as showed on equation.

$$SPF=\frac{minima\ erythemal\ dose\ in\ sunscreen\ protected\ skin}{minimal\ erythemal\ dose\ in\ unprotected\ skin}$$

Topical sunscreen agents can be divided into organic and inorganic agents.



(Latha and Bangere, sunscreen agent:reviews,2013)

The formulation that are commercially available include a combination of these agents to cover a wide spectrum of UV radiation. This sunscreen agents action may vary from blocking, reflecting and scattering light. An ideal sunscreen agent has to be safe, chemically inert, nonirritating, nontoxic, photo stable and should provide complete protection to the skin. (Lionetti and Rigano 2017)

Silk is one of the natural material having SPF which is a fine, strong, soft lustrous fibre produced by silkworms in making cocoons and collected to make thread and fabric. The domesticated silkworm is an important economic insect (Figure 1-A). The silkworm produces massive amount of silk proteins during the final stage of larval development. These proteins are stored in the middle silk gland and they discharged through the anterior duct andspinerret.

Silk protein represent a unique family of natural fibrous proteins due to their unique structure. It's major components are fibroin and sericin (Figure 1-B). Fibroin is a fibrous protein constituting the core of silk, while sericin is a glue like protein that envelopes fibroin fibers.

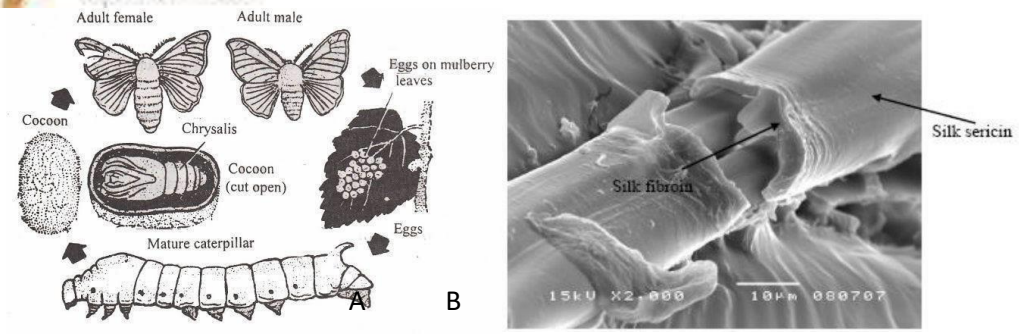
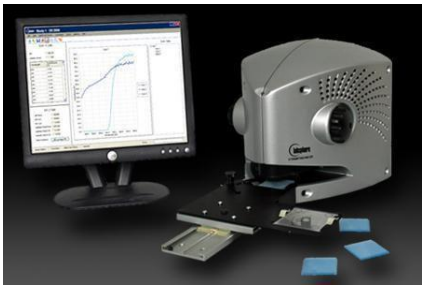


Figure 1. A: A general life cycle of the silkworm (*Bombyx mori*), B: Scanning electron microscope (×2000) Figure of silk fiber that contains sericin and fibroin (Aramwit 2015)

2.Material and Methods

Two different SPF creams with same formulas but one of them was enriched with silk peptides. UVA protection factor and "critical wavelength" values were evaluated with *in vitro* UV protection method, which is called "Colipa". This method provides two metrics describing the UVA protection of a sunscreen. (2006/647/EC)



Measurement parameters: *In vitro* SPF, UVA/UVB ratio, critical wavelength •

Method: Colipa •

Software: UV-2000S •

Lamp: Xenon flash lamp •

Measurement Range: 250-450 nm wavelengths •

Plate: PMMA HD-2 •

Surface area: 50x50 mm •

Permeability: 0-100% •

Absorbance: 0-2.7 A (read at 1nm intervals for 12 points). •

Methods:

STEP 1: *In vitro* transmission measurement of the sunscreen product was spread on a PMMA plate, prior to UV irradiation.

STEP 2: Acquisition of initial UV spectrum with $A_O(\lambda)$ data. An *in vitro* SPF (0%UV dose) equal to the labelled SPF (*in vivo*). $UVAPF_0$ is calculated using $A_O(\lambda)$ and C.

STEP 3: A single UV dose D is calculated, proportional to $UVAPF_0$.

STEP 4: UV exposure of the same sample as in step 1, according to the calculated UV dose D.

STEP 5: *In vitro* transmission measurement of the sun screen product after UV exposure. Acquisition of second UV spectrum with A (λ) data.

STEP 6: Mathematical adjustment of the second spectrum (following UV exposure) according to the same C coefficient, previously determined in step 2. Calculation of the *in vitro* UVA protection factor UVA-PF after irradiation using A (λ) and C and calculation of the critical wavelength value from A (λ) data. The wavelength range measured by the spectrophotometer (290 to 400 nm). The substrate / plate is the material to which the sun screen product sample is applied (made by polymethylmethacrylate -PMMA).

Firstly, the method provides in vitro UVA protection factors (UVA-PF), which have been shown to correlate well with *in vivo* UVA protection factor values derived from the persistent pigment darkening (PPD) method. Secondly, the method also provides a means of calculating critical wavelength values. The test is based on an assessment of the UV transmittance of a thin film of sunscreen sample spread on a roughened substrate after exposure to a controlled dose of UV radiation from a defined UV source. Due to the current lock of inter laboratory reproducibility of absolute in vitro UV measurements, each set of sunscreen transmission data is adjusted by first converting to absorption data and then by multiplying by a correction coefficient.

Both the final in vitro UVA-PF and in vitro critical wavelength value, are calculated from the absorbance data of the UV exposed sample.

3.Results

As a result, SPF cream with '**silk peptide'** scan were **SPF 50.87**, T(UVA) 8.68%, T(UVB) 1.52%, lambda critical 378.92 (number of scans :12, UVA/UVB ratio= 0.699). Whereas, scan results of the SPF cream without silk peptide were **SPF 39.31**, T(UVA) 6.71%, T(UVB) 2.27%, lambda critical 382.08 (number of scans :12, UVA/UVB ratio= 0.795) all those data indicate that the test was performed in a safe range. SPF value is very important for the study. The result of the SPF value of sunscreen with silk protein was found to be 50,87. the other sample was measured 39,31.

4.Conclusion

It was observed that the silk peptides have a strong protective property, especially in terms of UVA activity and it contributed to the increased homojenity of the formulation. UVA radiation is the main cocomitant cause of skin photosensitization and phototoxicity, whereas, UVB radiation has been known for immediate and evident skin damages. Therefore, besides all these benefits of silk peptides in moisturizing cosmetics, it can also be used as a UV protectant.

Comparison of sunscreen potential of both cream formulations

Sunscreen cream+ silk protein

	SPF	T(UVA)	T(UVB)	Lambda Critical
Number of Sets:	1	1	1	1
Mean:	50,87	8,68%	1,52%	378,92
STD:	n/a	n/a	n/a	n/a
COV:	n/a	n/a	n/a	n/a

UVA/UVB Ratio: 0,699

Set 1

	SPF	T(UVA)	T(UVB)	Lambda Critical
Number of Scans:	12	12	12	12
Mean:	50,87	8,68%	1,52%	378,92
STD:	0,72	0,36%	0,03%	0,29
COV:	1,42%	4,15%	1,94%	0,08%

UVA/UVB Ratio: 0,699

Scan	SPF	Critical Wavelength
Scan 1	51,80	378
Scan 2	51,05	379
Scan 3	52,53	379
Scan 4	50,79	379
Scan 5	51,15	379
Scan 6	50,00	379
Scan 7	50,56	379
Scan 8	50,91	379
Scan 9	50,40	379
Scan 10	50,42	379
Scan 11	50,86	379
Scan 12	50,02	379

Sunscreen cream only

	SPF	T(UVA)	T(UVB)	Lambda Critical
Number of Sets:	1	1	1	1
Mean:	39,31	6,71%	2,27%	382,08
STD:	n/a	n/a	n/a	n/a
COV:	n/a	n/a	n/a	n/a

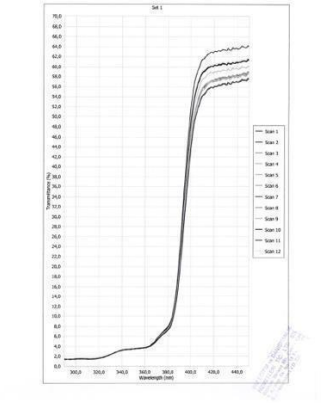
UVA/UVB Ratio: 0,795

Set 1

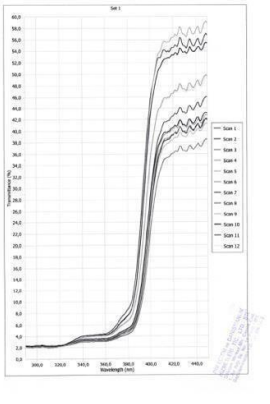
	SPF	T(UVA)	T(UVB)	Lambda Critical
Number of Scans:	12	12	12	12
Mean:	39,31	6,71%	2,27%	382,08
STD:	1,58	1,54%	0,10%	1,68
COV:	4,02%	23,01%	4,61%	0,44%

UVA/UVB Ratio: 0,795

Scan	SPF	Critical Wavelength
Scan 1	37,54	380
Scan 2	37,20	383
Scan 3	40,95	383
Scan 4	39,38	383
Scan 5	39,51	380
Scan 6	38,01	381
Scan 7	39,59	379
Scan 8	41,80	384
Scan 9	41,74	384
Scan 10	39,41	383
Scan 11	39,16	383
Scan 12	37,50	382



Sunscreen with silk



Sunscreen only

It was observed that the silk peptides have a strong protective property, especially in terms of UVA activity and it contributed to the increased homojenity of the formulation. UVA radiation is the main cocomitant cause of skin photosensitization and phototoxicity, whereas, UVB radiation has been known for immediate and evident skin damages. Therefore, besides all these benefits of silk peptides in moisturizing cosmetics, it can also be used as a UV protectant.

5. References

American academy of dermatology association, www.aad.org

Aramwit, P; (2015). In: Wound Healing, Biomaterials For Wound-Healing Applications, Editor: Lacie E. Wade Nova Science Publishers, Inc. Chapter 4, pages 49-104, ISBN: 978-1-63463-455-7

Commission recommendations of 22 September 2006 on the efficacy of sunscreen products and the claims made relating thereto (2006/647/EC). Official Journal of the European Union. 26.9.2006.265/39-265/43.

Latha M.S. and Bangera S.; (2013) Sunscreen agents: review JCAD journal of clinical and aesthetic dermatology.

Lionetti, N and Rigano, L; (2017). The New Sunscreens among Formulation Strategy, Stability Issues, Changing Norms, Safety and Efficacy Evaluations , 16 May

Svobodová A. and Vostálová J.; (2010). Solar radiation induced skin damage: review of protective and preventive options, Inernational journal of radiation Biology, December

Wang SQ, Setlow R, et al. Ultraviolet A and melanoma: a review. J Am Acad Dermatol. 2001:837–846.

Chemical Characterizationof Two Local Lınes of *Cannabis sativa* L. Under Warm Temperate Climatic Condıtıons of Ankara

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Abstract: *Cannabis* (*Cannabis sativa* L.) plants are grown since millions of years as they have wide adaptability to grow on all types of soils subject to availability of appropriate sunlight, temperature and humidity. They are primarily grown to obtain cannabinoids (terpenophenolics) for medicinal purposes. They are also used to obtain fibers for their use in textile industry. Turkey has seven major geographic regions; where, *Cannabis* can be grown economically under natural conditions. It has very light seed that can be easily carried to other places by wind, bird droppings, and insects and by attaching to animal bodies. There are very meagre studies on chemical and morphological characterization for better use in industry; therefore, it is desired to select and breed appropriate *Cannabis* lines and varieties for larger use. This study aimed chemical characterization of compounds found in essential oils of 2 local *Cannabis* lines namely Uşak and Kastamonu at three harvesting times using HPLC to find their stability. In total, more than 30 compounds were identified. The analysis further revealed that mean of two lines for α-Pinene, β-pinene, β-myrcene and β-caryophyllene were 1083.2 µg/g & 112.3 µg/g; 57.03 µg/g & 52.5 µg/g; 1085.2 µg/g &1064.1 µg/g and 30.64 µg/g &
22.3 µg/g respectively.

Keywords: Aromatic, Central Anatolia, Essential Oil Components, HPLC, Terpeniccompounds

1. Introduction

Cannabis (*Cannabis* sativa L.) family Cannabaceae is an annual, semi-herbaceous, upright, dioiceous plant species of summer and 1-5 m long plant species. Branching in the plant takes place in the middle or upper part of the stem. Leaves are fragmented, dark green with long stems, the lower parts are opposite and the upper parts are alternate. Flowers are found separately in male and female plants and the seeds, fiber, leaves and flowers of the plant are utilized (Arslan, 2018). The seeds contain 25-30% fat, 20-25% protein, 20-30% carbohydrates, vitamins and minerals. On the other hand, the stems contain 18-25% fiber and they are reported to be more resistant compared to cotton and linen fibers (Small and Marcus, 2002). Additionally, cannabidiods occur as main component in essential oils of flowers and leaves. *Cannabis* essential oil has more than 30 essential oil components, of which the main components are α- and β-pinene, β-myrcene andβ-caryophyllene.

Cannabis flora is seen in Istanbul, Tekirdag, Canakkale, Kirklareli and Burdur. The cultivation of the plant is currently permitted in 19 provinces. In our country, *Cannabis* cultivation is under state control and there is no restriction on the purchase and sale of seeds and cultivation is never banned. However, the production of *Cannabis* has decreased significantly as a result of some legal procedures in order to prevent misuse, under the cover of use in medicine as drug (Arslan, 2018). There has been progress in the field and laboratory studies realized with official support in recent years. There is no comprehensive information about the essential oil componenets of *Cannabis* in Turkey. Therefore, this study aimed to determine the essential oil components of two *Cannabis* lines of Turkishorigin.

2. Materials And Methods

This experiment was conducted in the experimental fields of the Department of Field Crops, Faculty of Agriculture, Ankara University. The experimental field lied at altitude of 860 m above sea level between 39°57’ north latitude and 32°52’ east longitude. According to the long- term average climate data of Ankara; total precipitation was 416 mm, average temperature was 12°C and relative humidity was recorded as 60.7%. In the experiment, 2 *Cannabis* lines were grown. The seeds were sown in 3 rows on 06.05.2019 in an area of 8,10 m² with 3 replications, with each row of 30 cm in length and row to row distance of 20 cm and plant to plant distance of 5 cm.

Nitrogen and phosphorus (8 kg) and potassium (4 kg) were applied to the soil at the time of seed sowing. Nitrogen fertilization was divided into two and the second application was applied to the plants in the period of stalk formation (Bennett et al., 2006; Small and Marcus, 2002).

Water stress in *Cannabis* affects negatively on fiber and seed yield. Insufficient precipitation may also affect growth and development of plants (Struik et al., 2000; Mert, 2009). Irrigation was done at the time of seed sowing, stalking, beginning of flowering and flowering period. Irrigation water analysis showed 0.6 mg / L chlorine, electrical conductivity of 24.6 mS/m (25°C) , <0.06 mg / L ammonium, <0.006 mg / L nitrite, 29 mg / L sulfate, <5 µg / L iron, and 71µg / L aluminum.

The samples were taken at flowering time using mixed flower and leaf samples earlier in the morning on 04.09.2019 at 06:00 h. Thereafter, study determined and compared chemical compounds of the *Cannabis* lines Uşak and Kastamonu using HPLC by taking the ethanl extracts samples from female plants.

The samples were dried in cool and shade (24º ± 1ºC). An analysis and comparison of the components of the two ecotypes showed that the quantities of all four components of Uşak ecotype were comparatively higher compared to their quantities in Kastamonu ecotype. The data obtained from the study were averaged using the M-STAT-C package program and are shown ing Table 1.

3. Results

Pinene ($C_{10}H_{16,}$ Figure 1, Figure 2) is a bicyclic monoterpene chemical compound. There are two structural isomers of pinene. It is not very effective by itself, but it is good for inflammatory diseases such as colds. Boiling point is 155 to 156°C, molar mass is 136.23 g/mol and density is 0.86 $g.cm^{-3}$. The structural formulae of two isomers of pinenes as specified by IUPAC are given below as α (Figure 1) and β pinene (Figure 2).

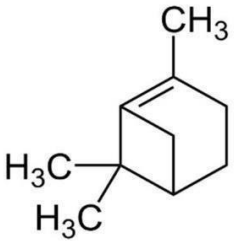

Figure1. 2,6,6-trimethylbicyclo [3.1.1] hepta-2-ene

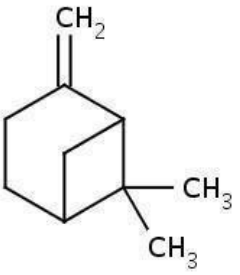

Figure 2. 6,6-dimethyl-2-methylidenebicyclo [3.1.1] heptane

α-Pinene was determined as 112.3 µg/g in Katamonu and 1083.2 µg/g in Uşak ecotype. Whereas, β-pinene was determined as 52.5 µg.g^{-1} in Katamonu and 57.03 µg.g^{-1} in Uşak ecotype. Comparing quantites of α-pinene and β-pinene, their quntities varied significantly. The quantity of α-pinene was approximately 20 folds higher inUşak ecotype and 2 folds higher in Kastamonu ecotype.

β-myrcene ($C_{10}H_{16,}$ Figure 3) is an olefinic natural organic hydrocarbon. It is more precisely classified as a monoterpene. Boiling point is 166 to 168°C, molar mass is 136.23 g/mol and density is 794 kg/m³. The name of β-myrcene IUPAC is given below as molecular structure. β- myrcene was determined as 1064.1 µg/g in Katamonu and 1085.2 µg/g in Uşak ecotype.

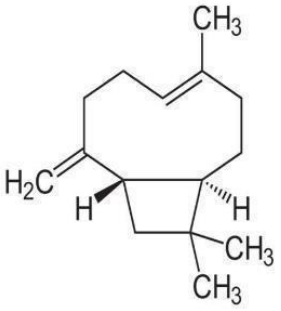

Figure3. 4, 11,11-trimethyl-8-methylidenebicyclo [7.2.0] undec-4-ene

β-caryophyllene ($C_{15}H_{24,}$ Figure 4) gives C. Sativa its smell Humulene. It is also known as α-humulene. Boiling point is 106°C, molar mass is 204.35 g.mol^{-1}, density is 886 kg.m^{-3}. β-caryophyllene was determined as 22.3 µg/g in Katamonu and 30.64 µg/g in Uşakecotype.

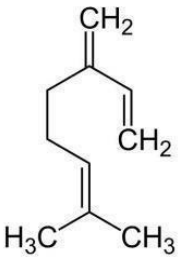

Figure4. Methyl-3-methyleneocta-1,6-diene 7-Methyl-3-methylene-1,6-octadiene

Table 1. Some chemical compounds of C. Sativa from Uşak and Kastamonu lines in Turkey

Substance	UŞAK (µg/g)	KASTAMONU (µg/g)
α-Pinene	1083.2	112.3
β-pinene	57.03	52.5
β-myrcene	1085.2	1064.1
β-caryophyllene	30.64	22.3

4. Discussion

The results are in agreement with Iseppi et al., (2019) has also confirmed presence of these components in fibre type *Cannabis* in France.

5. Conclusion

This is the first report of chemical composition of *Cannabis* in growing Central Anatolia. The results show potential of two local ecotypes towards their utilization in pharmacetical and fiber industry. There is need to analyze more ecotypes and breed them for their positive utlization in these industries under strict control of the government.

6. References

Arslan, 1999. Uyuşturucu kaynağı olarak kenevir ve kenevir preparatları, bunların kullanımı ve etkileri. Kenevir ekimi ve esrar seminerleri, T.C. İçişleri Bakanlığı Jandarma Genel Komutanlığı, Ankara.

Bennett, S.J., Snell, R., Wright, D. 2006. Effect of varity, seed rate and time of cutting of fibre yield of dew-retted *Cannabis*. İndustrial Crops and Products, 24: 79—86.

Iseppi R, Brighenti V, Licata M, Lambertini A, Sabia C, Messi P, Pellati F, Benvenuti S. 2019. Chemical characherization and evaluation of the antibacterial activity of essential oils from Fibre type *Cannabis* sativa L: (Hemp) Molecules,24, 2302.

Mert, M. 2009. Lif Bitkileri. Nobel Yayın Dağıtım. S:166-184.

Small, E., and Marcus, D. 2000. *Cannabis*: germplasm trials in Canada. III: International Symposium Bioresource *Cannabis* Wolfsburg, Sept. 13-16, Germany.

Struik, P.C., Amaducci, S., Bullard, M.J., Stutterheim, N.C., Venturi, G., Cromack, H.T.M. 2000. Agronomy of fibre *Cannabis* (*Cannabis* sativa L.) in Europa. Industrial Crops and Products 26; 5-9.

Cultivation Opportunities for Medicinal and Aromatic Plants in Iğdır

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Abstract: Medicinal and Aromatic Plants which have medicinal importance and therapeutic properties have been used for thousands of years without losing their importance. Besides, spices, various herbal teas, plants used in perfumery, cosmetics, dyeing industry and similar fields, and even aromatherapy plants are also included in this group. In particular, the diversity of the uses of these plants accordingly diversifies the fields of science that examine them, as well as increasing the value of these plants and their active substances both in terms of utilization and economic benefits. Medicinal and Aromatic Plants are usually collected from nature. Abundant quality plants can only be obtained by growing them. There are different breeding techniques for each plant. The presence of effective substances reaches the highest level in certain phases of vegetation periods in various organs of plants. Fresh plants shouldbe dried and stored with the right techniques to be able to use drugs for different purposes. When compared in terms of plant geographical regions, Turkey's endemic plants are seen in the greatest number in regions of Mediterranean and Iran-Turan regions. In Igdir, there are families such as *Apiaceae* (Umbelliferae), *Asteraceae* (Compositae), *Fabaceae* (Leguminosae), *Lamiaceae* (Labiatae) and there are some species from various families such as *Achillea* spp., *Artemisia* spp, *Chenopodium*, *Salvia*, *Thymus*, *Ziziphora*, *Allium*, *Polygonum*, *Rumex*, *Rosa* and *Verbascum*. All these opportunities of Iğdır region should be benefited with the scientific examination of the plants, the protection of endemic plants, the cultivation of various important and economically valuable plants and their contribution to the national economy. In Iğdır, lavender, rosemary, and similar plants are being studied. Some parts of Iğdır are in good condition for soil fertility and low rainfall and irrigation problems can be an obstacle. In these places, plants that do not need much water can be activated. In some regions, Medicinal and Aromatic Plants can be used as alternative plants. As these plants are perennial, the inconveniences of annual planting are eliminated. After conducting soil analyses in and around Igdir, suitable ones among these plants can be chosen to grow in theregion.

For example, if the cultivation of flowering plants such as Lavender or red rose is chosen in a suitable village, ecotourism can be revived there. Especially the rose which is located in the western part of Iğdır and in the villages close to the Armenian border, to cultivate and even to obtain essential oil from it, can contribute to the local population and Iğdır economically. Even if the agricultural lands of Iğdır are not sufficient, Medicinal and Aromatic Plants can be evaluated at least in the domestic market. When all the problems and possibilities examined for Iğdır province are evaluated; firstly, irrigation and salinity problems should be solved and soil improvement applications should be done. Besides, soil analyses should be carried out first in a field, followed by the arrangements for irrigation facilities and a plant growing plan should be made accordingly. In Iğdır, the cultivation of these plants, which are scientifically important and economically valuable, should be supported and facilitated. Economic development should be provided in the province, and there should be efforts to increase domestic and foreign demand. The government supports some producers in various fields. It is desirable that these supports increase in the fields of Medicinal and Aromatic Plants and that supports andprojects can be sustainable since it is absolutely necessary to continue to cultivate these valuable plants that are cultivated not only in Igdir but also in our country and even in the whole world. However, while cultivating these plants and also in examining and using these plants in different areas in various respects, only those who are specialized in their field should be resorted.

Keywords: Active substance, Cultivating, Medicinal and Aromatic Plants, Iğdır.

1.Introduction

Medicinal and Aromatic Plants which have medicinal importance and therapeutic properties have been used for thousands of years without losing their importance. Not only are they known as medicinal valued plants, but also some spices, various herbal teas and some plants used in perfumery, cosmetics, paint industries and similar fields, and even used in aromatherapy arein this group. The valuable active substances contained in these plants are used in various fields of medicine and drug content. In fact, thanks to the presence of these active substances have diversified the fields of science examining them. Therefore, the economic value of these kind of plants have been increasing continuously.

Medicinal and Aromatic Plants are usually obtained from nature by collecting. It should not be forgotten that; good quality, abundant plants can only be obtained by growing them. There are different breeding techniques suitable for each plant. According to the presence of effective substances, ıt reaches the highest level in certain periods of vegetation terms in various organs of plants such as flowers, leaves, seeds, bark, root. Fresh plants should be dried and stored with the right techniques to be able to get plants drugs for different purposes.

The fact that it is located in the Iran-Turanian transition region which ranks second after the Mediterranean in terms of number of species and varieties and has microclimate characteristics has enabled a rich flora to exist in Igdir. In addition, endemism is mostly concentrated in the mountainous areas (Şehirali ve Özgen, 2012). In Igdir, there are families such as Apiaceae (Umbelliferae), Asteraceae (Compositae), Fabaceae (Leguminosae), Lamiaceae (Labiatae) and there are some species from various families such as *Achillea* spp., *Artemisia* spp, *Chenopodium*, *Salvia*, *Thymus*, *Ziziphora*, *Allium*, *Polygonum*, *Rumex*, *Rosa*, and *Verbascum* (Altundağ, 2010).

All these opportunities of Iğdır region should be benefited from the scientific examination of the plants, the protection of endemic plants, the cultivation of various important and economically valuable plants and their contribution to the national economy.

1.1.Structure and Use Status of Agricultural Areas in IğdırProvince

According to the data of Iğdır Provincial Directorate of Food, Agriculture and Livestock (December 2011), the area of agricultural lands in the province constitutes 33% of the total

area. In addition, although 97,041 ha (81%) of agricultural land is irrigable, 81,719 ha (69%) of this land is currently being irrigated. Forest area is 1%, meadow - pasture is 41%, unused area and settlement area is 25%. Grain production is 15.5%, forage crops production is 25% and industrial plants production is 16.9% of the region's production (Tutar et al.,2013).

Iğdır is the most important production center of its region due to its favorable climate in fruit and vegetable growing. Apple, apricot and peach share the first three in fruit production. Because of the wrong irrigation practices such as keel irrigation and old irrigation networks cause excessive water consumption in agriculture, this brings various problems. The most important obstacle in solving these problems is waiting for completion of the studies related to consolidation.

Iğdır Plain is in semi-arid climate zone and 1/3 of total usable areas are affected by salinization. Since the need for nutrients increases day by day, it is absolutely necessary to reclaim the saline land and to use it more efficiently. Various bio-improvement studies should be carried out for the improvement of barren soils. Forage crops with high tolerance to salt pick up the salts in the soil and accumulate in their leaves and tame the soil (Temel & Şimşek, 2011). The best cultural process to prevent soil salinity is the alternating planting method. The climatic prolongation of the plant growth period makes it easier to evaluate the Igdir Plain as a region suitable for this system. According to KHGM, 1998 data of soil characteristics and salinity of Iğdır province, a large part of the province of Igdir is stony Aralık Region is generally the part where saline soils are needed primarily for improvement. Especially Karakoyunlu and Tuzluca sides are in good condition in terms of soil fertility (Karaoglu & Yalçın,2018).

1.2. Irrigation Status of Agricultural Areas in Iğdır Province

Serdarabad Dam was established with the agreement with the Soviets in the early years of the republic regarding the irrigation of Iğdır Plain (Başkaya, 2012). If we look at irrigation opportunities in Iğdır in recent years; Ipek (2015) conducted a research on the determination of irrigation habits of farmers, the solution of HEPP (hydroelectric power plants), network operation and general problems. While Aras reported that irrigated farming could be done thanks to the large pit extending from Khorasan to Nakhchivan. In our country, the East Iğdır (Aralık Irrigation Union) and West Iğdır (Green Iğdır Irrigation Union) are divided into irrigation, Iğdır 70530 ha irrigation area and the entire irrigation network is stated to be around

4000 km. According to the research final report; Iğdır Plain is very hot and dry due to the problem that no revision and renewal has been made to the channels and water cannot be transmitted instantly between the unions. In addition, it is stated that the problems such as insufficient number of flow observation stations used in determination of water amounts, not being installed in appropriate sections and not obtaining healthy data are important problems.

It has been reported that farmers do not want to be subject to control and inspection rules such as tertiary channel alternation system due to excessive and uncontrolled water use, that water distribution in the irrigation network is not at a fair, therefore, it was reported that the satisfaction of the farmer with the service provided was at minimum. In addition, the Directorate of Agriculture and Forestry, some plants are given incentive premiums and these plants because of the high consumption of water in the wide variety of plants in the plain, 2 or 3 plant species that are highly inconvenient to the dominant state of the problem is directed towards a single diversity.

1.3. Cultivation Opportunities for Medicinal and Aromatic Plants in Iğdır

If we look at the livelihoods of the people of Iğdır region in terms of agriculture, they generally earn income from animal production and a little income from apiculture. Besides, fruits such as apples, apricots are cultivated. Also, field crops such as wheat, corn as well as apples, apricots are cultivated as fruit. In addition, walnuts, plums, mulberries, pears, grapes, cherries and sour cherries are also grown.

However, since Iğdır province and its environs have microclimate, it shows that Medical and Aromatic Plant cultivation is suitable in here. However, parts of the area with low rainfall and lack of irrigation can be an obstacle. In these places, plants that do not need much water can be activated. Various herbs are also used in Iğdır, especially in meals orethnobotany.

Although the number of herbalist is not very much, because of the importance of spices among the public, the products they sell in general seem to be rich and high qualified.
Plant or drugs in Herbalist are obtained by collecting or growing plants from India, Pakistan, Iran and also different cities of Turkey. In Figure 1., the images of some herbalists in Iğdır are presented.

Figure 1. The images of some herbalists in Iğdır

In Iğdır, studies have been conducted with plants such as lavender, rosemary, rose "Kızılgül" which are the subject of even local folk songs (Figure 2). Besides, for the scientific experiment in villages local people first gave opportunity for the work then, although the necessary expenses, including the workers, were met by myself, they can no longer provide time and opportunity for this. The reasons for these can be thought to arise from the fact that they have the idea of earning income from existing fruit trees or viticulture in special regions and to continue animal production.

Certainly, the continuation of the studies in these areas is positive for both the local people and the national economy. However, it is obvious that Medicinal and Aromatic Plants are economically important. In addition, as mentioned earlier, in cases of rainfall shortage, due to various problems related to irrigation, irrigation in some places is not enough and in some cases, excessive irrigation due to lack of knowledge can be done.

Wheat and corn are grown from industrial plants in Igdir. It is not right to constantly grow the same plants in the same soil. For this reason, Therefore, rotation of planting is required.

In addition to forage crops, Medicinal and Aromatic Plants should be used as an alternative plant in some regions.

For example, thyme can be grown. Because thyme produced can contribute to export. However, since the farmland of Iğdır is not very sufficient, so, both thyme and thyme oil, which are harvested every year can be sold in the domestic market. In addition, the remaining part of the oregano after harvest can be added to the animal feed, to increase the meat quality.

Thyme from medicinal and aromatic plants, likes light loam, clayey and calcareous soils and is resistant to drought. Some of the lavender species are not very resistant to cold, the presence of moisture in the depth of the soil should be found. Although it is not selective in terms of soil, it wants dry, light and lime-rich soils. These and similar plants in Iğdır and around the appropriate plants after the soil analysis can be grown. Especially if flowering plants like Lavender, roses and so on are chosen in a suitable village. Ecotourism can be revived there. The locals, especially in the western part of Igdir, are located in the villages close to the Armenian border. The local people benefit from the existing rose, in jam making.

Cultivation of roses in the same places, even obtaining essential oil, economically for local people and Iğdır. Cultivation of rose in the same places and even obtaining essential oil can provide economic positive results for local people and Iğdır.

Figure 2. Some views from the studies on medicinal and aromatic plants in Iğdır.

2. Result

When all the problems and possibilities examined for Iğdır province are evaluated; first of all, the completion of the studies related to the consolidation and all the works related to irrigation

networks should be carried out in detail, irrigation channels should be renewed, digital monitoring stations to be increased numerical and regulated, the training and awareness-raising of the farmers on these and other issues, are urgent processes. In addition, salinity can be removed, soil improvement works should be done, drainage systems should beregulated.

Before sowing and planting, soil analysis should be done, irrigation facilities should be adjusted and a plan should be grown according to this. In all agriculture operations, especially corn and wheat planted places, alternate sowing should be applied. If corn and wheat are to be grown, the places where they are located should be changed. Depending on the village, soil and watering status, it is considered appropriate to grow plants by selecting plants from Legume Forage Plants and Medicinal and Aromatic Plants groups.

Even if the agricultural lands of Iğdır are not sufficient, Medicinal and Aromatic Plants can be evaluated at least in the domestic market. For example, the herbalists in the province can buy these valuable plants grown in the province from the farmers instead of bringing the products from other places. Both the different organs of the plants such as leaves, flowers, roots as well as the essential oils of plants containing essential oil can be utilized and income can be obtained. The geographical and climatic structure of Igdir should be evaluated with the ability to cultivate these scientifically important and economically valuable plants and contribute to the national economy. While doing this, it is necessary to benefit from the scientists who are specialized in their fields and to provide support and convenience in this matter.

In Turkey, some producers are supported in various fields. It is a desirable situation that these supports increase in the fields of Medicinal and Aromatic Plants and that support and projects can be sustainable. Because it is absolutely necessary to continue to cultivate these valuable plants that are cultivated not only in Igdir but also in our country and even in the whole world. However, these plants should be examined in different fields by only people who are trained in the field. Especially those with therapeutic properties and medicinal plants can be examined, researched and used in treatment only by experts in the fields of medicine and pharmacy for the treatment.

3.References

Altundağ, E. (2010). Iğdır'ın Faydalı ve Zehirli Bitkileri. Iğdır, Turkey. TC. Iğdır İl Özel İdaresi, Iğdır Valiliği, 187 pp.

Başkaya, M. (2013). In C. Atlı (Eds.), "Cumhuriyet'in İlk Yıllarında Iğdır'da Pamuk Ziraatı ve Serdarabat Barajı Meselesi" (pp. 697-717). Iğdır, Turkey, I. Uluslararası Iğdır Sempozyumu, Sosyal Bilimler Bildiri Kitabı (19-21 Nisan 2012-Iğdır). 739 pp.

Baytop, T. (1999). Türkiye'de Bitkiler ile Tedavi. İstanbul, Turkey, Nobel Tıp Kitapevleri LTD ŞTİ, 2.Baskı:1984, ISBN: 975-420-021-1, 480 pp.

Ceylan, A. (1995). Tıbbi Bitkiler I. E.Ü. Ziraat Fakültesi Yayınları, (312), III. Basım, Bornova, İzmir, Turkey, ISBN : 975-483-274-9, 140 pp.

İpek, Ş.İ. (2015). Yeşil Iğdır Sulama Birliği Arazilerinde Genel Sulama Problemlerinin Belirlenmesi ve Çözümü İmkanları Üzerine Bir Araştırma (Report No.2014-FBE-BO4). Iğdır, Turkey, Iğdır Üniversitesi Bilimsel Araştırma Projeleri Kesin Raporu, 21.4.2015. 24pp.

Seçmen, Ö. (2008). Türkiye Florası (Ders Notları). Bornova, İzmir, Turkey, Fen Fak Baskı İşleri E. Ü. Fen Fak. Teks. Ser. No: 120, E. Ü. 47 pp.

Şehirali, S., & Özgen, M. 2012. Bitkisel Gen Kaynakları. Değiştirilmiş 2. Baskı.Ankara, Turkey, Ankara Üniversitesi Yayınları:357, Yayın No:557,Ders Kitabı:1605, Ankara, ISBN: 978-605-136-066-9, 245 pp.

Karaoğlu, M., & Yalçın, A.M. (2018). Toprak Tuzluluğu ve Iğdır Ovası Örneği. Derleme makalesi/Review article Journal of Agriculture, 1(1),27-41.

Temel, S., & Şimşek, U. (2011). Iğdır Ovası Toprakların Çoraklaşma Süreci ve Çözüm Önerileri, Alınteri, 21(B) – 2011, ISSN:1307-3311, 53-59.

Tutar, H., & Aydoğdu, B., & Elyıldırım, G., & Dik, M., & Sarışen, & M., & İnce, O.G. (2013). Iğdır'ın Sosyo-Ekonomik Durumu ve Uygun Yatırım Alanları In H. Tutar (Eds.) Tarım Arazileri ve Tarımsal Yapı (pp. 32-40). Iğdır, Turkey, T.C. Serhat Kalkınma Ajansı Iğdır Yatırım Destek Ofisi, 156 pp.

Local Products From Türkiye Roses (*Rosa* L. spp.) and Their Importances For Health

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Abstract: There is a well-established history of Turkish people to benefit from plants. Recently, some of these products have been brought to the industrial sector. Consumers prefer handmade products, along with a decrease in the cost of mass-produced products. In this presentation, names and brief introduction of the products produced from natural and old garden roses of Türkiye are being described. Important ones from these products are being named and described in the presentation.

The emphasis is on the names and health of roses products that are produced in our work.The works were done by classic methods. Plant materials generally collected from mountains in Lakes Region and in 2014-2017 years. Some specimen was collected from SDU. Botanical Garden (Isparta) and worked in Ecological Product Laboratuary of Science Faculty of SDU (Isparta).

For food purposes: Rose Syrup, Rose Melissa, Rose Circle, Güllaç, Rose Preserve, Rose Tea, Rosehip Tea, Rosehip Marble, Delight with Rose leaf;
For pharmaceutical purposes: Oily Organic Rose Water, Sega Oil;
For cosmetic purposes: Rose Water, Rose Cream, Rose Lotion, Rose Colony;
Raw materials: Rose Oil, Rose Concrete, Rose Absolute, Vax, Food coloring, Rose Powder;
For fertilizer purposes: Microbial Fertilizer, Worm fertilizer, Vermicompost;
Animal feed: Fish and bird forages;
Ornamental items: Pen/Pencil holders, Pencil stalk, Mouthpiece, Bag, Cane, Rosary prayer rug, Rose scented candle and **Chimney cleaner** etc. are described.

Key Words: *Rose products*, Organic products, Food, Medicine, Cosmetics.

1. Introduction

Roses are one of the most popular plant groups in the world. It is accepted as the queen of plants / flowers. They are grown for different purposes. Today, industrial rose production, and its production, trade and economy are done only in the Lake District (Özçelik & Korkmaz, 2015).

It was used rose pavilions in the palace of the Roman emperor Neron and the rose water (***Aqua Rosa***) does not allow the people to use. It is a sign that the Romans know and use the roses. Egyptian Princess (69-30 BC) she is known that Cleopatra lived in Hierapoliste (Pamukkale in Turkish) and used roses in her banyos or washed with rose waters. Former French commander Napoleon, Phrygian king Midas, and other some foreign statesmen have set up rose gardens and demanded that their wifes take care of the garden (Özçelik & Korkmaz, 2015; Baytop, 2001; Özçelik, 2015)**.** In Second Sultan Beyazit Darüşşifa in Edirne, it is known that psychiatric and neurological patients who were treated in the nightingale rose garden. The first method that comes to mind in the treatment of these types of mental disturbances, which are becoming increasingly dependent on the development of life conditions in the present time, is treated with roses. An aromatherapy type treatment with roses; music therapy (Turkish Sufi Music, listening to the Holy Quran, preaching, nightingale and other bird sounds), acapuncture and salt treatment methods These methods are the traditional treatment methods that the Turks have applied since the advent of Central Asia (Özçelik, 2015)**.**

In Lakes region, about 25 factories are produced every year and an average of 10-12 thousand tons of oil rose (*R. damascena*) flowers are process and up to 2 tons of rose oil. 2 tons of absolute and 5 tons of konkret are produced annually in 25 distillation and extraction factories in the region. It is estimated that an average of 300 tons of flowers are processed per day. In the factory conditions, 1 kg of rose oil (0.035% of average essential oil yield), 1 kg of konkret (average concretion yield 0.30%) with n-hexane extraction of 250-350 kg of fresh rose flower and 1 kg of konkretten with ethyl alcohol extraction, 0.5-0.6 kg absolute (mean absolute yield 55%) is obtained (Özçelik et al., 2014; Özçelik et al., 2009)**.** The quality of the flowers that first open and the flowers that open towards the end of the season are the difference between oil yield and composition (Kazaz, Baydar & Erbaş, 2009)**.** Sona falls in quality and yield. The same change is seen in the flower color. When the first flowers are dark pink, they turn to pale pink towards the end. A factory that processes rosehips (fruit roses) does not yet exist in Lakes Region. Gümüşhane, Tokat and İzmir have such factories. Rosehip products are largely handmade and expensive (Özçelik, 2015)**.**

2. Material and Methods

The works were done by classic methodes and collected knowledge from Lakes Region and in 2014-2017 years. Rose flower material was procured from SDU. Botanical Garden and the applications were carried out in Ecological Products Laboratory in the Biology Department of

SDU. Faculty of Science. When the facilities were inadequate, help was received from the industrial and other places.

The remaining pulp from distillation of rose flowers was separated into a liquid and a solid parts by a semi-processed raw material thought, the water was evaporated and solid and liquid food stains and extracts were obtained from the liquid body. The solid part is dried in industrial ovens and ground into small granular mills and turned into raw materials that can be used in food and cosmetics. Sprinkled flowers of some landscape roses were also converted into food coloring in the same way. The raw material, called paint, was tried not only in food but also in other areas.

Some experiments have been carried out through distillation. The flowers were distilled both classically and with new methods. The results were compared. In the new methods, the flowers were separated from the petals, distillation was carried out with the petals separated and the other separated. We got oiled rose waters. The pulp obtained from the distillation by the conventional method was distilled again. The products and pulp amounts obtained from all distillates were weighed. The solid and liquid parts of the posan were distinguished and chemical analyzes were carried out. The flowers were dried at different grades before distilling. Powdered. Additives for different food and cosmetic products have been added. Quality checks were done. Some plants were distilled not only from their flowers, but also from their fresh leaves. The shelf life of the obtained rose water was studied depending on the time.

The following types of classic roses oils and their production methods are described:

Liquid (thin) rose oil: Water vapor is based on condensation of distilled with boiling water.

Solid rose oil (konkret): An extract obtained as a result of treatment of rose flowers with crucifixion and flying of hexagons. Contains all volatile and non-volatile oil groups.

Absolute (Rose essence): Liquid rose oil is prepared by stirring at 10% or more. For example, 75 g of liquid rose oil and 675 g of migliol are mixed to make 10% absolute.

The products and preparation methods of rose in the region are as follows:

Gül mayası: Rose petals are scooped with sugar and placed in a cupola and stored until closed.

Rose oil from İmbik (Rose essence): The oil that accumulates on the water of rose flowers which are boiled in the last.

Aqua Rosa: After distilling the roses, 2 kinds of rose water are obtained. It is about to be greasy and oiled rose water.

Rose berry: Rose yeast is kneaded, it can stand for a long time. The sugar is boiled with water and added in a small amount from the yeast.

Other products have no standard definition. It's usually about domestic needs. It depends on the manufacturer and region. Other products, applications and materials are explained and discussed in the text.

3. Results and Discussion

3.1. Oil Roses: The roses in this group are predominantly based on ***R. damascena*** flowers. However, when it is said oil rose in Türkiye, ***R. sempervirens, R. versicolor, R. moschata, R. alba, R. gallica*** and ***R. centifolia*** is understandable. Only ***R. damascena*** is produced in the Lakes Region. Everyone in the area, roses, rose cream, rose syrup, roses, prayer rugs and so on. a rose product is absolutely found. Everyone in the Lakes Region, a rose product is absolutely found as dry rose, rose cream, rose syrup, prayer rugs with rose, and so on. It is known that rose scent strengthens memory, facilitates digestion, calms nerves, has antiseptic properties .... The pharmaceutical industry is a major raw material.

There is a well-established history of Turkish people to benefit from plants. Recently, some of these products have been brought to the industrial sector. Consumers prefer handmade products, along with a decrease in the cost of mass-produced products. Türkiye, which grows naturally grown garden roses or all of *Rosa* L. (roses). Their names and brief introduction of the products produced from rose taxa. From these products;

For food purposes: Rose Syrup, Rose Melissa, Rose Circle, Güllaç, Rose Preserve, Rose Teas, Rosehip Teas, Rosehip Marble, Rose Delight;

For pharmaceutical purposes: Oily Organic Rose Water, Sega Oil;

For cosmetic purposes: Rose Water (Aqua Rosa), Rose Cream, Rose Lotion, Rose Colony, rose shampoo, rose soap, rose spray;

Raw materials: Rose Oil, Rose Concrete, Rose Absolute, Vax, Food coloring, Rose Powder;

For fertilizer purposes: Microbial Fertilizer, Worm Gurage;

For animal feed: Fish and bird foods;

For ornamental items: Pen holder, pen stalk, mouthpiece, bag, cane, rosary prayer rug, rose scented candle and so on.

Product varieties: The main products developed from roses are on food and cosmetics. Isparta companies are prized up to 120 cosmetic products. Cream, lotion, cologne, rose water (oil rose water, synthetic rose water, rose essence etc.) .... Delight on food, ice cream, syrup, ice cream etc. In recent years, Turkish leafy rose delights have been kept very much and the maker's face laughed. The rose lokum (delight) was made with the broken rose petals at the beginning. Then, it has begun to be obtained with the rose powders recently obtained from us. While the price of

a normal locust is 15 TL, leafy rose delight is sold at least 50 TL. In our Ecological Products Laboratory in Süleyman Demirel University, we are continuing our efforts to obtain paint from rose and its pulp.

Rose ink-based paint production has often failed. However, the roses to be painted must have a darker color than a light color. Black roses are very important in this regard. If the paint and ink can be obtained from these roses, Holy Qur'an Kerim et al. it will surely be the reason for preference in writing the religious books without any doubt. Other rose sculptures will be sought after in religious motifs and can be used to write or multiply valuable religious and cultural artifacts. Such a cultural practice will undoubtedly be reflected in the economy. In addition, it will win prestige to my country, to the local and rose sector.

If rose oil can be transformed gradually over time, or when aromatherapy is available, it means that the rose has come to the point it deserves. Thus, the face of the sector will be economically cheerful. It is known that the "**Sega Oil**" obtained by fermenting some of the roses in the past is an elixir used for every kind of disease in every home.

Dye obtained from rose pulp and flowers was tested in food and textile products. It has done well in food products. The situation is not exactly successful. However, weaving (cotton, silk and fiber) products are not very high quality, most of them were woven cloth weaving. Work on ink usage and other areas is ongoing. Our experiments with ink failed. In this regard too…

In our experiments on the use of liquid repellent as an insecticide, contrary to our aim, the beetles came to the plant and caused the roses to become more ill. However, it was concluded that spraying other honey plants (such as sunflower) could increase honey production. It has been seen that the quality of a rose roast can be higher than that of the wormpaste production experiments. However, it was suggested that manura should not be preferred commercially because of its low economic value. A company manufactures microbial fertilizers and evaluates them on rose fields. If present, the oil can be used as a fuel in the form of bellets or as a cleaner in the vicinity of the chimney.

Effects for health of rose products: Smell of rose has a calming and memory strengthening effect. The smell of rose strengthens the memory, relaxes the person, calms them. It increases sexual power. It prevents the formation of various important diseases (such as malignant tumors). It is known that all fragrant roses are of medical value. Important statesmen have set up rose gardens for this purpose, especially for their wives. People like jams, rose water, rose petals, rose syrup are also from these roses. Their dry flowers and vocals smell their houses.

True rose water (oily, natural) is a good disinfectant. It is good for sore throat, tooth wounds, rheumatism pain (bactericidal, antimicrobial) etc. (Özçelik, 2015). It is a good tonic (skin cleaner). It is a powerful fever reducer. Because it is oily, it evaporates and cools the area where it evaporates. From our organic oily rose water, we used modern physicians in dental surgery and tested; it as an antiseptic. Organic oily rose water is also used by us in the gout and gingivitis.

Organic oily rose water produced by us and even rose water obtained from the 2nd distillation from the pulp, sniffs the experimental animals (rats), adds them to their feed, etc. . Nearly all of the animals with cancer were treated (Ogut et al., 2015). This suggests that organic rose water is an important anticancer agent.

3.2. *Fruit Roses (Rosehips):* Most of the roses in this group grow wild in the mountains. When the fruit is ripe, it is collected and processed. Important species in this rose group; ***R. dumalis, R. canina, R. beggeriana, R. alba, R. noisettiana, R. pulverulenta, R. pisiformis*** and like (Özçelik et al., 2011).

Usage in the industry of fruit roses (rosehips): Rosehips, rich in many organic substances, vitamins and minerals, are an important raw material of the pharmaceutical industry (Razungles, Oszmianski & Sapis, 1989). Paints and tannins obtained from roots, stems, leaves and flowers especially petals of rosehip plants are used as a sepia material in paint industry (Tipi, 1996; Akyüz, Coşkun & Bakırcı, 1996).

Use in Food of fruit roses (rosehips): Natural antioxidants that are beneficial to human health are also rich and become an important fruit by consumers. It is used for making marmalade, pulp, jam, fruit juice, fruit tea, baby food. Vitamin C obtained from rosehip fruit is used as a natural additive in the enrichment of fruit and vegetable juices (Tipi, 1996). According to Kostic (1994); the absence of pesticides and heavy metals (Arsenic, Cadmium, Lead and Mercury etc.) harmful to human health in the rosehip juice makes it a safe baby food feature (Akyüz, Coşkun & Bakırcı, 1996). It is known that heavy metals taken with food nowadays cause many serious diseases. User, (1967) notes that the rosehip soup is famous in Switzerland (Keleş & Kökosmanlı, 1996). Although there is no soup in Türkiye; marmalade, syrup, cola, tea, food etc. are produced in the country. Our studies on rosehip juice and pest production continue.

Using in cosmetics and treatment of fruit roses (rosehips): The tea (infusion) of rosehip fruit, the drinking of the liquid extract obtained by distillation increases the body resistance against colds, flu and fever. It also has an effective blood purifier and intestinal softener. It is used in the treatment of diseases such as rickets, rheumatism, hemorrhoids. It has been reported in many countries that it is used against people such as diabetes, stomach ailments, kidney disorders, gingival hemorrhage. It was also used in the treatment of scorpion disease in the olden times (Baytop, 2001). In recent years, the seeds have been beaten and mush. This porridge was wrapped around the joints of the knee and was clearly beneficial to joint rheumatism.

Rosehip seeds contain highly unsaturated fatty acids: This has also been shown to lower plasma cholesterol and triglyceride ratios significantly compared to control in rats fed with rosehip seed, thus raising the possibility that rosehip seeds can be used in dietary human food.
It has been determined that fruit seeds contain omega-3 fatty acids. Fatty acids such as omega-3 are used in the cosmetic industry for the health benefits of rosehips because of their age-retarding and life-sustaining effects. The oleic, linoleic and linolenic acids, single, double and triple unsaturated fatty acids contained in the fruit core are used in the cosmetic industry as an extension of the life span and anti-aging (Kazaz, Baydar & Erbaş, 2009). Rosehip carotenoids are predominantly beta carotene and have an important place in the diet as provitamin and antioxidant (Yılmaz, Bulut & Kelkit, 1996; Çınar, Çolakoğlu & Alma, 2004).

Chemical Compositions of Rosehips and Their Importances for Health: The amount of vitamin C of rosehips in Türkiye is higher than the world in general. Vitamin C was highest in the first year (13276 mg / g) in sample 13276; in the second year 730 numbered sample, 11104.88 (mg / g) appeared. Gallic acid and caffeic acid were the phenolic compounds of the first year in all samples examined; 2nd year chlorogenic acid could not be detected; whereas gallic acid and caffeic acid were detected for 2 years. The % fat content in the kernel was highest in the first year (502.7%) and lowest in the 1733 (16.16%) samples. The second year was the highest in sample numbered 1274 (13.66%) and the lowest in sample number 502 (8.22%). *R. dumalis* is a more important and wild species than *R. canina* in terms of fruit rose. This species is endemic to the Türkiye. Its fruit analysis is also very important (Özçelik et al., 2014).
Alternative methods should be sought instead of water vapor distillation in the presence of Gülyağı. Prior to exposure to heat, the oil-level methods should be emphasized.

Some field crops can increase pollination if the fields are close to the rose horses. Moreover, if these plants are fragrant, beekeeping in the immediate vicinity may become very efficient.

New uses of rose oil and rose water should be sought. For example, can you put rose oil or water in a freezer?

4. Conclusion

The "carotenoid form" of vitamin A is more anti-oxidant20 and anti-inflammatory. In the absence of vision disorders, eye inflammations, skin incontinence, respiratory and urinary tract infections, etc. visible. A group of nutrients most commonly found in vitamin A is bird flu. The fixed oil in the rosehip seeds is around 8% in general and is very valuable in cosmetics. It is a very important raw material of anti-aging creams. It is very important to remove the wrinkles around the eyes. For this reason it is a very expensive raw material. It is a very important raw material for cosmetic companies. However, the production can be done with cold pressing, which leads to product loss. Produced oil is very low in 8%.

The color of rose oil distilled from petal leaves is light yellow. The color of rose oil distilled from other flower parts outside the petals is a blue color that plays green. The petal of flower oil is not azulene (an organic substance which is isomeric of naphthalene and gives a dark blue color), which is not found azulene in petal volatile oil; it (azulene) is reported that 1.6 % in volatile oil of other parts of flowers except for petal (Kazaz, Baydar & Erbaş, 2009; Gül et al., 2015)**.** If rose oil is seen for a certain period of time in the colors that play with greenery due to azulen existence, the colors first turn into open green and then into light yellow due to the disintegration of azulene.

Important drugs are being produced from ***R. damascena***, which we call Gülo Mohammadi (we call Isparta rose to it).

Şam Gülü, Katmer Gül or Bülbülevi: During the Ottoman period, Burdur was raised to obtain rose oil in the villages. It was abandoned because of the pungent smell of the oil. It is still rarely seen in the region. According to the given tariff, this type is estimated as ***R. damascena*** (Baytop, 2001)**.** To us, this kind of ***R. sempervirens*** should be. It has been determined that this crop is only produced for the purpose of oiling in Aksu, Yakaavashar town. The flowers of ***R. semperflorens*** are bigger, more fragrant, so it is more important in making jams, rose water, tea, dry rose and vinegar. It is also a priority in achieving food coloring. 300-350 kg from flowers of ***R. damascena*** can be produced 1 kg concrete; 1 kg konkret can be produced from150 kg from ***R. semperflorens*** flowers. Here we have at least 150 kilograms of flowers. It is a species that reduces the cost at least by half. It should not be ignored.

This type was previously a subset of *R. damascena*. The "Rose of the Prophet" on the Sivas side, the rose called "Güla-Muhammedi" on the side of Şanlıurfa, Mardin, is this kind. Gülo-Muhammedi name is often used by the people of Iran. It is probably Iranian origin that people in our eastern regions use this name. Tokat, Sivas people uses a similar name "Prophet's Smell". It is suggested to be preferred in the production of confectionery, especially the preservation of roses and the preparation of rose water, jam and especially leafy rose delight.

Here are some suggestions for flower processing: For this reason, the collected material contains pedicel, receptacles, seals, petals, stamens and female organs of flowers. If the most and highest quality oil is found in the petals (no methyl compound), the quality can be improved by taking only petals in total. The petals must also be collected separately, even in other parts. Even fresh stem leaves can be placed in the part collected without petals. In this case, **3 classes of rose oil will be obtained:**

Extra oil and oily rose water obtained from petals,

Classic oil and rose water obtained from whole flower in this day's form and

Oil and rose water obtained from other parts except petals it will be 2nd class.

In 2017 year, distillation was carried out oil production by distillation of water from both organic rose flowers and conventional rose flowers. The obtained oily rose waters are analyzed in SDU Experimental and Observational Research Laboratory. According to the results of the analysis the amount of methyl eugenol was 0.0% in organic rose oil, and 4.5% in conventional rose oil. It is understood by sensory analysis that the roses produced by conventional agriculture are more fragrant than the organic rose water. This suggests that the amount of phenyl ethyl alcohol is more synthesized in the rose flowers produced in conventional agriculture.

In rosehips is rich vitamin C content, the brightly colored fruity, which is also known as **'fukara orange'** among the people in Anatolia, reaches a full extent and contains more vitamin C than ripe and dark colored fruits Apart from macro-nutrients, phytochemicals, organic acids and plant-derived natural compounds have recently been recognized. Phytochemicals have been found to have the antioxidant property of free radicals, which makes the molecules attacking the cells in our body harmless(Pawlosky, Ward & Salem, 1996; Keleş & Kökosmanlı, 1996)**.** Rosehip is a fruit that is popular with consumers in recent years because of its natural antioxidants that are beneficial to human health; it has also become an important contribution to industrialists (Simopoulos & Salem, 1996).

Vitamin C is used as an additive in many foods due to its natural antioxidant as well as being an important component in terms of nutrition. Thus increasing the quality and technological properties of foods (Salminen et al., 2005; Hertog et al., 1993). Rosehip fruit is a powerful

antioxidant source because it contains phenolic substances such as vitamins C and E, carotenoids, flavonoids, glycosides and proanthocyanins (Razungles,Oszmianski & Sapis, 1989; Gül et al., 2015). The reason for its use in the food and drug industry is also due to its rich content. Vitamin C is associated with a protective relationship between food borne and uterine cancer (Hertog, Hollman & Van de Putte, 1993).

The content of tocopherol (µg / g) is an important compound in determining the quality of rosehip fruits. It is an important group of compounds for human and animal health and is important for reproduction. The content of tocopherols (µg / g) of rosehip seeds was investigated by us and α, β, γ and δ tocopherols were determined in all samples. Study; γ tocopherol as the major component, and α tocopherol as the second major component. In our work; in the first year, gamma (γ) tocopherol was found most commonly followed by alpha α tocopherol, delta δ tocopherol and beta β tocopherol. In the second year, α-tocopherol was the most common, followed by γ, δ and β tocopherol in the rosehip samples (Özçelik, 2009).

Content of phenolic substance in fruit meat; gallic acid, catechin, crojenic acid, caffeic acid and apigenin 7-O-glucoside were detected in the birds and gallic acid was detected as the main component in all species.

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5. References

Özçelik, H., Korkmaz, M. (2015). Çeşitli Yönleriyle Türkiye Gülleri, SDU Journal of Science (E-Journal), 10 (2): 1-26.

Baytop, T. (2001). Türkiye'de Eski Bahçe Gülleri. T.C. Kültür Bakanlığı Yayınları, Yayın No, 2593, Sistem Ofset Basım Yayın Sanayi Ticaret Ltd. Şti. Ankara, 149 p.

Özçelik, H. (2015). Ekonomik Botanik Ders Notları (elektronik versiyon), SDÜ. Fen-Edb. Fak., Biyoloji Bölümü, Isparta.

Özçelik, H., Sadıç, O., Ekici, L., Karakurt, H., Oğraş, T., Yıldırım, B., Özçelik, Ş., Koca, A. (2014). Ülkemizde Yetişen Bazı Gül Çeşitliliğinin Peyzaj ve Endüstriyel Amaçlı(Tıp, Kozmetik ve Gıda Sektöründe) Kullanım Olanaklarının Araştırılması, SAN-TEZ, 01177. STZ.2011/2 no.lu Proje. Müşteri Firma: İstanbul Ağaç, Peyzaj, Eğitim Hizmetleri ve Hayvanat Bahçesi İşletmeciliği San. Tic. A.Ş.

Özçelik, H., Gül, A., Orhan, H., Özgökçe, F., Ünal, M., Özkan, G., Fakir, H., Sakçalı, S., Korkmaz, M. (2009). Türkiye Rosa L. (Gül) Taksonlarının Genetik Çeşitliliği Tespiti, Ekonomiye Kazandırılması

Olanaklarının Araştırılması ve Süleyman Demirel Üniversitesi Bünyesinde Rosaryum (Gülistan) Tesisi, TUBİTAK, TOVAG 105O627 No.lu Proje.

Kazaz, S., Baydar, H., Erbaş, S. (2009). Variaitions in Chemical Compositions of *Rosa damascena* Mill. and *Rosa canina* L. Fruits. Czech. J. Food. Sci, 27 (3): 178-184.

Ogut, S., Kilinc, D., Yaman, H., Koc, E., Gokcimen, A., Ozcelik, H., Turgut, C., Cesur, G., Bircan, C., Deniz, B. (2015). An Investıgatıon of Preventıve Effects of Rose Water Contaıning Essential Rose Oil Agaınst

Toxicological Effects of Chlorpyrıfos (Dursban 4) Ethyl In Rats, Fresenius Bulletin, 24, 3B: 1009-1015. Özçelik, H., Korkmaz, M., Özgökçe, F., Ünal, M., Yıldırım, B. (2011). Isparta Gülcülüğünde Yeni Alternatifler, Biyoloji Bilimleri Araştırma Dergisi, 4(2): 123-130.

Razungles, A., Oszmianski, J., Sapis, J.C. (1989). Determination of Carotenoids in Fruits of *Rosa* sp. (*Rosa canina* and *Rosa rugosa*) and of Chokeberry (Aronia melanocarpa). J. Food Sci, 54 (3): 774–775.

Tipi, E. (1996). Kuşburnu Fidan Üretim Teknikleri ve Üretim Hedefleri, Kuşburnu Sempozyumu, 5-6 Eylül 1996, Gümüşhane: 127-133.[ ]

Akyüz, N., Coşkun, H., Bakırcı, İ. (1996). Kuşburnunun Değeri ve Kullanım Alanları. Kuşburnu Sempozyumu, 5-6 Eylül 1996, Gümüşhane, pp. 271-279.

Keleş, F., Kökosmanlı, M. (1996). Kuşburnu ve Kuşburnu Çayında C Vitamini. Kuşburnu Sempozyumu, 5-6 Eylül 1996, Gümüşhane: 245-252.

Yılmaz, H., Bulut, Y., Kelkit, A. (1996). Peyzaj Planlama Çalışmalarında *Rosa canina* (Kuşburnu)' nın Kullanım Alanları. Kuşburnu Semp., 5-6 Eylül 1996, Gümüşhane: 169-176.

Çınar, İ., Çolakoğlu, A.S., Alma, M.H. (2004). Kuşburnu Karotenoid Pigmentlerinin Ekstraksiyonu ve Gıdalarda Kullanım Potansiyelinin Belirlenmesi. Geleneksel Gıdalar Sempozyumu, 23-24 Eylül 2004, Van: 198-200.

Gül, M., Kazaz, S., Baydar, H., Sırıkcı, B.S., (2015). Study About Technical, Economical Situation, Problems and Improvement of Oil Rose (Rosa damascena Mill.) in Turkey, Jeobp 18 (3): 613-626.

Pawlosky, R.J., Ward, G., Salem, N., (1996). Essential Fatty Acid Uptake and Metabolism in the Developing Rodent Brain Lipids, 31(Suppl.): 103–107.

Keleş, F., Kökosmanlı, M. (1996). Kuşburnu ve Kuşburnu Çayında C Vitamini. Kuşburnu Sempozyumu, 5-6 Eylül 1996, Gümüşhane: 245-252.

Simopoulos, A.P., Salem, N. (1996). Fatty Acids and Lipids from Cell Biology to Human Disease. Lipids, 31 (Suppl.): 1–2.

Salminen, J.P., Karonen, M., Lempa, K., Liimatainen, J., Sinkkonen, J., Lukkarinen, M., Pihlaja, K. (2005). Characterisation of Proanthoccyanidin Aglycones and Glycosides From Rosehips by High-Performonce Liguid Chromatography-Mass Spectrometry and Their Rapid Quantification Together with Vitamin C. Journal of Chromatography A., 1077: 170-180.

Hertog, M.G.L., Hollman, P.C.H., Van de Putte, B. (1993). Content of Potentially Anticarcinogenic Flavonoids of Tea infusions, Wines and Fruit Juices. Agricultural Food Chem., 41: 1242-1246.

Gül, M., Kazaz, S., Baydar, H., Sırıkcı, B.S. (2015). Study About Technical, Economical Situation, Problems and Improvement of Oil Rose (Rosa damascena Mill.) in Turkey, Jeobp 18 (3): 613-626.

New Technological Approaches
On Production of Essential Oils From Aromatic Plants

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Abstract: The Mediterranean region is the center of aromatic plants. The Lake region is an important center where aromatic plants are grown and processed in the industry. There are about 25 rose oil factories in the region. These factories produce essential oil from flowers of R. damascena, then produce the oils of other aromatic plants. Some factories only produce kongregate of oil rose.

There are three objectives: to dry the crops, to distill them in the field or mountain, and to make the existing plants free of waste. After essential oil production from rose flower or other aromatic plants, then other materials throw out, the waste pollute the environment.

In 2017 year, drying experiments were carried out on industrial furnaces under different conditions and their results were recorded. The results are presented to the customers who have been subjected to sensory and visual tests. This report focuses on the methods of evaluating scum or making unsuitable production from aromatic plants by us. Three technological approaches and innovations have been identified:

1. An easy-to-carry distillation device capable of distilling volatile oil in the field environment.
2. A design was made so that existing plants could be run without waste and more efficient.
3. Drying and pulverizing aromatic plant parts in industrial ovens. In these methods, the aim was first determined, then technical drawings of the works were made. Later experiments on designs were made. It is also stated that for families or small scale producers, the need for the production of small industrial boilers, in which aromatic plants can be distilled outside the factories, and that such a product is manufactured by us. Without waste rose oil factry was made a design. It is succesful fort he purposing. Drying and pulverizing aromatic plant parts in industrial ovens are succefull.

Keywords: Aromatic plants, Essential oil production, Drying, Powder, New methods.

1. Introduction

The current method used for the distillation of essential oils; with the help of water vapor then condensed by cooling. Volatile oils are carried with water vapor, cooled and liquidized. Due to the specific gravity difference, oil and water can be distinguished from each other as they form two separate phases. Clavenger devices are used in laboratories for research and education purposes. However, the distillation times of the Clavengers are long and the raw material reserves are small. On the other hand, industrial machines do not operate as efficiently as these devices, but with greater capacity. They save little energy, in short time very labor. Since the location of industrial machinery is fixed, it is inevitable to transfer to the factory from where the raw material to be processed is produced. This means additional expense and loss of fat in the urine.

A large number of volatile oil plants are cultivated in the region or collected from nature and processed in the same way at the production facilities. At the beginning of these are rose, lavender and lily. The design will also apply to these plants (Özçelik et al., 2009; Özçelik et. Al., 2014)

Oil rose production and analysis of the present situation: The oil rose production in the Lakes region has been going on since the Ottoman period. The oil production of *R. damascena* started with the Imbik was converted to industrial in 1935. The current method used in the production of liquid juice; it is based on boiling with 1 unit of rose flower and 3 unit water addition, condensation of volatile oils with the help of water vapor and then cooling. It is expected that about 40,000 tons waste will be produced in the case of about 12 000 tons of roses being distilled annually. Although the waste is an important raw material in terms of economy, it soon becomes fermented and emits a bad smell after it has passed to the atmosphere. The waste is deteriorated in 2-3 days due to long time boiling and organic matter in contact with oxygen in a short time. The purpose of the design is to save the fermentation from the ferment and to gain the economy. Numerous researches have been done on economic prospects of the waste. However, a study and opinion on how fabs can process the paint is only included in our design.

In the winter of 1933, Deputy and Minister of Economy who Celal Bayar came to Isparta. He deal with the problems of the province, especially the easiness. The minister Celal will meet with the rose producers. Hafiz Ali (Bilginer) asks for a factory of gardens in Isparta to the Celal. State administrators receive the requests of the Isparta from the First Five-Year Industrial Program on 11 April 1934. Then, on 30 September 1934, the Gülyağı Factory, founded by the Deputy and Economist Celal (Bayar) Bey, started production in 1935. The production capacity

of the Factory is 250 kg and the sales value is around 100 thousand TL. In those years, the world's total exports of 700 kg; the monetary value was 250 thousand liras (Anonymous, 2018). Türkiye produces more than half of the world needs rose oil in these days. The rose oil production is made in an area known as "Göller Yöresi" (Isparta, Burdur, Afyonkarahisar and partly Denizli). There are about 25 rose oil production units (factories) in the region. These units process flowers of *R. damascena*. The annual processing amount of rose flower is about 12,000 tons. One kilogram of rose oil is obtained from 3,5 to 4 tons of rose flowers. For 2017 year, the economic value is about 1 kg rose oil 70,000 TL; 1 kg rose flower 12 TL. Some facilities also produce konkret. This is called solid rose oil. It is easier to get and less costly. Liquid rose oil is produced by water vapor distillation method and concret production method is extracted using hegzane. The boilers of the flowers are approximately 3,000 liters. 500 kg rose flower is distilled with 1500 kg water for 90-110 minutes. After the process is over, resulting pulp is thrown out, fermented and spreads a bad smell to the surrounding area (Özçelik et al., 2009; Özçelik et. Al., 2014; Özçelik, 2013)**.** The same method applies to the retort system. The longer the time, the less is the distillate material.

The current method used for the distillation of essential oils; with the help of water vapor, and then condensed by cooling. Volatile oils are carried with water vapor, cooled and liquidized. Due to the specific gravity difference, oil and water can be distinguished from each other as they form two separate phases. Clavenger devices are used in laboratories for research and education purposes. However, the distillation times of the Clavengers are long and the raw material reserves are small. On the other hand, industrial machines in factories do not operate as efficiently as these devices, but with greater capacity they save energy, labor and time. Because the location of industrial machinery is fixed, transfer from field to factory is inevitable. This means additional expense and loss of fat in the urine.

In the same way, other aromatic plants are collected from the mountains or the fields and can be decomposed while drying in the field. On the other hand, some aromatic trees are cut in the forest. The branches and leaves remain on the ground and can not be evaluated. A mobile distillation boiler is needed to regain this economic loss (Özçelik & Durukan, 2017).

There needs to be an intermediate solution other than the Clevenger device and the volatile oil plant. There is a need for a small-scale, industrial-type machine that can be transported on the ground, operated in the field and is highly efficient. For this purpose, a machine was designed and manufactured by us as a prototype. If the spread of the machine, small family businesses will be proliferated and developed, the area where the aromatic plants produced by the families will distill itself, will only bring aromatic water to the house, and sell it to the merchant / factory.

This is especially the case in the production of lavender oil in Bulgaria (Özçelik & Korkmaz, 2015).

The small but industrially portable distillation device that will serve the above-mentioned purpose has been designed by us as an example model. The technical drawing will be added during the printing of the work. The features are described below.

Another problem is that 40.000 tons of pulp (waste) per year are present in the existing rose oil factories. The waste has been searched for ways to make it a semi-processed raw material from polluting the environment. Because there is a lot of material that needs to be processed and turned into a product in waste called pulp. If we can solve this problem as we wish, the waste will contribute to the economy in a serious way. This was the preliminary experiment. A design was made to make the existing plants work without waste and more efficient (Özçelik et al., 2009; Özçelik, 2014).

There is another problem with the processing of aromatic plants: drying and pulverizing. If this problem is solved, the damages that do not dry out will come to a standstill, and plants, which the cosmetics and food industry or even the pharmaceutical industry desire, can be turned into raw materials. The purpose and border of these methods were first determined, then technical drawings of the works were made. Later experiments on designs were made.

It is expected that our trial work will be beneficial to the cosmetics, food, pharmaceutical sectors, researchers, industrialists and investors (businessmen) and agricultural producers.

2. Methods

In 2017 year, drying experiments were carried out on industrial furnaces under different conditions and their results were recorded. The results are presented to the customers who have been subjected to sensory and visual tests. This report focuses on the methods of evaluating scum or making unsuitable production from aromatic plants by us. Three technological approaches and innovations have been identified:

An easy-to-carry distillation device capable of distilling volatile oil in the field environment.

A design was made so that existing plants could be run without waste and more efficient.

Drying and pulverizing aromatic pigments in industrial ovens. In these methods, the aim was first determined, then technical drawings of the works were made. Later experiments on designs were made.

3. Results and Discussion

Successful results were obtained from our trial work for each purpose. The mobile distillation boiler was made in the specified specifications and distillation was carried out from about 150 aromatic plants. The characteristics of this machine are as follows:

3.1. The machine is made of 3 units. Stove (heating system), reservoir (boiler) and the installed distillation system. The elderly can be transported in the car, the elderly in the tractor. It is technically sufficient to have a water source at the place to be run.

• Boiler and distillation system made of chrome-nickel metal (stainless). Only the juice of the distillate material should be from glass or a heat-resistant hard plastic transparent material.

• The heating system is stove type and works with solid fuel (wood, coal etc.). Other energy sources can be installed.

• More raw materials can be distilled at a time by changing the boiler volume without changing the distillation system. In this case heating costs increase.

• The device is switched off. The temperature increases and the possibility of burning / explosion of the boiler is very low.

With the use of the device, small enterprises will be able to produce semi-finished products besides herbal raw materials production. In this way, the factories will not be able to buy cheap money, and it will be possible to solve problems such as quota, deterioration, poor quality, storage and transportation. This is the source of the problem the employee is looking for.

3.2. Purpose of the design; to save the scrap from being waste and to gain the economy. Approximately 12 000 tons of flowers are processed annually and approximately 40 000 tons of waste are produced in the 25 production facilities located in the region. By installing a pressurized filter at an appropriate scale to the discharge pipe of existing plants, it can be separated into pulp solid and liquid part. The liquid sponge is made solid (powder) with a spray dryer. The extruded solid part is also dried in the drying oven in a short time. Or it can only be converted into a single product by mounting the Pneumatic dryer, preventing the fermentation of the sponge. The products can be used in the food, feed, cosmetics and cleaning sectors. Existing rosewater factories have to be converted to a rosewater-free rose-oil factory, with improved yields.

The genotype which is defined as lean gull is like 1-4 rows of petal order. Lean rose does not weight, it is lighter than other roses and takes longer to collect. The yield per decade is low. In other roses, the number of brides is higher. With more flower production per decade, the yield of fat per kilogram of red roses is lower. In 2005, roses produced ecologically were 2,800 YTL / kg; In 2006, it was sold at 1500 YTL / kg den. In some years the rose maker complains that it

produces satamamaktan. In recent years, the rose farmer has been relieved of these troubles. In 2016, the price of the flower is 8, and the organic rose flower is sold over 10 Tl. In 2017, this price has increased a little more. In the meantime, a company that produces dry rose flowers has emerged. This company has a little more attention to the rose flower, but paid more than 1-2 TL per head. This means that the factory paid 10 TL for the factories where they bought a pair of rose flowers from 8 TL (12 Tl. in 2018 year). In the last years, a new product called "rose leaf lokumu" has been developed in Turkish delight production and it is sold at 40-60 TL / kg. The effect of this rose is that you can dry rose flowers and make them dusty. The price of rose powder is 100-120 TL / kg. These products are becoming increasingly popular on the market and are preferred in candy. This type of raw material and product diversity needs to be increased (Özçelik et al., 2009; Özçelik, 2014). With the prevalence of broken rose petals and sticking to the outer part of the locus, some producers started to produce a different type of leafy rose delight adding rose powder to the delight. The delights produced with rose additive have a simple appearance like other locals. However, it can be understood that the leafy rose is the lokum during the defeat.

In recent years, some food industry in Isparta gave importance to raw material production and diversification. The diversity of raw materials led to diversification of the product. The drying of vegetables, fruits and aromatic plants is an old tradition of the Turks, but now it has been transformed into a new industry. The drying process is mainly known to the industrialists. During the drying process, however, the additives (sugar groups, colorants, etc.) added to the product lowered the customer preference. Some items could not be consumed by each person, it has led to health problems.

Thus, the conventional drying system will be applied and developed by the industry. Our experiments are to heat the ovens with no additives, wood or coal and dry them for a long time under certain temperature and humidity. Too much trial was done to keep the standard quality. The plants with more than 95% water content, such as oranges, bananas, apples, watermelons and mushrooms, could be dried like the original. Products such as strawberries, leeks, beans, pomegranates, rosehips, thyme, rose flowers were more easily dried. There was a significant relationship between the water content and the chemical composition of the product. For example, not all types of apples have dried well. The variety is important. Each type of mushroom could not be dried at the same quality. The species and the growing environment are important.

Crushing and grinding processes are followed by drying. Making the appropriate machines is also a priority for this process. The particle size is an important measure for the sector that will

use the product. For spices or medicinal plants to be used in medicine and cosmetics, the particle size should be the smallest. This is also the case in paint manufacturing. Larger particles can be used in the food and feed sector. It is already known to produce large blobs. The smaller the grain, the higher the risk of burning the product (Özçelik, 2014).

3.3. Problems Solved by the Invention: The plants that process the volatile oil plants will not produce pulp, but will make the pulp into different products. The plants will not pollute the environment. The products made from pus will fall into the cost of these products because they can participate in food, cosmetics, animal feed and cleaning products. With the drying method, the shelf life of the products will be prolonged, the volume and weight will be reduced and storage, packaging and transportation will be easier. Deepening of the process will lead to an increase in the income of the factories and therefore of the rose producer (or other aromatic plant producers).

3.4. Technical Specifications of the Design

There are two models of design:

1) To install a pneumatic dryer in the facility which can process the waste produced by the evacuation pipe in the facilities that produce rope. This machine can dry the muddy substance. The material is supplied to the packaging machine. The cost is approximately TL 100,000-150,000.

2) By adding a pressurized strainer to the pulp discharge tube, the pulp solid is separated into the liquid fraction; the solid pulp is delivered to the squeezing machine, the liquid portion is fed to the previous liquid pulp portion; the squeezed solid pulp is also sent to drying ovens and dried. Dried solid pulp is ground and packed. The liquid waste is supplied to the spray dryer for dusted. Then it is packed. The power of the machines must be adjusted depending on the pulse. The cost is TL 150,000-300,000.

Pneumatic dryer is a drying machine that can be dried in a short time and cheaply. When the waste is taken out of the existing machine at the rose processing plants, a sieve is put into this discharge channel, then a pressure system is put into the solid part and then this dryer is given to give the waste economy. This pulp, which is dried at a later time, is powdered to make godad additives, animal feed (for fish and birds), etc. . It can also be used in creams if it can be ground in powder.

The designs can be changed according to necessity. Cost comparison and product variety can be provided.

3.5. Advantages of the invention: This design made by us for the rose oil plants also can be applie to all other plants operating on essential oils.

The additional cost of the design can be recovered with about 1 year of production. Raw material will be diversified in industrial products, especially rose, and will gradually become export products. The economic value of the powder obtained from Spray Dryer is very high. Pharmaceutical companies may be interested in this raw material. Other products can be used in the production of food, cosmetics, cleaning products and animal feed.

The insects of the essential oil plants are 2 groups as attractants and repellents. Rose-colored bugs are attracted to fruit trees, sunflowers, etc., if they can be stored for long periods. in industrial plants etc. it can be sprayed as a fertilizer to increase the product. Labiatae/Lamiaceae family group (lavender, mint, thyme, basil, melissa etc.) is known as insect repellent. For this reason, the loose pulp that comes to the end of the process can be sprayed as an insect repellent, so that the roses can be prevented from sickness. It can be used for other plantings (vegetables, fruit plants, etc.) that have been infested by insects such as rose group and disease. This practice will cause organic farming to become widespread and costly. The pesticides of insect repellent plants may in time be converted into deodorants or insecticides such as room sprey, car sprey. Industrial waste of volatile oil plants are removed from the environment pollutant waste situation, we can earn the economy with the design. The application is a particularly significant contribution to the organic production, processing and profitability of rose flowers. This is the source of the problem the employee is looking for.

4. Suggestions

The information given in this article covers some of our efforts to obtain quality products from medical, aromatic and food plants. The results obtained from every experiment are hopeful. However, our studies are still continuing. On the other hand, our experiments were made not only on the basis of scientific research and laboratory scale but also on industrial small machines. Application of laboratory-scale experiments is difficult in the industry.

The distillation boiler is an original design. Details of this design are SDU. It is included in a book that will be printed by the Technology Transfer Office. With the series production of the machine, farmers, small family businesses, small industrialists, beginners, researchers, non-wood forest products, aromatic plant producers, collectors and industrialists will make significant profits and make their business easier. If the machine is rebuilt, some defects will be corrected. This application is an original design. Enlargement of the machine goes beyond its main purpose as possible. Because this machine is easy to carry and is designed to be high yield. It is very ideal for producing oil-based aromatic water, but an additional unit or process is required for oil removal.

The design of the wasteless rose oil factory (***Atıksız Gül Yağı Fabrikası*** in Turkish) is also an original project. The machines are not original, they are selected from the ones available. In this application design is new. It is aimed at improving the existing factories and increasing the product and economic contribution. Its cost is very high. Thus, we could not do a lot of experiments because our facilities were not enough. However, there is no doubt that this model will make a significant contribution to industrial and environmental health, taking advantage of the known characteristics of machines. Modeling can be further improved (Özçelik & Korkmaz, 2015).

Numerous attempts have been made in the drying and grinding processes of plant-derived products. Most of these things are unsuccessful (Özçelik, 2017). However, if the conditions are successful and the application is made widespread, economics, product variety and health will be very beneficial. It has many advantages such as fast consumption, easy digestion and cheap processing. It is a very fast way to develop new products in the food industry. In addition, it is an agricultural country with consumption rather than production in Türkiye in the period in which the raw material is very cheap and this method will provide a significant contribution to the agricultural sector. Classical drying methods are made by taking measurements as a very important application in terms of health. Today, healthy foods can be produced by this method instead of food that causes children in primary and secondary education to become obese. We hope that the Ministry of National Education and the students and their parents will pay attention to these types of domestic and classical products and that they will consume these dried and delicious food instead of ready-made gypsum. For example, we can not eat a watermelon juice that is grafted to a cabbage. However, if this watermelon is dried, the dryness can be a very attractive food. It is an incredible profit for the agriculture and food sector to buy and dry food such as watermelon, melon, citrus, apple, strawberry, garlic and mushroom which is abundantly grown in the season at cheap price. In addition, the addition of these powdered foods to the ready-to-eat garbage when the baby food or the digestive power of the elderly is weak is an important gain for every person and slaughter. The findings of the study's work are outlined in this publication, outlines the inventions and schemes. Because our studies were original, too much literature knowledge was not used and compared. It is hoped that these applications will spread and be used in other sectors over time.

5. References

Özçelik, H., Gül, A., Orhan, H., Özgökçe, F., Ünal, M., Özkan, G., Fakir, H., Sakçalı, S., Korkmaz, M., (2009). Detection of Genetic Diversity of Rosa L. Taxa in Türkiye and to be acquired Investigation of Economic

Facilities and Rosarium (Gulistan) Facility in Süleyman Demirel University, TUBİTAK, TOVAG 105O627 Numbered Project.

Özçelik, H., Sadıç, O., Ekici, L., Karakurt, H., Oğraş, T., Yıldırım, B., Özçelik, Ş., Koca, A., (2014). Investigation of Usage Possibilities of Some Rose Varieties Growing in Türkiye for Landscape and Industrial Purposes (Medicine, Cosmetics and Food Sectors), SAN-TEZ, 01177. STZ.2011/2 numbered Project. Customer Company: İstanbul Ağaç, Peyzaj, Eğitim Hizmetleri ve Hayvanat Bahçesi İşletmeciliği San. Tic. A.Ş. (İstanbul).

Anonymous, (2018). Ün Dergisi (Journal), p.1447. 26.02.2018. http://ispartaninkokusu.com.tr/?author=2 date of access:

Özçelik, H., (2013). Rose Production in Turkey: Determinations / Assays, Süleyman Demirel University, Journal of Science and Technology Inst.. 17(2): Special Issue: 44-51.

Özçelik, H., Durukan, F., (2017). Köylü Tipi Mobil Distilasyon Cihazı / Mobil Distillation Device for Production, UKECEK, 12-15 Sept. 2015, Edirne/Turkey, p. 746 (12720 numbered).

Özçelik, H., Korkmaz, M., (2015). Various Aspects of Türkiye Roses, SDU Journal of Science (E-Journal), 10 (2): 1-26.

Özçelik, H., (2017). Gül Atıklarının Ekonomiye Kazandırılması ve Yeni Ürünler / To be Winned to Economy of Rose Wastes and Their New Products Environmental Conservation and Biodiversity, UKECEK, 12-15 Sept. 2015, Edirne/Turkey, p. 453(12711 numbered).

New Technological Approaches To Drying Aromatic Plants In Industrial Furnaces

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Abstract: Aromatic plants are usually harvested from natural fields in Türkiye. Some of them is cultured. Most of the aromatic plants are dried, ground and packaged for domestic needs and presented to the consumer. Conventional method in drying; evaporation of moisture by laying them in an area where the air is circulated. In practice; drying in industrial ovens is not common. In addition, aromatic plants dried in industrial ovens have a weaker customer preference. The results of physical, chemical, biological and sensory analyzes such as color, flavor, aroma are not as successful as traditional methods. The Mediterranean region and especially the Lake Region within this region are the production centers of aromatic plants. Aromatic plants collected from the nature are scattered in the mountains and are exposed to light, humidity and temperature differences during the day and night, unexpected precipitation, etc. it makes it difficult to dry according to the standards and even drying and hygiene control is not achieved It is aimed to provide drying of aromatic plants in industrial furnaces with better quality, hygienic, controlled and evenly dried than conventional methods. In some plants with high economic value, it is aimed to obtain the aromatic water and the volatile oil contained in the plant by passing it through the cooling system under vacuum while the water contained in the plants (rose, lavender etc.) is evaporated.

Drying experiments were carried out in industrial furnaces under different conditions in 2017 and their results were recorded. The results are presented to the customers who have been subjected to sensory and visual tests.

In the drying process, wood-coal (solid fuel) was used for hot air, and additives such as coloring and flavoring were not used. The raw material was sliced to a certain size, then placed in oven trays and dried at a temperature of 40-70 degrees for about 3 hours. Drying time, the size of the dried food and the temperature of the oven are found in the related charts.

The Mediterranean region and especially the Lake Regions within the region are the production centers of aromatic plants. Aromatic plants collected from the nature are scattered in the fields seen in the mountains and are exposed to light, humidity and temperature differences during the day and night, unexpected precipitation, etc. it makes it difficult to dry according to the standards. In this case, the taste of the product, the color, the chemical composition does not disturb; In short, there is a need for industrial furnaces that are closest to natural drying or capable of drying in better quality, controlled conditions. Our scientific and industrial purposes are described in this report as a probing solution.

Drying of aromatic plants made with traditional methods in industrial ovens can be carried out under controlled and hygienic conditions. In the developed vacuum drying system, it has been tried to dry the plants which have high economic value in a short time at low temperatures under vacuum, to obtain aromatic waters and volatile oils, and positive results have been obtained.

Keywords: Aromatic plants, Drying, Industrial drying oven, Lakes region

1. Introduction

Turks continued their nomadic life along the centuries. Even from time to time even in the face of the forces of the state, they still did not want to leave this life. After 20 centuries, urbanization increased rapidly and nomadic life decreased in the people. Nomadic life has its own difficulties. One of them is health problems, the other is not being able to find food and cannot keep the food found for a long time. This problem was solved by feeding from nature, making medicine, developing folk medicine and drying food by storing it.

Foods with drying provide the opportunity to store the product for a long time while increasing the quality of the product. In contrast, the amount of product decreased. The reduced amount was considered an advantage for nomads. Advantages of drying in storage, shelf life and flavor were determined. For example, there are many people who prefer chopped and dried beans in shadow not green beans. Vine (***Vitis vinifera***) leaves, drying and stuffing in winter still exists. Zucchini, pepper, eggplant, tomato, melon peel, as well as vegetable products, plums, apricots, cherries, pears, Çöğre/Menengiç (***Pistacia terebinthus*** fruits) and so on. drying is still carried out in Türkiye. There are also dehydration of wild plants: sorrel (***Rumex*** spp.), Yavşan (***Artemisia absinthium***), mint (***Mentha*** spp.), wild plum etc. vegetables, fruits and spices are still being dried and stored. Used if needed.

The drying method in nomadic life is not limited to plant group foods. The meat group also has drying. In general, the sheep and goat meats. Turks who prefer the meats, especially after the slaughter of the ribs in the open and salty parts of the wind hanging place. Drying process is completed within a few days. It is then stored in a cool / cold environment. Food is consumed by taking it from the warehouse gradually. If there is a pothole or a cold cave near the settlement or oba, storage is preferably carried out there. For this purpose, the relevant fields have already been determined by experience and information is transmitted from ancestor to son. ‘Pastırma ‘ which is local meat product, it still being made in the vicinity of Kayseri, is largely a meat drying process. Even though this food, which is highly preferred, is produced in many parts of the country, Kayseri region is more suitable for this process in terms of climate and wind.

Another conventional method of drying is salting. Salting is more preferred, especially in the case of meat products that break down in a short time.

This research has been designed with the search for a technical solution to the surplus need and loss of unsold products in our country in recent years.

2. Material And Methods

In an industrial company; in 2017, in the industrial furnaces, drying attempts were carried out under different conditions in the vegetable, fruit and spice group as well as rose blossom and distillation waste pulp and the results were recorded. Different temperature, interior and final humidity, air circulation methods were applied to the products. The results were subjected to sensory and visual tests and presented to the customers. In the drying process, wood-coal (solid fuel) was used for obtaining hot air; preservatives, colorants and sweeteners. The raw material was sliced to a certain size, then placed in baking trays and dried at about 40-70 degrees for about 3 hours. The drying time, the size of the dried food and the temperature of the oven can be found in the relevant tables in the findings section.

The text includes figures of some products taken during the trial. Figures and trial conditions of spoiled products are not included. Figures of the machines used for drying purposes have been put in place and their advantages over other machines have been indicated. Figures and charts are original, without source.

3. Purposıng, Results And Suggestıons

Türkiye is acquainted with the milk powder in the 1970s. Today, in the provinces of Eastern and Southeastern Anatolia, whose livelihood is largely based on animal husbandry, people in Van, for example, complain about the cheapness of milk in the summer period and the use of milk powder due to insufficient milk in the winter season. If the producer can make milk powder from milk produced during the period when milk is high, they will not have to buy milk powder from outside in winter. Adana, especially watermelon producing provinces, especially in Afyonkarahisar producing potatoes and tomatoes, potatoes, watermelons, which can not sell tomatoes, potatoes and watermelons to the degree of throwing the situation of the producers has been the starting point of this study. A similar situation applies to fishing. This study is a new sectoral study that describes the processability of agricultural products by drying and avoiding economic losses in the period of production. In this way, the producer can be protected from damage and no price drop or damage can be minimized. The technical purpose of each drying method is evident: It is to extend the shelf life of the product by removing the excess water from the product and to facilitate the storage by reducing the amount. There is also the obligation of drying and dusting the product for some sectors. If a plant part to be used in cosmetics is to be used as a powder, it must be dried and ground to the desired size. Powdering in special foods to be prepared for the elderly, patients and infants provides great advantages. Some medicinal plants are also required to dry and dust the desired conditions. Powderable

foods can easily be added to liquid beverages. The same is true for instant teabags. As the grinding process provides surface increase in volume according to the volume, it is easier to digest and the effect is maximum.

Figure. 1. Drying of aromatic and vegetable plants in by traditional methods and harvesting.

Until the 1980s, very few of the Turkish people lived in cities. Today, he has filled the cities and established mega cities. The changing conditions of life, especially with the increase in migration from rural areas to cities, traditional drying methods have been forgotten and inadequate. In today's conditions, the necessity of industrialization of drying has emerged. Is it possible to dry enough food to the growing population by traditional methods in houses that cannot get enough sun and air circulation in cities? It is obvious that traditional methods cannot meet the need. However, in our study, drying process in industrial furnaces was designed by taking these traditional drying methods as a guide.

With the drying process;

• Due to the decrease in moisture content in the product, volume decreases and dry matter ratio increases.

• Due to the reduced volume, the costs of packaging, storage and transportation operations are reduced and easier.

• As the moisture content is reduced, microorganism activity is minimized and the shelf life of the product increases.

• Food consumption may be consumed in four seasons and transported to remote areas, thus increasing profit margins and product diversity in consumption.

• Drying in food processing allows the design of new product formulations. Prepared soups, instant pastas, ready-made herbal teas, cosmetics, medicine etc. is open to new product development. Ready-made, natural and cheap food, cosmetics and pharmaceuticals are being opened.

• By this applied, in Türkiye in recent years, especially seen in children with obesity and nutrition problems of poor quality will be minimised. And also organic product methods are used to find solutions with chips type foods from industrial products using raw materials. By dissemination of applications and diversification of products, it is expected that the Ministry of National Education will draw attention to the proposed instead of the prohibited Food Fast Food" type products.

Food products targeted at the industrial drying process:

This process is mainly applied to fruits, vegetables and spices. However, it can also be applied to meat and dairy products. There are almost no experiments on this subject. Fatherland and thousands of years of dry fruit production area is Türkiye and it has made important contributions throughout history and today especially the foreign trade income.

Dried fruit production in the country is still performed using primitive methods. Many manufacturers perform this drying process in uncontrolled outdoor weather conditions. Drying without pretreatment and controls after drying leads to the inability to obtain the desired quality product.

Some characteristics of industrial drying systems:

The dryer must be suitable for the product to be dried (fruit / vegetable / spice products, dough / sludge products, powder products, liquid products, animal products etc.).

• It is necessary to determine the amount of product to be dried annually (product quantity and tonnage in weekly / monthly tonnes).

• The establishment cost of the drying facility (between 70.000-700.000 TL, 1-10 sequential dryer, 10-100 m^2 closed drying area) should be known.

• The suitability of the energy type to be used by the dryer (natural gas, coal, electricity, solar energy or thermal hot water support etc.) should be known.

• The suitability of the dryer to the customer's residential area (m^2 closed area, factory design) must be known.

• The operating costs of the dryer or drying plant must be known. The waste caused by the material during the drying process should be known. As water is removed by drying, the essence of the product remains. For example; 125 g of dry orange chips remain from 1 kg of fresh orange. When calculating the cost, the amount of water to be evaporated should be considered.

Drying Machines and their Products:

Figure. 2a. General view of the vacuum dryer.

Its Advantages: Low energy cost, low temperature sensitive products to dry, oxygen-free or dry by pressing different gases to the environment, evaporating water and volatile oil has the ability to hold the product.

This machine developed by us with the support of KOSGEB brings a new opening to drying technology. In particular, this machine is intended to dry essential oil plants. Rose, lavender, thyme, rosemary are the most important of these plants. In this new prototype machine, Isparta oil rose flowers and lavender were tested. In one process, both dried flower, essential oil and aromatic plant water were obtained by absorbing and cooling the evaporated hot air. In this system, three products can be produced together. One of the most important features of the system; it is able to convert all raw materials into products and work under vacuum at low temperature. The cosmetic properties of the plant waters produced were poor but suitable for food use. New research is needed on this subject.

Figure. 2b. Lavender pouch, its aromatic juice and oil obtained by the vacuum dryer.

Figure. 3a. General appearance and advantages of Pneumatic (Flash) dryer.

Its advantages: Labor is less in operation It is a fast dryer. It is a low energy consuming machine. It is a machine without drying alternative for sludge and dough type raw materials. It is cheaper than other drying ovens.

Rose pulp is a semi-processed material. As a result of distillation, a significant amount of valuable material still remains in the pulp. We think that it is a high economic importance of this raw material and discard waste is a major economic loss for Türkiye. Although much research has been done on pulp to date, there has not been a study that can bring economy to the economy, rather it has been concerned with its chemical composition.

In our study, the pulp was filtered and separated into solid and liquid parts. The solid part was squeezed to reduce water and dried with a Pneumatic dryer. The liquid material was dried with a spray dryer to make a particle size smaller than powder. The uses and properties of these materials are different. Dried solid rose pulp can be milled in mills and added to foods and feeds. Although the cost of the powder obtained from liquid pulp is high, there are no areas of use yet. Researches should be continued on the improvement of usage areas. There is also a need for industrial mills with very small particle size. If such a machine can be made, the supply of raw materials to cosmetic and pharmaceutical products to be produced from medicinal and aromatic plants will be cheaper and increased.

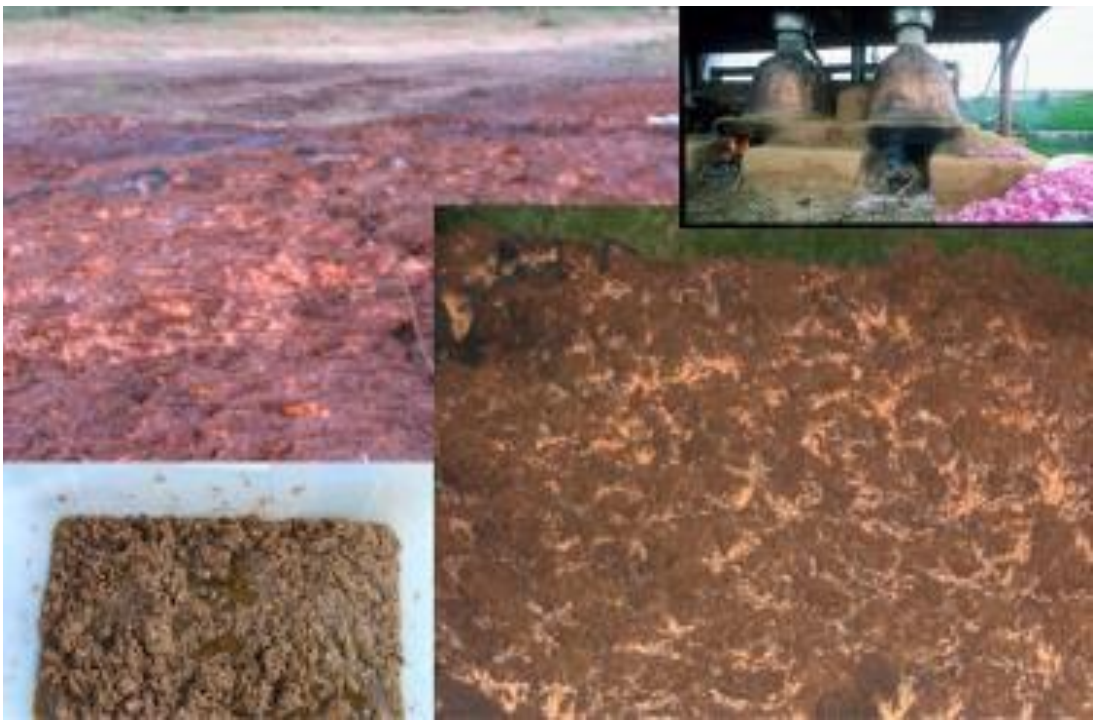

Figure. 3b. Rose pulp was dried in the Pneumatic (Flash) dryer and the economy was gained.

Figure. 3a. General appearance and advantages of Pneumatic (Flash) dryer.

*Its advantages***:** Labor is less in operation. It is a fast dryer. It is a low energy consuming machine. It is a machine without drying alternative for sludge and dough type raw materials. It is cheaper than other drying ovens.

Figure. 4. General view and advantages of the Spray Dryer.

*Its advantages***:** It can be used for the establishment of products in many fields from pharmaceutical to ceramic industry. Its capacity is very flexible. The deterioration in the product is minimal due to the high quality of the product and the short drying time and therefore the contact with the hot air for a very short time. The process moves continuously and its control can be performed completely automatically.

Figure. 5. General appearance and advantages of tray dryer.

Its advantages: There is no alternative in drying fruits and vegetables with high sugar content. Different products can be dried in the same system. Maintenance costs are low. The initial investment cost is lower (less) than other systems. The drying area of an oven is approximately 10 m^2 and its price is approximately 70.000 TL.

Table 1. Drying parameters of some drying products.

Products and drying conditions	**Melon**	**Mushroom**	**Lavander**
Drying temperature	80 °C	60 °C	45 °C
Drying humidity	6 %	% 7	% 10
Drying time	390 dk	320 dk	210 dk
Initial humidity (wet product moisture)	91 %	% 89	% 90
Final moisture (dry product moisture)	10 %	% 9	% 10
Tray rotation speed	7 times /dk	5 times /dk	5 times /dk
Air flow rate	2m^3/sn	1.3 m^3/sn	4 m^3/sn
Product shape	Chopped into thin slices	Slices of chopped mushrooms on slide	Freshly harvested lavender with stems
Product quantity that can be dried in 1m^2 area	8 kg	4 kg	2 kg

Table 2. Performance classes of various industrial type drying machines.

Machinery-Products	**Drying fruits and vegetables**	**Drying liquid products**	**Drying mud type products**	**Drying grain products**	**Drying large volume products**	**Drying powder products**	**Drying filter press waste**
Pneumatic Dryer	Bad	Bad	Very good	Bad	Bad	Good	Very good
Moving Tray Dryer	Very good	Bad	Middle	Middle	Middle	Middle	Middle
Belt Dryer	Very good	Bad	Bad	Middle	Middle	Bad	Bad
Fluidized Bed Dryer	Bad	Bad	Bad	Very good	Bad	Middle	Bad
Spray Dryer	Bad	Very good	Bad	Bad	Bad	Bad	Bad
Room Type Dryer	Middle	Bad	Bad	Middle	Very good	Bad	Bad

Table 3a. Chopping and grinding information of some dried fruits and vegetables.

DRIED VEGETABLE GROUP	
Products	**Features**
Fungus-fine granules	Leaf Mushroom - (1-2 mm)
Mushroom	Leaf Mushroom - (2-8 mm)
Cultivated mushroom	2-8 mm
Tomato powder	Sulfur-fired tomato oven (0-1 mm)
Tomato granules	Sulfur-fired tomato oven (1- 4 mm)
Tomato hunk	Pieces of baked-large cut tomato
Green pepper powder	Sweet, nasal powder
Green pepper fine granules	1-5 mm
Kapya pepper-thin	1-6 mm
Cube cut apple	Shell and belly removed-cube cut-Oven Dried
Cut figs	Thin piece cut (5 mm)
Cut figs	Coarse cut (10 mm)
Lemon chips - **New product**	Thin ring cut lemon
Mandarin chips - **New product**	Fine ring-cut mandarin
Orange chips - **New Product**	Thin ring cut orange
Pomegranate - **New product**	Pomegranate

Table 3b. Chopping and grinding information of some drying plants.

DRIED PLANT PRODUCTS AND THEIR FEATURES	
Products	**Features**
Rose (*Rosa damascena*) powder	Powder- 0-1mm
Rose (*Rosa damascena*) petals	Screened leaf (petals)
Rosebud-Isparta rose (*Rosa damascena*)	Dried buds in the shape of bud
Lavander (*Lavandula x hybrida*)	Lavender Pouch

There are very few systems in the drying technologies where the product can be dried and removed with the introduction of the liquid product. In the drying of liquid materials, the Spray Dryer is the most common system with a wide range of products and the availability of different systems according to the characteristics of the product.

Table 4. The amount of waste of some fruit products obtained in our drying work.

Products (Fruits)	**Yield %**
Orange (*Citrus sinensis*)	16-17
Banana (*Musa cavendishii*)	23-25
Strawberry (*Fragaria vesca*)	8-9
Apple (*Malus domestica*)	13-14
Pomegranate (*Punica granatum*)	23-25
Melon (*Cucumis melo*)	8-9
Watermelon (*Citrullus lanatus*)	7.5-9
Peach (*Prunus persica*)	10.5-11.5

Countries / Companies where dried herbal products are sold best and some uses according to our observations:

- **Fruit and herbal teas;** America, England, China, Bulgaria, Kyrgyzstan, Iraq, Azerbaijan, Qatar, Bosnia and Herzegovina etc.
- **Domestic Hotels; Companies producing instant soup,**
- **Dietary products and snacks:** Markets, especially chain stores,
- **Turkish delight and nuts;**
- **Boutique chocolate producing companies:** Firms that make special production by covering chocolate on fruits.
- **Electronic Sales Channels:** Companies selling via virtual markets for individual consumption.
- **Boutique chocolate producing companies:** Companies that make special production by covering chocolate on fruits.
- **Electronic Sales Channels:** Companies selling via virtual markets for individual consumption.

Figure. 6. Various products dried / milled from the trials carried out by us

Studies, and new products are promising for Türkiye. During our trips to Europe drying samples were seen. However, drying without additives is a difficult process. Very requires trial and patience. Bananas, apples, watermelons, strawberries are examples. Our purpose product. Besides drying, it is drying without losing its natural properties. Preserving the taste of our people, drying without using additives to produce healthy food. Demand for dried products is higher than expected because it will take time for the public to recognize this sector. Therefore, the sale of parekente quite is low. The future of our work in the pharmaceutical and cosmetics industry direction. The results given in the paper are customer satisfaction and sensory. color, odor, taste differences are given for products. Satisfaction with the product sold is an important analysis criterion. Increasing these trials for health and economy and it is expected to be expanded.

The aim of this study; That can not be consumed especially season in Turkey is to ensure the long-term storage of dried fruit and vegetables. This process prolongs the shelf life of products and makes it easier to store. There are two conditions that must be known for these processes: The manufacture of suitable machines and the appropriate drying methods must be known. For this reason, new machines were manufactured and drying attempts were made with these machines.

The product range is also important in drying. For example, not all types of apples are suitable for drying. An overview; water is less, the thicker shell in the products are easier to dry. Repeated drying trials should be performed for each product. The experience of drying one product may be inadequate for another product.

The machine is the foundation of the industry. Turkey's economy is based on agriculture. Lakes Region is also known as the capital of agriculture in Turkey. Especially medicinal and aromatic plants are mostly produced in this region. Therefore, it is not a coincidence that studies are conducted in this region. With the support of the state, we will continue to produce new agricultural machines. These studies are important for the Ministry of Agriculture. Because in an unexpected time, agricultural products can rise to very high prices. One of the most important ways to prevent this unfair competition and to bring the labor of the farmer to the economy is drying. We strive to dry herbal products. The same machines can also serve for animal products. Another issue is the contribution of our studies to healthy life: Elderly, patients and children cannot consume large grain foods. Powdering products solves this problem. It makes food liquid. On the other hand, preservatives, colorants, flavors and so on. additives. In particular, the Ministry of National Education prohibits the delivery of these foods to school-age children. It's the right decision. But what will replace these foods? This question is unanswered. These

studies are aimed at eliminating this deficiency, organic nutrition. Additives are never used. There are interesting findings in these trials. For example, when drying rose or lavender, oily rose water and oily lavender water can be obtained as a by-product. We are able to obtain products with high medical and cosmetic value by condensing the evaporated plant water. However, the customer preference of these products for now is weak. Because they are new products, not classic products. We believe that the products will be recognized and preferred over time.

Machine prices are quite cheap because it is domestic production. If these machines had been imported, the prices would probably have been ten times higher. There is no problem in the sale of the machines. Sales to many countries. Because our machines are both cheap and functional. We are pleased that the Ministry of Agriculture has prioritized drying support in recent years and we believe that support will continue.

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In particular, these machines are designed for those who want to install essential oil plants. Some machines developed by us bring a new expansion to drying technology with the support of KOSGEB Project. We thank KOSGEB Isparta Provincial Directorate for its financial support.

4. References

Anonymous, 2018. Gıda İşlemede Kurutma Teknolojilerinin Temel İlkeleri, İstanbul Sanayi Odası, İSO Yayın No: 2010/4 ISBN: 978-9944-60-582-3. İstanbul. https://www.google.com/search?q=•+Gıda+İşlemede+Kurutma+Teknolojilerinin+Temel+İlkeleri%2C+İstanbul+Sanayi+Odası&oq; (Date of access: 04.06.2018).

Arslan, N., Baydar, H., Kızıl, S., Karık, Ü., Şekeroğlu, N., Gümüşçü, A. (2015). Tıbbi ve Aromatik Bitkiler Üretiminde Değişimler ve Yeni Arayışlar, TMMOB Türkiye Ziraat Mühendisliği 8. Teknik Kongresi, 12-16 Ocak 2015, Ankara.

Baktır, İ. (2015). Her Yönüyle Gül ve Gül Yetiştiriciliği, Hasad Yayıncılık.

Baydar, H. (2013). Geçmişten Günümüze Tıbbi ve Aromatik Bitkiler, Harman Time 7: 34-44.

Baydar, H. (2013). Tıbbi ve Aromatik Bitkilerin Islahı ve Biyoteknolojisi. Tıbbi ve Aromatik Bitkiler Bilimi ve Teknolojisi (Genişletilmiş 4. Baskı), S. Demirel Üniv. Yayın No.: 51.

Özçelik, H., Gül, A., Orhan, H., Özgökçe, F., Ünal, M., Özkan, G., Fakir, H., Sakçalı, S., Korkmaz, M. (2009). Türkiye Rosa L. (Gül) Taksonlarının Genetik Çeşitliliği Tespiti, Ekonomiye Kazandırılması Olanaklarının Araştırılması ve Süleyman Demirel Üniversitesi Bünyesinde Rosaryum (Gülistan) Tesisi, TUBİTAK, TOVAG 105O627 No.lu Proje.

Özçelik, H., Korkmaz, M., Özgökçe, F., Ünal, M., Yıldırım, B. (2011). Isparta Gülcülüğünde Yeni Alternatifler, Biyoloji Bilimleri Araştırma Dergisi, 4(2): 123-130.

Özçelik, H. (2017). Gül Atıklarının Ekonomiye Kazandırılması ve Yeni Ürünler, Ulusal Ekoloji ve Çevre Kongresi, Trakya Üniv., Edirne.

Özçelik, H., Sadıç, O., Ekici, L., Karakurt, H., Oğraş, T., Yıldırım, B., Özçelik, Ş., Koca, A. (2014). Ülkemizde Yetişen Bazı Gül Çeşitliliğinin Peyzaj ve Endüstriyel Amaçlı (Tıp, Kozmetik ve Gıda Sektöründe) Kullanım Olanaklarının Araştırılması, SAN-TEZ, 01177.STZ.2011/2 no.lu Proje. Müşteri Firma: İstanbul Ağaç, Peyzaj, Eğitim Hizmetleri ve Hayvanat Bahçesi İşletmeciliği San. Tic. A.Ş.

POTENTIAL USE OF EXTRACTS OBTAINED FROM *Cannabis sativa* L. AS CORROSION INHIBITOR

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Abstract

Cannabis (*Cannabis sativa* L.) plants are important medicinal plants that are grown and found in almost every part of Turkey and can be grown economically in areas with ample sunlight, temperature and humidity. The plants contain many chemical compounds obtain from cannabinoids (terpenophenolics). Electrochemical analysis performed by electrochemical impedance spectroscopy (EIS) and current potential curves verified showed that the chemical compounds had corrosion inhibition potential of around 98%. It is established that these compounds could serve as corrosion inhibitor depending on their harvest time and the region of collection. This study aimed to find anti corrosion effects of the terpenoids found in cannabis obtained from line Diyarbakır to evaluate its anticorrosion characteristics.

Keywords: Anti corrosion, Line Diyarbakır, Central Anatolia, Terpenic compounds

1.Introduction

Aluminum known to be one of the most widely used anode materials in all atmospheric environments **(**Wang L, at al.**).** Aluminum or its alloys are widely used in the automotive industry (especially using in cooling water radiators), construction (as a supporting a material), aerospace (as it provides a lightweight material) and electric power generation. The aluminum electrode potential is very negative (-2.35 V) compared to the standard hydrogen electrode (SHE) and has high energy capacity (8.1 kW h/kg). Aluminum can easily form a thin film in atmospheric environment, due to it has a negative potential. Since this film is very thin, we need to make an extra coating for preventing corrosion as inhibitor. Generally, inhibitor should be cheap, useful, non-hazardous to health and accessible.

The use of inhibitors is one of the most practical methods to prevent corrosion of metals. Various inhibitors of aluminum in some acidic solutions have been reported (Tang et al 2003, Jia-Jun et al., 2010; Mahmoud, 2007; Ozcan et al., 2004; Manjula et al., 2001; Babu et al, 2000). However, many of them are dangerous, costly and not safe for environment and human health. Therefore, it is desired if safer corrosion inhibitors for aluminum to surrounding environments; therefore, environment friendly plant extracts can be considered as lower cost inhibitors. Phytochemicals (including alkaloids, flavonoids), heteroatoms such as N, S, O and p-electrons on the aromatic ring and p-electrons in the plant extracts are adsorbed on the metal surface to prevent corrosion.

Cannabis (*Cannabis sativa* L.) preparations are derived from the female plant of cannabis (Family Cannabidaceae). The use of cannabis in medicinal treatments has become widespread in recent years. Substances such as nabilone, dronabinol and its some derivatives are used in the treatment of glaucoma, multiple sclerosis and chemotherapy (Gerra et al., 2010**).**

The aim of this study is to develop a cheaper and natural inhibitor alternative to expensive chemical inhibitors. In recent years, it will be important to work on cannabis to contribute to the economy. It is necessary to take the opportunity to gradually remove political permits this will be a pioneering work for the spread of legal permits. This study is intended to inspire similar studies.

2.Materıals and Methods

C. sativa was obtained from Department of Field Crops, Faculty of Agriculture, Ankara University. Aluminum metal, 99.90% purity, was taken from ETİ Aluminum A.Ş, Seydişehir, Konya. This company contributes significantly to the regional and national economy. *C.sativa* extract was used to prevent corrosion of aluminum. The extraction was carried out following modified method of Turner and Mahlberg (1984)**.** Upper leaves of the female *C. sativa* are harvested at 06:00 in the morning with their flowers and dried under suitable conditions**[10].** The dried sample was ground to powder. 10 grams of this dry sample was dissolved in 200 ml of 0.5M sulfuric acid and stirred for 1 day with heating. The homogenized mixture was heat filtered to give 30 ml solution.

Corrosion of aluminum in *C. sativa* extract were carried out by electrochemical system. This sistem consist of CHI 660 B instrument potentiostat, polyscience thermostat, corrosion cell and with a computer for obtaining corrosion parameters. Corrosion cell consists three electrode, aluminum, reference electrode (Ag/AgCl) and platinum (platin wire) electrode. Aluminum surface polished with alumina, washed with double distilled water before experiment. After washing aluminum were carried in *C. sativa* extract obtaining electrochemical current potential (scan rate 1mV/s) and impedance spectroscopy (EIS, 0.1) curves at 25°C.

$$\boldsymbol{E}\,\% = (CR(Blank) - CR(C.sativa))/CR(Blank) \times 100 \qquad \text{Eq.1}$$

$$Stern - Geary\ (\boldsymbol{S} - \boldsymbol{G}) = [(Ba \cdot Bc)/2{,}303(Ba + Bc)\,] \times 1/\boldsymbol{R}p \qquad \text{Eq.2}$$

$$\boldsymbol{E}(\boldsymbol{R}p)\% = [R(C.sativa) - R(Blank)]/R(C.sativa) \times 100 \qquad \text{Eq.3}$$

Corrosion inhibition was calculated from **Eq.1** equation. The polarization resistance obtained from the electrochemical current potential was replaced by Stern-Geary equation and corrosion rate was also calculated from **Eq.2** equation. The data obtained from these methods are compatible with each other. In addition, the percent inhibition effect (E%) was calculated using the polarization resistance obtained from the electrochemical current potential curves method from **Eq.3** equation.

3.Results

There are many organic compounds in C.sativa. These compounds are most commonly phenolic mono or poly terpene compounds (Bayraktar et al., 2019; Wang et al., 2019). These compounds interact with aluminum deposited on the metal surface without passing into the solution medium, increased the resistance at the metal/solution interface from 295 Ω.cm2 to 10200 Ω.cm2. As the resistance increased, aluminum showed the ability to cover the metal surface in acidic solution by means of activated carbon centered carbanions of these compounds. Thus, the average corrosion inhibition increased to 98% and the corrosion of aluminum was significantly reduced. Corrosion rate and other parameters were obtained from electrochemical current potential curves at presence of C.sativa at room temparature shown in **Table** 1.

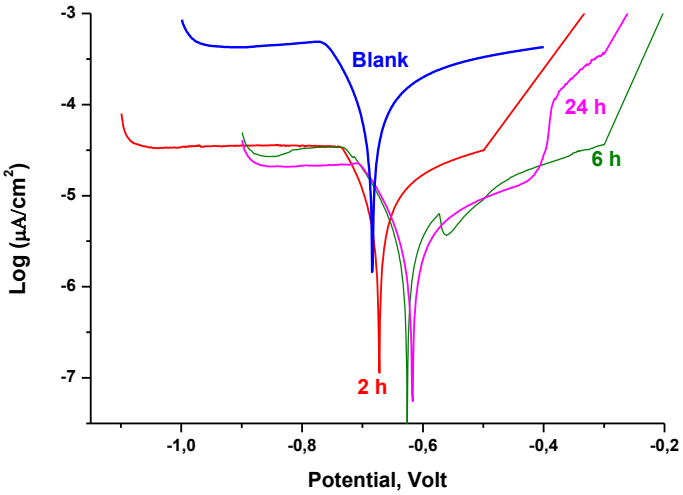

Fig. 1. Electrochemical impedance spectroscopy (EIS) curves of aluminum in the presence of *C.sativa* extract in 0.5M H_2SO_4 with during 2, 6 and 24 h.

Inhibition effect was evaluated by electrochemical impedance spectroscopy (EIS) (**Fig.1**) and current potential curves (**Fig.2**). In the impedance method, the resistance increases at the metal/solution interface that occurs on the metal surface without the current passing through the same mechanism both in the real axis ($Z'_{re.}$) and in the imaginer axis ($Z''_{im.}$). This increase was obtained at 2, 6 and 24 hours respectively. The impedance resistances were obtained as 325 ohm.cm^2, 625 ohm.cm^2, 875 ohm.cm^2 and 1125 ohm.cm^2.

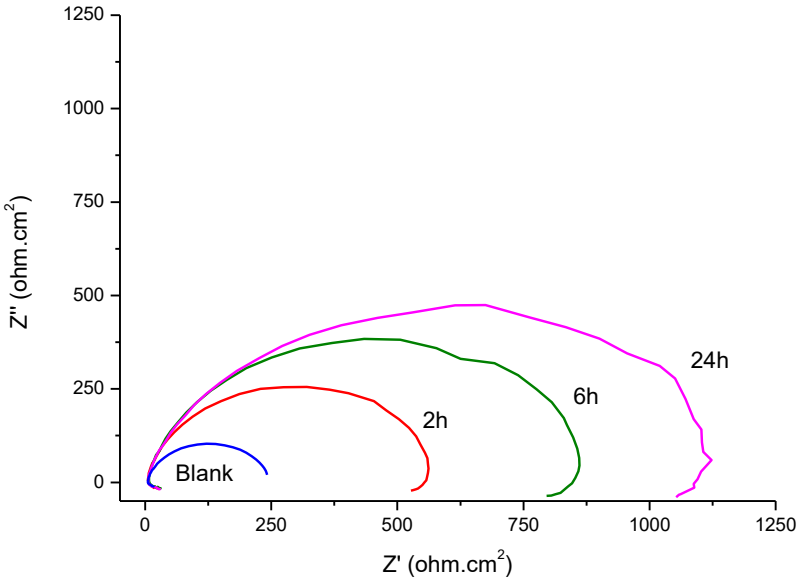

Fig. 2. Potentiodynamic current potential curves of Al in 0.5M H_2SO_4 in the presence of C.*sativa* extract in 0.5M H_2SO_4 with during 2, 6 and 24 h.

Table 1. Corrosion parameters obtained from current potential (C-P) curves for aluminum presence of *C.sativa* extract at room temparature.

Media	**E***corr* (Volt)	**B***a* (mV/dec)	**B***c* (mV/dec)	**R***p* (Ω.cm^2)	**Corrosion Rate** (*CR*, μA/cm^2)		**E** %			
					C-P	**S-G**	**R***p*	**C-P**	**S-G**	**Avr**
0.5M H_2SO_4	-0.675	196	359	295	470	187	-	-	-	-
+*C.sativa* 2 h	-0.668	325	239	3721	16	16	92	97	91	93
6 h	-0.610	318	38	4592	3.25	3.2	93	99	98	96
24 h	-0.607	293	31	4926	2.50	2.4	94	99	98	97

Avr: Average, C-P: Current Potential, S-G; Stern Geary,

Electrochemical studies showed corrosion rate of aluminum was determined by two different methods. These methods are compatible with each other. Different compounds in *C.sativa* exhibit better inhibitive effect on the corrosion of aluminium. *C.sativa* also acted as anodic inhibitör for 2 h, 4 h and 24 h. All compounds in *C.sativa* may have a role in preventing corrosion of aluminum. *C.sativa* increased the efficiency of aluminum average 97 percent.

REFERENCES

Wang L, Wang W, Yang G, Liu D, Xuan J, Wang H, LeungMKH, Liu F. Int J Hydrogen Energy 2013;38:14801–9.

L. Tang, G. Mu, G. Liu, Corros. Sci. 45 (2003) 2251.

F. Jia-Jun, L. Su-Ning, C. Lin-Hua, W. Ying, Y. Lian-He, L. Lu De, J. Mater. Sci. 45 (2010)979.

S.S. Mahmoud, J. Mater. Sic. 42 (2007) 989.

M. Ozcan, I. Dehri, M. Erbil, Appl. Surf. Sci. 236 (2004) 155.

P. Manjula, S. Manonmani, P. Jayaram, S. Rajendran, Anti-Corros. Meth. Mater. 48(2001) 319.

B.R. Babu, R. Holze, Br. Corros. J. 35 (2000) 204

Gerra G, Zaimovic A, Gerra ML, Ciccocioppo R, Cippitelli A, Serpelloni G, et al. Pharmacology and toxicology of Cannabis derivatives and endocannabinoid agonists. Recent Pat CNS Drug Discov. 2010;5:46–52

Turner JC, Mahlberg PG. Separation of acid and neutral cannabinoids in Cannabis sativa L. using HPLC. In: Agurell S, Dewey WL, Willete RE, editors. The cannabinoids: chemical, pharmacologic and therapeutic aspects. Orlando, Fla: Academic Press Inc; 1984. pp. 79–88.

Nilgün Bayraktar, Turan Yanardağ, Yasin Özgen, Yağmur Kahraman Yanardağ, Chemical characterization of two local lines of *Cannabis sativa* L. under warm temperrate climatic conditions of Ankara, 1.International Aromatic Plants and Cosmetics Symposium-AROPCOS, 03-06 September 2019, Iğdır.

Wang, C.-T.; Wiedinmyer, C.; Ashworth, K.; Harley, P.C.; Ortega, J.; Vizuete, W. Leaf enclosure measurements for determining volatile organic compound nemission capacity from Cannabis spp. Atmos. Environ. 2019, 199, 80–87.

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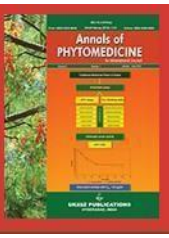

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