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# Determination of Essential Oils Components of *Maclura pomifera* (Osage Orange) Fruit from Turkey

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**Abstract**: This study was conducted to determine the essential oil components in Macrura pomifera, a North American plant. The essential oil components were determined by GC / MS method after the essential oil isolation of the fruit sample was completed. The relative abundances of the chromatograms obtained as a result of the analyses were compared with the similarity indices of the probable results in the library of the GC / MS for the highest peaks and retention index calculations were made from the retention time. As a result of the analyzes, the structure of 28 essential oil components in the fruit was clarified. When the components were examined, dodecanal (9.05%), Eugenol (8.36%) and α-humulene (7.84%) emerged as the first three major components. Other compounds are less common than these three compounds.

**Keywords:** *Maclura pomifera*, osage orange, essential oils.

## 1. INTRODUCTION

Plants are the main source of the primary metabolites (carbohydrates, proteins and oils) needed to meet the basic nutritional needs of human beings. Apart from these important compounds, some useful substances such as wood, cellulose, gum, rubber are also provided from the plants. In addition to providing food and energy, plant natural products are used in the chemical, nutritional, cosmetic and agricultural fighting sectors, especially in the pharmaceutical industry [1].

Today, medical plants are known as the most active elements of traditional treatment methods. World Health Organization (WHO) data have shown that 80% of people in developing countries use these treatment methods and 3.3 billion people also benefit from medicinal herbs as a therapy tool [2, 3].

*Maclura pomifera* has a long and interesting history of use by both Native Americans and early pioneers. Its wood was once in demand for making hubs and wheel rims for horse drawn wagons, mine support timbers, posts and many other uses where decay resistance was important. For many years our country is grown as an ornamental plant. It is a plant belonging to the genus Moraceae. The color of young shoots is greenish-gray or light brown. There are many lentis on it. Exiles have thorns on them. When the shoots are torn or cut, they release a liquid in the milk-like appearance. The peak bud is pseudoterminal. The buds are small,

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flattened, sphere-shaped. Its leaves 5-12 cm long are egg shaped with long drop-tip. The upper face is bright green, the lower face is light green. It is a full-edged, one-sexed enclosure [4].

Essential oils are obtained from plants. They are liquid at room temperature and can be dragged with water vapor. Essential properties are odorous and oily mixtures. They can evaporate even in the room heat when exposed. Due to pruning, they are known as "essential oil" or "essence" [5, 6]. Essential oils are water-insoluble substances, but they dissolve in water to the extent that their smell is transferred to the water. Soluble in organic solvents such as ethanol, ether, benzene and petroleum ether. Essential oils are water-soluble. A few are heavier than water. They are optically active. The polarized light turns right and left at a certain level. Their reflactive index is high [7].

This research was conducted to determine the essential oil components of *Maclura pomifera* juice. Firstly, essential oil insulations of fruit samples were carried out in the research. Then, the determination of essential oil components was carried out by GC/MS method.

## 2. MATERIAL and METHODS

### 2.1. Material

*Maclura pomifera* fruit gathering was performed in August when the fruits were mature. All samples were collected in August, 2012. Different locations in Istanbul and Bursa were determined as the study area. Collection of samples was carried out in these areas. Two samples were taken from each locality. Fruits were dried in the research laboratory under room conditions. After the drying processes, identification of the essential oil compositions was carried out.

### 2.2. Method

100 g of sample taken from the dried and milled *Maclura pomifera* fruit was placed in a 1000 mL balloon. 700 mL of water was added and boiled in a Clevenger apparatus for four hours. This process was repeated twice for each sample. The essential oils obtained were dissolved in 0.5 ml of n-hexane (HPLC grade). Dried with $Na_2SO_4$ and stored at 4° C in dark colored bottles. Analysis of essential oils was carried out by GC / MS method [8].For this purpose, Thermo brand DSQII model GC / MS device in Pharmaceutical Sciences Research Laboratory of Ege University Faculty of Pharmacy was used. The column of the device is again Thermo TR-WAXMS 60mx0.32 mm x 0.25m and injection volume 1µl. The injection was made in three replicates. Relative abundances in sample chromatograms were evaluated for the highest unknown peaks. The possible results from the MAINLIB, WILEY7N and Replic libraries of the GC/MS were determined together with the similarity index. Retention indices of compounds for verification were compared with literature data.

## 3. RESULTS

The following components were found in the structure of the *Maclura pomifera* fruit; n-hexanol, α-pinene, benzaldehyde, hexanoic acid, α-terpinene, nonanal, camphor, pinocarvone, 1-nonanol, isoamyl alcohol, decanal, 1-decanol, δ-elemene, p-cresol, α –cubebene, eugenol, dodecanal, α-humulene, dodecanoic, acid, tetradecanal, cubenol, β-selinene, octadecane, valerenol, phenol, palmitic acid, linolenic acid and pentacosane. The retention indices and content (%) of the obtained compounds are shown in Table 1.

**Table 1.** Retention indices and content of the obtained compounds.

| No | Compound | RI* | LRI** | Formula | Content % |
|---|---|---|---|---|---|
| 1 | n-hexanol | 869 | 871 | $C_6H_{14}O$ | 2.56 |
| 2 | α-pinene | 943 | 949 | $C_{10}H_{16}$ | 3.78 |
| 3 | Benzaldehyde | 963 | 960 | $C_7H_6O$ | 0.59 |
| 4 | Hexanoic acid | 977 | 978 | $C_6H_{12}O_2$ | 2.71 |
| 5 | α-terpinene | 1016 | 1017 | $C_{10}H_{16}$ | 0.81 |
| 6 | Nonanal | 1100 | 1101 | $C_9H_{18}O$ | 3.21 |
| 7 | Camphor | 1148 | 1146 | $C_{10}H_{16}O$ | 2.49 |
| 8 | Pinocarvone | 1165 | 1165 | $C_{10}H_{14}O$ | 1.86 |
| 9 | 1-nonanol | 1168 | 1171 | $C_9H_{20}O$ | 1.66 |
| 10 | İsoamyl alcohol | 1200 | 1201 | $C_5H_{12}O$ | 2.32 |
| 11 | Decanal | 1202 | 1204 | $C_{10}H_{20}O$ | 4.25 |
| 12 | 1-decanol | 1251 | 1254 | $C_{10}H_{22}O$ | 3.45 |
| 13 | δ-elemene | 1336 | 1338 | $C_{15}H_{24}$ | 0.69 |
| 14 | p-cresol | 1342 | 1344 | $C_7H_8O$ | 1.10 |
| 15 | α -cubebene | 1352 | 1352 | $C_{15}H_{24}$ | 1.98 |
| 16 | Eugenol | 1360 | 1359 | $C_{10}H_{12}O_2$ | 8.36 |
| 17 | Dodecanal | 1405 | 1409 | $C_{12}H_{24}O$ | 9.05 |
| 18 | α-humulene | 1452 | 1455 | $C_{15}H_{24}$ | 7.84 |
| 19 | Dodecanoic acid | 1578 | 1580 | $C_{12}H_{24}O_2$ | 2.7 |
| 20 | Tetradecanal | 1615 | 1613 | $C_{14}H_{28}O$ | 1.79 |
| 21 | Cubenol | 1648 | 1648 | $C_{15}H_{26}O$ | 1.24 |
| 22 | β-selinene | 1668 | 1670 | $C_{15}H_{24}$ | 2.77 |
| 23 | Octadecane | 1779 | 1800 | $C_{18}H_{38}$ | 5.28 |
| 24 | Valerenol | 1869 | 1870 | $C_{15}H_{24}O$ | 1.42 |
| 25 | Phenol | 1928 | 1928 | $C_6H_6O$ | 0.66 |
| 26 | Palmitic acid | 1966 | 1968 | $C_{16}H_{32}O_2$ | 0.54 |
| 27 | Linolenic acid | 2101 | 2102 | $C_{18}H_{32}O_2$ | 1.45 |
| 28 | Pentacosane | 2487 | 2500 | $C_{25}H_{52}$ | 1.38 |
| | TOTAL | | | | 77.94 % |

The analysis results were evaluated and the first three major components were identified. These are dodecanal (9.05%), eugenol (8.36%) and α-humulene (7.84%). Other compounds are less common than these three compounds. Dodecanal is also known by the names of lauraldehyde or dodecyl aldehyde. This compound is a colorless liquid. It is a fragrance compound used in cosmetics. It is an organic compound which can be easily converted into acid and alcohol by chemical methods. Eugenol is a phenyl propene compound. It is abundant in the structure of many spices, especially carnations. The compound is widely used in pharmacology. It is also known that pharmacology is also used to give flavor to certain medicines. Insoluble in water but soluble in alcohol and oil. α-humulen is abundant in many plants in the world. Pharmacologically due to its analgesic properties.

In Tunisia, a research has been done with the seeds of the same fruit. In this research, a very rich chemical composition was found in the seed of *Maclura pomifera*. Accordingly, it is thought to be an important nutrient. It has been reported that it can be used as pharmaceutical raw materials in pharmacology. Due to the linenoic acid content they have also come to the conclusion that it may be important for the cosmetic industry [9].

Jerkovic et al. examined the essential oil components with GC-MS in *Maclura pomifera* fruit samples from Croatia in 2006. According to their work, the phenylpropane derivatives, monoterepenes and other compounds have been encountered in the aliphatic structure. In the structure of the fruit, 39 different essential oil components are encountered. Among these, eugenol (9.9%) and p-cresol (9.6%) were identified as the main constituents [10].

It is known that the essential oil components of plants vary according to geography and climate. Moreover, no further research has been conducted on this fruit. The results obtained are partially in agreement with other studies.

## 4. DISCUSSION

It is known that plants are effective on the chemical components of the regions they grow. For this reason, it is not expected that the contents or component amounts are the same. It is thought that this study requires more intensive study of the chemical components identified. New studies are planned, which may be important both in cosmetics and pharmacology. The results of the new research reveal that the crust, fruit and seed parts of the fruit are separated from each other to obtain more detailed results. In addition to these, a new study aims to determine the phenolic compounds and acids belonging to the fruit. This research has been seen as a research that will give direction to other studies to be done in the future.

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**Conflict of Interests**

Authors declare that there is no conflict of interests.

## 5. REFERENCES

[1]. Phillipson, J. D. (1990). Plants as sources of valuable products, Clarendon Press, Oxford.

[2]. Eloff, J. N. (1998). Which extractant should be used for the screening and isolation of antimicrobial components from plants?. Journal of Ethnopharmacology, 60(1), 1-8.

[3]. Keles O, Akü, S, Bakirel, & T, Alpinar, K. (2001). Türkiye'de yetişen bazı bitkilerin antibakteriyel etkisinin incelenmesi. *Turk J Vet Anim Sci*, 25, 559–565.

[4]. Wiersema, J. H., & Leon, B. (2016). *World economic plants: a standard reference*. CRC press.

[5]. Baytop, T. (1986). Farmakognozi, Cilt:1, İstanbul, İstanbul Üniversitesi Ecz. Fak, Yayınları

[6]. Berk, A. (1953). Esanslar (Eterik Yağlar), İstanbul, Hüsnü Tabiat Matbaası.

[7]. Svigar, A.A., & Silverstein, R.M., (1981). Monoterpenes: Infrared, Mass, $^{1}$H-NMR and $^{13}$C-NMR spectra and kovats indices, *Aldrich chemical Co., Milwaukee*, Wiaconsin.

[8]. Adams, R. P.(2004). Identification of Essential Oil Components by Gas ChromatographyMass Spectroscopy, Allured, Carol Stream, IL, USA.

[9]. Saloua, F., Eddine, N. I., & Hedi, Z. (2009). Chemical composition and profile characteristics of Osage orange Maclura pomifera (Rafin.) Schneider seed and seed oil. *Industrial crops and products*, 29(1), 1-8.

[10]. Jerkovic, I., Mastelic, J., & Marijanovic, Z. (2007). Bound volatile compounds and essential oil from the fruit of Maclura pomifera (Raf.) Schneid (osage orange). *Flavour and fragrance journal*, 22(1), 84-88.