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INSIGHT INTO THE AROMA PROFILE OF TOBACCO COMMERCIAL BLENDS

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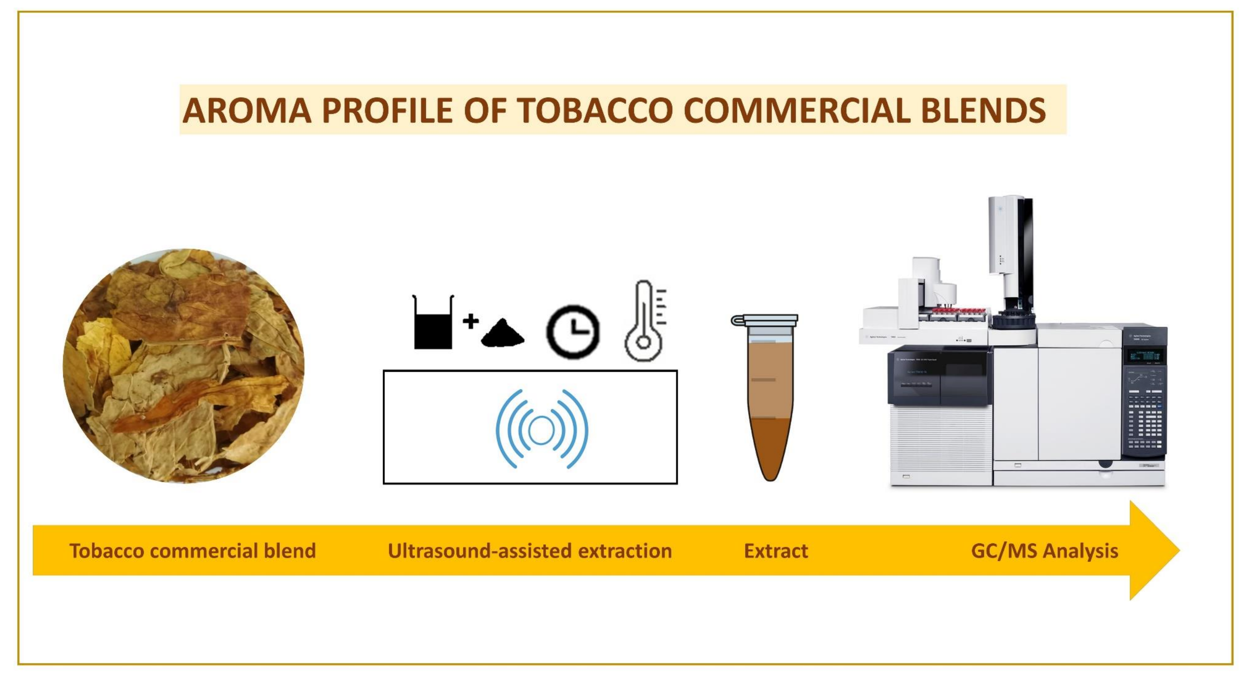
INTRODUCTION

During the past decades investigation of aroma compounds of foods, food ingredients and plant products has attracted considerable research interest. Aroma compounds are present in very low concentration, but they have important influence on flavor and tobacco quality. Tobacco aroma compounds are originated from degraded carotenoids, isoprenoids, mono- and sesquiterpenoids, fatty acid metabolites, phenylalanine and alkaloids, mainly nicotine. Also they can be found in glycosides where they are combined with carbohydrates. Tobacco glycosides are able to release aroma (through breakdown of the glycosidic bond) during tobacco growing and processing, especially during curing and fermentation. Sensory properties such as aroma, flavor and odor are the most important attribute to define consumer acceptance of tobacco and tobacco products. Thus, objectives of this study was to determine aroma profile of tobacco commercial blend.



MATERIALS

TOBACCO COMMERCIAL BLEND

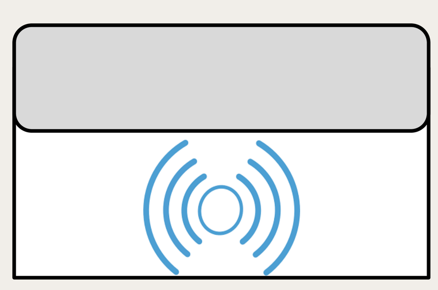
Tobacco commercial blend was obtained in 2019 from tobacco processing factory "Fabrika duhana Sarajevo" (Bosnia and Herzegovina).
Tobacco blend was obtained in dry condition, after industry processing. Samples were kept at ambient temperature at dark and dry place before the extraction. Tobacco blend was pulverized before the extraction (MRC Sample mill C-SM/450-C. Holon, Israel).

Figure 1. Tobacco commercial blend)

ULTRASOUND-ASSISTED EXTRACTION

EXTRACTION

n-Hexane was chosen as the extraction solvent. The extraction was performed in ultrasound-bath Elma, Elmasonic P 70 H (Elma Schmidbauer GmbH, Singen am Hohentwiel, Germany), at constant frequency of 37 kHz and power 50 W. UAE was performed with hexane as the solvent at 3 different temperatures (30, 50 and 70 °C), applying different extraction times (15, 30 and 45 min), and using solvent-solid ratio (10, 20 and 30 mL/g)



ANALYSIS

Qualitative analysis

Gas Chromatography and Mass Spectrometry (GC/MS) was employed for determination of volatile compounds in tobacco commercial blends composed of leaf lamina. The compounds percentage composition was calculated from the GC peak areas using the normalization method (without correction factors) and were calculated as mean values from triplicate GC-MS analyses of all extracts. The structural identification was based on mass data (comparison with available standards and Wiley 09 MS library (Wiley, New York, NY, USA) and NIST14 (Gaithersburg, MD, USA) mass spectral database) and by comparison of GC retention data relative to C9-C25 n-alkanes for HP-5MS column.

Quantification

Before quantitative analysis of nicotine in tobacco extracts by GC-MS, a linear calibration curve of nicotine was prepared using concentration range (20–1000 μg/mL). Linearity of nicotine calibration curve was confirmed by R^2=0.99. The amounts of 4,8,13-duvatriene-1,3-diol and neophytadiene were expressed as nicotine equivalents.

Table 1. Volatile organic compounds composition (%) of tobacco commercial blend obtained at different UAE conditions

No	Compound	RI	RUN																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	2-Methyl-nonane	968	0.1	-	-	-	-	-	-	-	0.3	-	0.3	0.4	-	0.3	0.3	0.3	0.6
2.	Decane	1000	-	-	-	-	-	-	-	-	0.2	-	0.2	0.3	-	-	-	-	-
3.	2,6-Dimethyl-nonane	1026	0.5	1.1	1.0	1.6		0.5	-	0.2	1.1	0.9	1.0	1.4	0.8	1.2	1.0	1.1	1.8
4.	2-Methyldecane	1062	1.0	2.1	2.3	3.9		0.9	-	0.4	2.3	1.8	2.2	3.1	1.8	2.5	2.1	2.1	3.8
5.	2-Methylundecane	1168	-	-	-	-	-	-	-	-	0.3	-	0.3	0.3	-	-	-	-	-
6.	Dodecane	1200	0.2	-	-	-	-	-	-	-	0.5	-	0.5	0.7	0.5	0.6	0.5	0.5	1.0
7.	Tridecane	1300	-	-	-	-	-	-	-	-	0.5	-	0.5	0.6	-	-	-	-	-
8.	Nicotine	1345	57.2	46.7	56.6	49.7	57.3	40.0	71.7	59.6	13.3	40.9	8.3	12.4	37.4	32.3	49.6	45.0	23.6
9.	Tetradecane	1400	-	-	-	-	-	-	-	-	0.7	-	0.6	1.0	0.6	0.8	0.6	0.7	1.0
10.	Pentadecane	1500	-	1.4	1.4	2.4	-	0.7	-	0.3	2.1	1.2	2.2	2.5	1.2	1.8	1.4	1.9	2.4
11.	Hexadec-1-ene	1594	-	-	-	-	-	-	-	-	0.5	-	0.6	0.6	-	-	0.5	-	-
12.	Hexadecane	1600	-	-	-	-	-	-	-	-	0.4	-	0.4	0.5	-	-	-	-	-
13.	Heptadecane	1700	0.7	1.6	1.7	2.2	-	0.8	-	-	1.8	1.4	2.1	2.3	1.2	2.0	1.5	1.4	2.5
14.	Octadec-1-ene	1794	1.5	3.0	3.1	4.5	-	1.5	-	0.5	4.3	2.5	5.1	6.0	2.8	4.5	3.5	3.8	6.8
15.	Octadecane	1800	-	-	-	-	-	-	-	-	0.3	-	0.2	0.3	-	-	-	-	-
16.	Neophytadiene	1841	7.5	6.1	6.3	7.1	6.0	3.6	4.0	5.4	3.9	4.5	4.1	5.3	5.4	6.8	6.3	6.8	8.1
17.	Diisobutyl phthalate	1869	0.9	1.9	2.2	2.1	0.8	2.1	1.0	0.6	0.9	2.2	0.8	0.9	0.7	2.0	1.3	1.8	2.6
18.	Eicos-1-ene	1995	-	-	-	-	-	-	-	-	0.8		1.1	1.3	0.6	1.2	1.2	0.8	1.5
19.	Octadecanal	2020	0.2	-	-	-	-	-	-	-	0.6	0.7	0.8	0.9	0.7	1.1	0.6	0.8	1.1
20.	10-Methyleicosane*	2079	-	7.1	-	-	-	18.2	-	0.9	8.3	-	0.2	0.3	14.6	-	-	-	-
21.	Heneicosane	2100	-	-	-	-	-	-	-		0.3	-	3.0	2.8	-	-	-	-	-
22.	Docos-1-ene	2185	1.4	2.3	3.0	3.6	0.1	1.1	-	0.6	3.3	2.5	4.4	5.0	2.7	4.0	3.2	3.6	6.0
23.	Docosane	2200	0.6	-	-	-	2.4	-	-	1.9	-	-	0.1	-	-	-	-	-	-
24.	4,8,13-duvatriene-1,3-diol	2217	14.1	9.8	11.5	9.9	12.5	5.1	7.1	9.6	7.6	8.6	7.5	10.2	8.9	11.2	13.0	10.7	11.7
25.	Tricosane	2300	1.3		2.1	-	6.3		13.2	11.0	8.9	25.8	3.0	-	-	10.4	-	0.5	-
26.	Tetracosane	2400	2.4	9.1	-	-	14.1	23.0	3.0	5.5	-	-	-	0.9	10.3	-	-	1.3	-

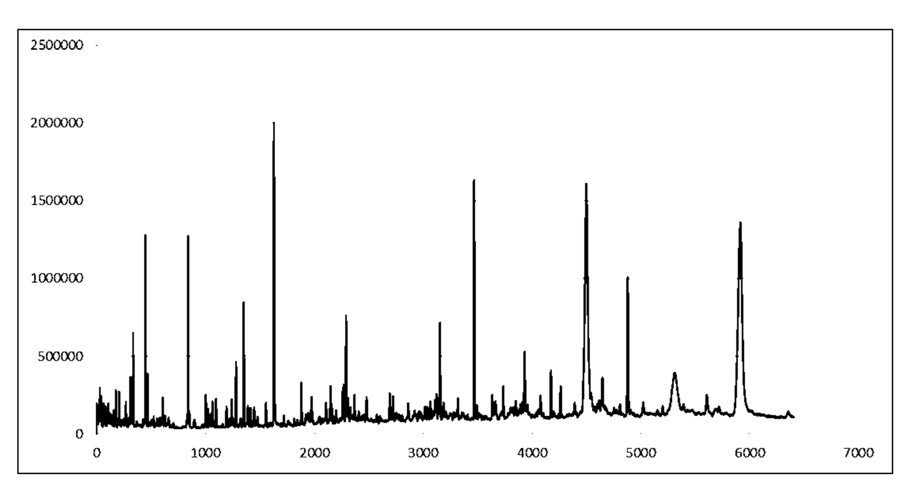


Figure 2. GC-MS chromatogram obtained under UAE condition of 50 °C, 10 min, 10 mL/g

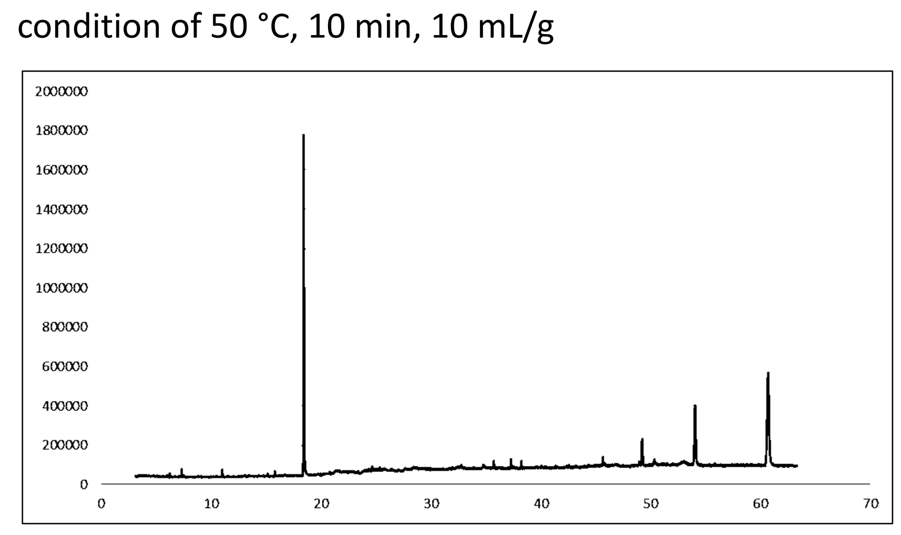


Figure 3. GC-MS chromatogram obtained under UAE condition of 70 °C, 30 min, 30 mL/g

Table 2. The quantificated content of nicotine, 4,8,13-duvatriene-1,3-diol and neophytadiene in tobacco commercial blend

Run	Nicotine (mg/g_{dw})	4,8,13-duvatriene-1,3-diol ($mg_{EQnicotine}/g_{dw}$)	Neophytadiene ($mg_{EQnicotine}/g_{dw}$)
1	0.4943	0.1218	0.0648
2	0.2638	0.0354	0.0345
3	0.3089	0.0628	0.0644
4	0.1848	0.0368	0.0264
5	0.4230	0.0923	0.0443
6	0.4269	0.0544	0.0384
7	0.6589	0.0652	0.0368
8	0.7984	0.1286	0.0723
9	0.1723	0.0985	0.0505
10	0.2903	0.0610	0.0319
11	0.1277	0.1154	0.0631
12	0.4032	0.3317	0.1723
13	0.3247	0.0773	0.0469
14	0.2042	0.0708	0.0430
15	0.3858	0.1011	0.0490
16	0.3839	0.0913	0.0580
17	0.1037	0.0514	0.0356

*dw- dry weight,
EQ- equivalents

CONCLUSIONS

Nicotine, neophytadiene and 4,8,13-duvatriene-1,3-diol were dominant compounds in all aroma profiles. Besides major compounds, tobacco blends contained variety of strait chain alkanes such as decane, dodecane, tridecane, tetradecane, pentadecane, hexadecane, heptadecane, octadecane, heneicosane, docosane, tricosane and tetracosane. Aroma is the most important attribute to define consumer acceptance of tobacco and tobacco products. Therefore, results obtained in this research could have further applications in the tobacco industry, but cosmetics and fragrance industry as well.

ACKNOWLEDGEMENT

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