

# GC-MS analysis of *Cedrus atlantica* var. *Pendula* (Carrière) Carrière

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**Abstract** - The chemical composition of essential oil of *Cedrus atlantica* var. *pendula*, growing in Black Sea region/Turkey has been studied. Oil were prepared by hydrodistillation process with the help of clevenger apparatus and analyzed using GC-MS. The obtained results show the presence of about 30 compounds in the chromatogram. The major compounds are Santolina triene which contribute about 55.73 % followed by  $\beta$ -Myrcene with 21.63 % of its total amount. D-Limonene shows a good peak contributing 8% of the total volume.

**Keywords** - *Cedrus atlantica* var. *pendula*, *Pendulous Atlas Cedar*, GC-MS, *Essential oil*

## I. INTRODUCTION

Essential oils are used in the field of perfumery, cosmetics and aromatherapy with their rich chemical content. As the content of these oils is investigated in more detail, it will be beneficial to human health, agriculture and the environment. These oils can be effective alternatives to the synthetic components of the chemical industry to produce solutions. Interest in medical and aromatic plants is increasing day by day with rising consumer demand [1]. These plants produce a large number of secondary metabolites, including essential oils. These volatile oils are generally liquid and colorless at room temperature. They have a characteristic odor, are usually liquid at room temperature and have a density less than unity, with the exception of a few cases. They have a refractive index and a very high optical activity. These volatile oils contained in herbs are responsible for different scents that plants emit [2]. The genus Cedar is the common name for cedar wood, used for several different trees that grow in different parts of the world. They are native to the mountains of the western Himalayas and the Mediterranean region, occurring at altitudes of 1.500-3.200 m in the Himalayas and 1.000-2.200 m in the Mediterranean. Cedars are very popular ornamental trees, widely used in horticulture in temperate climates where winter temperatures do not fall below about 25 °C. *Cedrus atlantica* is evergreen. Pyramidal shaped tree often with low branching habit. Bark is rough, plated and dark grey and short, stiff silvery blue needles held in rosettes [3,4]. Variety of “*pendula*” is a columnar, weeping form featuring pendulous branches clad with bluish-green needles in clusters and upright, barrel-shaped cones. Training determines the form of the tree which can range from narrow-upright [5]. In this study aim to find out phytochemical composition of *Cedrus atlantica* var. *pendula* taking essential oil from Kastamonu of Blacksea Region in Turkey with using GC-MS equipment.

## II. MATERIALS AND METHOD

### A. Collection Plants

Fresh leaves of *Cedrus atlantica* var. *pendula* have been collected from the city center of Kastamonu. Determination of plant sample was carried out at the University of Kastamonu faculty of forestry.

### B. Obtaining Volatile Oil

Fresh leaves of *Cedrus atlantica* var. *pendula* were subjected to essential oil analysis. A 100 g sample of leaves were mixed with 1000 ml distilled water and subjected to hydrodistillation in a clevenger-type distilling apparatus for 3h [7,8,9].

### C. Chemical Composition Analysis

GC- MS Analysis - In order to identify the chemical components, each sample was analyzed using GC-MS qp 2010 ultra (Shimadzu) equipped with rtx-5ms capillary column (30 m  $\times$  0.25 mm; film thickness, 0.25  $\mu$ m). Analysis conditions were as follows: injector temperature, 250°C; carrier gas, helium (at a flow rate of 1 mL/min); injection method: split ratio, 1:10; injection volume, extracted oil inside 1  $\mu$ L of hexane; and oven temperature, 4°C/min with the oven set to 40°C-240°C; pressure, 100 kPa; and purge flow, 3 mL/min. MS scan conditions were as follows: transfer line temperature, 250°C; interface temperature, 250°C; and ion source temperature, 200°C. Identification of compounds was based on the comparison of retention times and matching with Wiley database. Where applicable, reference compounds were chromatographed in order to confirm the retention times in GC [10,11,12].

## III. RESULTS AND DISCUSSION

The essential oil yield of *Cedrus atlantica* var. *pendula* was 1.7%. The obtained result shows the presence of 30 compounds in the chromatogram for variety of *pendula* (Table 1., Figure 1). The major compounds are Santolina triene 55.73 %,  $\beta$ -Myrcene with 21.63 %, D-Limonene 8 % of the total volume.

A component of essential oil of *C. atlantica* var. *pendula* differs from *Cedrus atlantica*. Table 2 compares the top ten chemical compounds of the GC-MS analysis for *Cedrus atlantica* and variety of “*pendula*” [4,5,6].

Table 1: GC-MS analysis of *Cedrus atlantica* var. *pendula* (Carrière) Carrière

Peak	R.Time	Area	Area%	Name
1.	9,055	439216301	55,73	Santolina triene
2.	11,323	170470291	21,63	$\beta$ -Myrcene
3.	12,703	65878458	8,36	D-Limonene
4.	10,602	52143916	6,62	$\beta$ -Pinene
5.	9,503	16607033	2,11	Camphene
6.	34,313	7087103	0,90	$\alpha$ -Bisabolol
7.	29,165	6491638	0,82	Germaacrene-D
8.	15,065	4455900	0,57	$\alpha$ -Terpinolene
9.	29,801	2883323	0,37	$\beta$ -Himachalene
10.	28,117	2748936	0,35	$\alpha$ -Himachalene
11.	29,070	2275958	0,29	1H-Benzocycloheptene
12.	8,494	2159724	0,27	Tricyclene
13.	22,533	1830284	0,23	Bornyl acetate
14.	27,142	1553653	0,20	Caryophyllene

15.	15,725	1488877	0,19	Thujone	23.	25,977	698388	0,09	$\beta$ -Bourbonene
16.	11,724	1442547	0,18	$\alpha$ -Phellandrene	24.	13,912	462097	0,06	$\gamma$ -Terpinene
17.	49,352	1157939	0,15	Grandiflorenic Acid	25.	36,628	445537	0,06	Pentadecanolide
18.	43,593	1098609	0,14	Kaur-16-ene	26.	30,505	413098	0,05	$\delta$ -Cadinene
19.	44,116	1025384	0,13	Hovenidulcoside B1	27.	16,542	406627	0,05	$\alpha$ -Campholene aldehyde
20.	10,520	907028	0,12	$\beta$ -Phellandrene	28.	17,214	379241	0,05	Camphor
21.	12,538	892014	0,11	o-Cymene	29.	9,745	379030	0,05	Verbenene
22.	18,082	711050	0,09	Borneol	30.	8,752	344386	0,04	$\alpha$ -Thujene

Table 2: Comparison of GC-MS results from different articles about *Cedrus atlantica* and the *pendula* variety.

Milad and Güney, 2018- <i>Cedrus atlantica</i> var. <i>pendula</i>	
Components	%
Santolina triene	55,73
$\beta$ -Myrcene	21,63
D-Limonene	8,36
$\beta$ -Pinene	6,62
Camphene	2,11
$\alpha$ -Bisabolol	0,90
D-Germacrene	0,82
$\alpha$ -Terpinolene	0,57
$\beta$ -Himachalene	0,37
$\alpha$ -Himachalene	0,35

Aberchane and Fechtal, 2004, <i>Cedrus atlantica</i>	
Components	%
$\beta$ -Himachalene	40,0
Benzylbenzoate	16,4
Khusimol	9,7
$\beta$ -Vetivenene	8,2
G-dehydroar-himachalene	2,2
Isolodene	1,8
14-hydroxy-murolene	1,2
8,9-dehydro neoisolongifolene	1,2
Elemicin	1,2
$\alpha$ -Calacorene	1,2

Derwich and Benziane, 2010 - <i>Cedrus atlantica</i>	
Components	%
$\alpha$ -Pinene	14,85
Himachalene	10,14
$\beta$ -Himachalene	9,89
$\sigma$ -Himachalene	7,62
cis- $\alpha$ -Atlantone	6,78
Himachalol	5,26
$\alpha$ -Himachalene	4,15
D-Germacrene	3,52
$\beta$ -Caryophyllene	3,14
Cadinene	3,02

Saab and Harb, 2005, <i>Cedrus atlantica</i>	
Components	%
Himachalol	46,32
$\gamma$ -Himachalene	13,95
$\alpha$ -Himachalene	8
$\beta$ -Himachalene	7,03
allo-Himachalol	4,97
(E)- $\gamma$ -Atlantone	1,47
Longiborneol	1,40
$\alpha$ -Himachalene epoxide	0,86
Isolongifolene	0,33

TIC

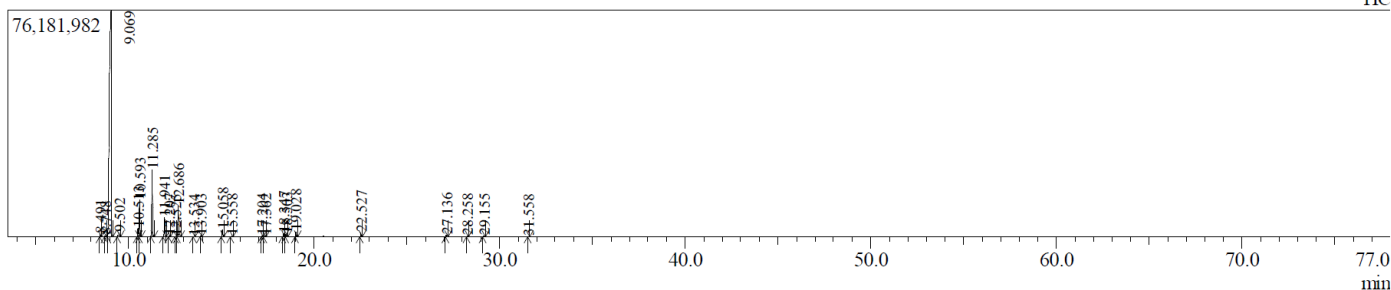


Figure 1. Chromatogram of *Cedrus atlantica* var. *pendula* Carrière

**CONCLUSION**

The aim of the study is to analyze the chemical components present in the essential oil of *Cedrus atlantica* var. *pendula* grown in Blacksea region. Essential oil obtained by means of hydodistillation using clevenger type apparatus were analyzed by (GC-MS) Gas chromatography-mass spectrometry. Thirty compounds were identified and characterized as Santolina triene 55.73 %,  $\beta$ -Myrcene with 21.63 %, D-Limonene 8 % of the total volume. GC-MS results of varieties *pendula* are quite different from *Cedrus atlantica*. Significant differences in major components have been identified.

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