APTEFF, 39, 1-212 (2008)
DOI: 10.2298/APT0839085V
UDC:634.747:635.076:543.645
BIBLID: 1450-7188 (2008) 39, 85-90
Original scientific paper

CHEMICAL CHARACTERISTICS OF CULTIVATED ELDERBERRY FRUIT

Jelena J. Vulić, Ljubo O. Vračar and Zdravko M. Šumić

This work is consered with the processing value of Elderberry fruit (berries) from domestic plantation selection (Horgoš region). Chemical analyses of reference parameters (dry matter, acidity, pectin, pectic acid, protopectin, Ca-pectat, ash, cellulose, total and reducing sugars, mineral substances, proteins and aminoacids, surface colour, anthocyanins and vitamin C) confirmed high nutritional and physiological value of samples and full validity of work on this selection and production in plantation conditions.

KEYWORDS: Elderberry, berries, chemical composition, colour, mineral substances

INTRODUCTION

Elderberry (*Sambucus nigra*) grows in Europe and Western Asia (with black berries). Both, flowers and berries can be made into elderberry wine. The berries are best not eaten row as they are mildly poisonous, causing vomiting. The mild toxicity is destroyed by cooking. The berries can also be made into jam, pies and sauces. All green parts are poisonous, containing cyanogening glycosides. The flowers may be used to make an herbal tea, which is believed to be remedy for colds and fever. In Europe, flowers are made into syrup or juice (in Romania - sokata), which is diluted with water before drinking (1, 2, 3).

Fruit and fruit products are very important in quality human nutrition. They are an irreplacable source of indispensable substances (structural, energetic and protective) in human body. Biological value of the fruit is in high level of vitamins, minerals, pectins, colour, cellulose, dietetic fibres, sugars, organic acids and low energetic value. Because of all this, consuming of fruit and fruit products is favourable in everyday life.

EXPERIMENTAL

Cultivated elderberry berries (*Sambucus nigra*) were collected from Horgoš region.

Dry matter, ash content, acidity (citric acid equivalent) (4), mineral substances, cellulose, sugar were done according to valid regulations (5).

Pectin content and Ca-pectat were determined gravimetrically (6, 7).

Vulić J. Jelena, BSc., Dr. Vračar O. Ljubo, Assoc. Prof., Šumić M. Zdravko, B.Sc.; University of Novi Sad, Faculty of Technology, Bul. Cara Lazara 1, Novi Sad, Serbia

APTEFF, 39, 1-212 (2008) UDC:634.747:635.076:543.645
DOI: 10.2298/APT0839085V BIBLID: 1450-7188 (2008) 39, 85-90
Original scientific paper

Surface colour was measured using a tristimuli photocolorimeter MOM color 100. Measurings were done on sample 1 (original sample), sample 2 (original sample dilluted to the concentration of 50%) and sample 3 (original sample dilluted to the concentration of 30%).

Surface colour measurement is a method for describing the colour changes closest to sensory (visual) perception, i.e. the changes that can be noticed by observation. The CIELab colour space is the most widly used system today, which give the characteristics of colour in different systems (CIEnormal, CIELab, ANLab, Hunter). The elements of the perceived colour are lightness (L), hue(h) and chroma, and they are determined from the L*, a*, b* coordinates.The hue and chroma colour aspects are easier to conceptualize than a* and b* values. A sample with hue angle of 0˚ is purplish-red, 90^o is yellow, 180^o is bluish-green and 270˚ is blu (8).

Anthocyanins were assayed according to valid regulation (9).

Proteins and aminoacids were measured on an aminoanalyzer.

RESULTS AND DISCUSSION

Chemical composition of investigated Elderberry berries is presented in Table 1.

Table 1. Chemical composition of Elderberry berries

Chemical parameter	Result
DM (%)	20.22
Total sugar (%)	8.88
Reducing sugar (%)	8.55
Sucrose (%)	0.33
Pectin (%)	0.1593
Pectic acid (%)	0.2299
Protopectin (%)	0.0409
Ca-pectate(%)	1.53
Cellulose (%)	1.65
Total acidity (%citric acid)	1.3
Ash (%)	0.915
Anthocyanins (mg/l)	863.89
Polymerized colour (%)	0.0253
Vitamin C (mg/100g)	34.10

Results of chemical analyses are in accordance to the available literature, so elderberry berries from domestic selection are highly valuable. The cellulose content is very important in lowering the risk of developing type II diabetes, heart desease, etc. It may also help preventing high cholesterol and fighting obesity.

High-fiber foods help move waste throught the digestive tract easier and faster, reducing strain and limiting contact between potentially harmful substances and gastrointestinal tract (3). Based on the obtained results shown in Table 1, it can be concluded that elderberry is a rich source of naturally important compounds.

Ash content may be one of criteria for astimation of biological value and hygienic safety. Also, the content of anthocyanins and vitamin C is very high, thanks to which this plant can exibit antioxidant and anticancer activity. Anthocyanins are a group of naturally occurring phenolic compounds responsible for the attractive colour of many fruits and vegetables. They are potent antioxidants in vitro. Elderberries and especially elderberry juices are rich dietary sources of these plant pigments.

Mineral substances are present as salts of organic or inorganic acids or as complex organic combinations. They are in many cases dissolved in cellular juices (10). Contents of mineral substances in Elderberry berries are presented in Table 2.

Table 2. Mineral substances content in Elderberry berries (mg/100g)

Mineral substances (mg/100g)	Results
K	391.33
P	54.00
Ca	28.06
Na	2 17
Mg	25.99
Fe	1.86
Zn	0.36
Mn	0.27
Cu	0.14

Results of instrumental determination of colour in Elderberry berries expressed in the CIE, CIELab, ANLab and Hunter systems are presented in Table 3.

On the basis of values for chromaticity coordinate a (red component) is the highest in sample 3 (10.53) and b (yellow component) are very low. Colour difference values (ΔE_{ab}) is the highest in the sample 3 (84.44). CIELab parameters are according to ANLab and Hunter parameters. CIEnormal parameter $d\Lambda$ for all 3 samples is almost the same, it is in the non-spectral part (11). Colour clearance is the highest in sample 3 (25%). Chroma values are according to colour clearance in CIE and Hue and Hue angle (h°=arctanb*/a*) with a and $\Delta E_{ab.}$

Table 3. Instrumental determination of colour

Characteristic		Sample 1	Sample 2	Sample 3
Trichromatic values	X_1	2.08	1.41	1.07
	X_2	0.43	0.27	0.18
	Y	2.4	1.43	0.96
	Z	2.51	1.61	1.09
CIELab	a	6.4	7.53	10.53
	b	0.99	0.78	0.56
	L	16.69	12.15	8.65
	ΔL	-75.95	-80.1	-83.6

UDC:634.747:635.076:543.645
BIBLID: 1450-7188 (2008) 39, 85-90
Original scientific paper

Table 3. Continuation

CIELab	ΔH_{ab}	5.96	6.5	7.72
	ΔE_{ab}	75.95	80.59	84.44
	ΔC_{AB}	4.96	6.05	9.02
ANLab	A	6.06	7.1	9.53
	B	0.94	0.72	0.48
	L	15.08	10.8	7.64
	ΔE_{AN}	70.05	74.41	77.86
Hunter	a_{hu}	3.74	4.15	5.62
	b_{hu}	0.53	0.36	0.26
	L_{hu}	14.96	11.95	9.79
	ΔE_{hu}	75.35	78.38	80.65
CIE-normal	X	0.35	0.36	0.38
	Y	0.31	0.30	0.29
	dΛ (nm)	494	495	496
	Y (%)	2.24	1.43	0.96
	Č (%)	10.1	16.7	25
Psychromatic characteristics	C (hroma)	6.48	7.57	10.54
	Hue	6.46	9.65	18.80
	Hue angle (^{o})	8.79	5.91	3.04

Elderberry berries have a high level of protein content of 2.84 g/100ml and amino acid content is presented in Table 4. The investigated sample has 7 essential amino acids.

Table 4. Amino acid content

Amino acid %		Results
Lys		0.091
Ala		0.238
Thr		0.071
Gly		0.073
Val		0.165
Ser		0.174
Pro		0.092
Ile		0.085
Leu		0.205
Met		0.025
His		0.062
Phe		0.123
Glu		0.311
Asp		0.303
Cys		0.008
Tyr		0.198
Protein content	g/100ml	2.84

CONCLUSION

Elderberry berries investigated in this work show very rich chemical composition. High level of protein content and presence of seven essential amino acids are very important parameters which have protective influence in many chronic degenerative diseases.

The present study demonstrated the high content of anthocyanins, vitamin C, mineral content and pectin substances of elderberry originated from Serbia. All of these results show that the elderberry extracts can be used as easily accessible source of natural components and as a possible food supplement.

Rich chemical composition of Elderberry berries is a good stimulant for cultivated production in field conditions. Also, the food industry can produce a wide range of high-quality Elderberry products.

REFERENCES

1. Mratinić, E., Kojić, M.: Samonikle vrste voćaka Srbije, Institut za istraživa nja u poljoprivredi, Beograd (1998).
2. http://www.kirka.co.yu/kirkapharma/lekovitobilje/zova.htm
3. http://www.wikipedia.org
4. Ćirić, D., Vujičić, B., Badrić, Ž.: Priručnik za kontrolu kvaliteta sirovina i proizvoda od voća i povrća, Tehnološki fakultet, Novi Sad (1974).
5. Vračar, Lj.: Priručnik za kontrolu kvaliteta svežeg i prerađenog voća, povrća i pečurki i bezalkoholnih pića, Tehnološki fakultet, Novi Sad (2001).
6. Pravilnik o kvalitetu voćnih sokova, koncentrisanih voćnih sokova, voćnih nektara, voćnih sokova u prahu i srodnih proizvoda, Službeni list SRJ 33/1995.
7. Pravilnik o metodama uzimanja uzoraka i vršenja hemijskih i fizičkih analiza radi kontrole kvaliteta proizvoda od voća i povrća, Službeni list SFRJ 29/83.
8. Wall, M. M., and P.W. Bosland: Analytical methods for colour and pungency of chiles (capsicums), in Instrumental methods in Food and Beverage Analyces. Eds. D. Wetzel and G. Charalambous, Elsevier Science B. V. (1998) pp.347-373.
9. Giusti, M. M., Wrolstad, R. E.: Characterization and Measurement of Anthocyanins by UV-Visible Spectroscopy, in Current Protocols in Food Analytical Chemistry, John Wiley & Sons, New York (2001).
10. Mircea Enachescu Dauthy: Fruit and vegetable processing, FAO Agricultural Services Bulletin No. 119, Food and Agriculture Organization of the United Nations, Rome (1995) Ch II.
11. Popov-Raljić, J.: Tehnologija i kvalitet gotove hrane, Tehnološki fakultet, Novi Sad (1999).
12. Karlson, P.: Biokemija za studente kemije i medicine, Školska knjiga, Zagreb (1993).
13. Prior, R.L.: Fruits and vegetables in the prevention of cellular oxidative damage, American Journal of Clinical Nutrition **78** (Suppl.) (2003) 570-578.

APTEFF, 39, 1-212 (2008)
DOI: 10.2298/APT0839085V
UDC:634.747:635.076:543.645
BIBLID: 1450-7188 (2008) 39, 85-90
Original scientific paper

ХЕМИЈСКЕ КАРАКТЕРИСТИКЕ КУЛТИВИСАНОГ ПЛОДА ЦРНЕ ЗОВЕ

Јелена Ј. Вулић, Љубо О. Врачар и Здравко М. Шумић

Бобичасти плодови црне зове из домаће селекције анализирани у овом раду показали су богати хемијски састав. Одређени висок садржај протеина и присуство седам есенцијалних аминокиселина доприносе високом протективном ефекту овога плода, код многих хроничних дегенеративних болести.

Резултати испитивања приказани у овоме раду указују на висок садржај антоцијана, витамина Ц, минералних и пектинских материја плодова црне зове пореклом из Србије. Добијене вредности хемијских анализа потврђују да се екстракти црне зове могу користити као извор природних активних једињења и као могући нутритивни додатак прехрамбеним производима.

Хемијске анализе на референтне параметре потврђују високу нутритивно-физиолошку вредност узорака и потпуну оправданост ангажовања на овој селекцији и производњи у плантажним условима.

Received 11 July 2008
Accepted 05 October 2008