Electronic Journal of Polish Agricultural Universities is the very first Polish scientific journal published exclusively on the Internet, founded on January 1, 1998 by the following agricultural universities and higher schools of agriculture: University of Technology and Agriculture of Bydgoszcz, Agricultural University of Cracow, Agricultural University of Lublin, Agricultural University of Poznań, Higher School of Agriculture and Teacher Training Siedlce, Agricultural University of Szczecin, and Agricultural University of Wrocław.

ELECTRONIC
JOURNAL
OF POLISH
AGRICULTURAL
UNIVERSITIES

1998
Volume 1
Issue 1
Series
FOOD SCIENCE AND TECHNOLOGY

KALBARCZYK J., JABŁOŃSKA-RYŚ E. 1998. THE INFLUENCE OF SELECTED ENZYMATIC PREPARATIONS ONTO THE YIELD AND CHEMICAL COMPOSITION OF ROOT PARSLEY JUICE. **Electronic Journal of Polish Agricultural Universities**, Food Science and Technology, Volume 1, Issue 1.
Available Online http://www.ejpau.media.pl

THE INFLUENCE OF SELECTED ENZYMATIC PREPARATIONS ONTO THE YIELD AND CHEMICAL COMPOSITION OF ROOT PARSLEY JUICE

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ABSTRACT

This paper presents a method of juice production from two varieties of root parsley with the use of enzymatic preparations. Two preparations PECTINEX BE and ROHAPECT D5-L were used in the study. Yield and chemical composition of juices as a function of the kind and/or dose of each preparation were examined. It was found that the PECTINEX BE offers better effects in comparison to the ROHAPECT preparation. Higher yields of juice were obtained from parsley of the FAKIR variety. This juice exhibited higher contents of dry matter, extract and total carbohydrates. The results of statistical analysis have shown that an increase of enzymatic

preparations did not always result in the significant increase of yield of juice and contents of its selected chemical compounds.

Key words: parsley, enzyme, vegetable juices

INTRODUCTION

Juices made from vegetables demonstrate some advantages in comparison to other drinks. They possess both the high biological, and dietetic values resulting from their chemical composition, which is very close to the composition of the initial raw material. The juices are rich in vitamins, minerals, volatile oils, phytoncides and fibre [3, 14].

Mash juices are produced by heating root vegetables in the temperature of 100°C for 15 - 30 minutes. Such a procedure destroys the structure of plant cells, causes looseness of tissue and, as a result, an increase in the yield of the pulp production is observed. It is also easier to extract pigments and aromatic substances from the pre-heated raw material [14].

However, from the biological point of view, the heating of vegetables should be considered as an undesirable process because of relatively high losses of vitamins, pigments and other valuable substances which are sensitive to the influence of high temperature.

In order to reduce the loss of many compounds and to limit the undesirable influence of heating time on the raw material enzymatic pre-treatment is recommended. In the processing of fruits and the commercial production of juices, enzymes are mostly used. Attempts to apply this method in the production of vegetable juices have also been reported [2,12]. The thermal treatment of vegetables is performed in the temperature of ca 40°C which also offers optimal conditions for activating the majority of enzymes applied [7,11]. In this way, thermal conditions of such treatment are significantly milder in comparison to the conventional process of mash juice production.

The principal aim of this study was to determine the influence of selected enzymatic preparations onto the yield and chemical composition of root parsley juice.

MATERIALS AND METHODS

An attempt to apply enzymatic preparations traditionally used in production of fruit juices to the process of maceration of root parsley tissue was undertaken. Juices were produced using two varieties of root parsley "Berlinska" and "Fakir". Two enzymatic preparations ROHAPECT D5-L (obtained from Röhm Company) and PECTINEX BE (from Novo Nordisk Ferment Company) were used in this study with doses 0.32 and 0.40 ml/0.5 kg of raw material. The juice obtained by means of a traditional method (without enzymatic preparations) was the reference sample.

Parsley juice production: the procedure

Parsley roots were cleaned and peeled. Then parsley roots were cut into ca 1 mm thick chips and portioned per 0.5 kg samples. All samples were treated with 1.3 ml of 50% lactic acid solutions to adjust the pH value equal to 4.5 as an optimal value for enzyme activity. Next enzymatic preparation was added to both samples using the doses 0.32 and 0.40 ml/0.5 kg of raw material. The samples were carefully mixed and incubated in the lab thermostat in the temperature of 45°C for 60 minutes.

Next the vegetable pulp were pressed in the robot machine type KUZ-1 to separate juices. To inactivate all enzymes the juice obtained was heated in water bath in the temperature of 80°C

for 2 minutes and poured out to glass containers. Finally, all juice samples were pasteurised in the temperature of 90°C for 10 minutes.

The following chemical analyses were carried out on obtained juices during the study :
- determining the total extract content by means of the refractometric method [8],
- determining the total carbohydrates content using the Samogyi Nelson method [13],
- determining the total acidity juice converted to the lactic acid content using the method of titration and indicator [10],
- determining the dry matter content; samples were dried to constant weight at 105°C [9]
- determining the pectins content by the method according to Gaponenkow [4].

All determinations were performed using three replications. The obtained results were evaluated statistically using a method of variance analysis.

Enzymatic activity of preparations was determined according to the Deuel's method (the pectinolytic activity using Kyzlink's formula modified by Strimsk [15]) and the Bernat's method (the cellulolytic activity) [1].

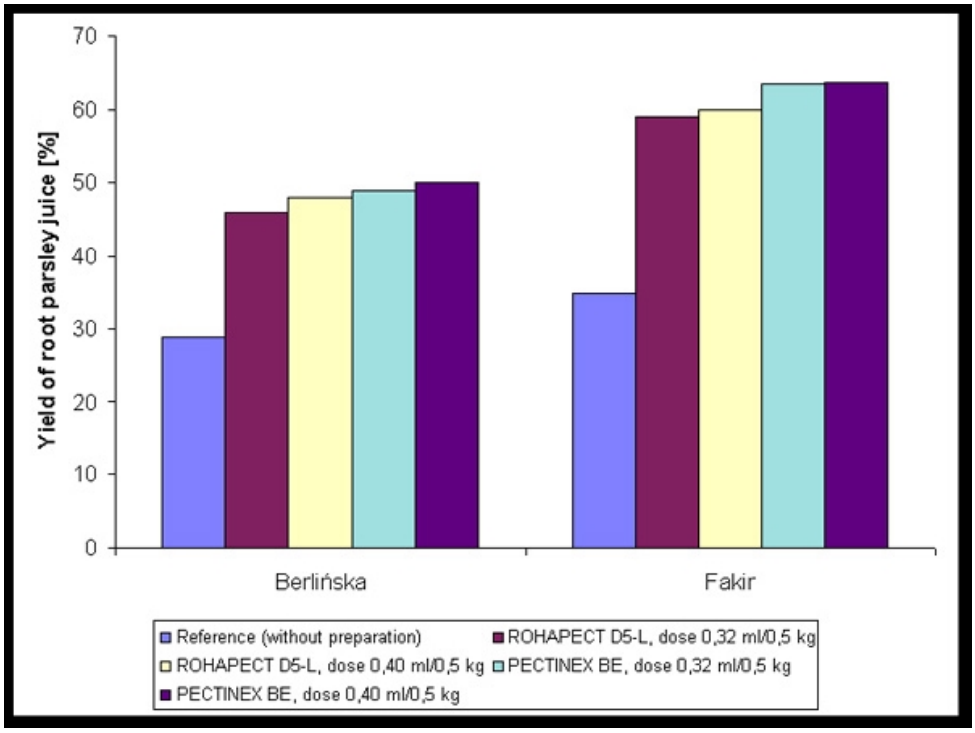
RESULTS

The results of juice yield determination and chemical analyses are presented in tables. In Tables 2 - 7 the following combinations of enzymatic preparations were considered as an "A" factor:

1. reference (without preparation)
2. ROHAPECT D5-L, dose 0.32 ml / 0.5 kg of raw material
3. ROHAPECT D5-L, dose 0.40 ml / 0.5 kg of raw material
4. PECTINEX BE, dose 0.32 ml / 0.5 kg of raw material
5. PECTINEX BE, dose 0.40 ml / 0.5 kg of raw material

Parsley varieties were defined as a "B" factor.

Fig. 1. Yield of root parsley juice



On the basis of the analyses conducted during this study it can be stated that both preparations were characterised by the similar values of pectinolysis activity as well as cellulolysis activity. The results of juice yield determination, measured after pressing of the pre-treated raw material, indicated the PECTINEX BE preparation as more effective in comparison to the ROHAPECT D5-L preparation. Even though, the pectinolysis activity of the PECTINEX preparation was 40000 unit lower that the activity of ROHAPECT preparation, it was possible to achieve higher juice yields using this preparation from both of examined parsley varieties. Thus can be explained by higher cellulolytic activity of the preparation which is the reason for better final maceration of the raw material [6].

Table 1. Pectinolytic and cellulolytic activity of applied enzymatic preparations

Preparation	Pectinolytic activity [^{0}PM]	Cellulolytic activity [g]
Rohapect D5-L	150000	670
Pectinex BE	110000	740

A significant difference in juice yields with respect to parsley variety was observed. Both in the reference juice sample and in the samples produced with the addition of enzymatic preparations higher values of juice yield was found by the FAKIR variety. Additionally, more beneficial chemical composition (higher contents of dry matter, extract and carbohydrates) indicated that this variety was more attractive for commercial production of parsley juice [5].

Table 2. Yield of parsley juice (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley variety	Fakir parsley variety	Mean value (preparation or reference sample)
Control sample	-	29.2	34.0	31.6
Rohapect D5-L	0.32	46.0	59.0	53.1
	0.40	47.4	60.0	
Pectinex BE	0.32	48.4	63.0	55.9
	0.40	49.0	63.3	
Mean value (variety)	-	44.0	55.86	-

An increase of the PECTINEX BE dose did not have a statistically significant effect on the juice yield.

Table 3. Total extract content in juices (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley	Fakir parsley	Mean value (preparation or reference sample)
Control sample	-	13.5	14.5	14.0
Rohapect D5-L	0.32	14.0	15.0	14.8
	0.40	14.5	16.0	
Pectinex BE	0.32	14.0	15.0	14.8
	0.40	14.5	16.0	
Mean value (variety)	-	14.1	15.3	-

The results of chemical analysis indicated changes depending on the kind of the preparation applied for the juice production. Generally, it was observed that the use of enzymatic preparation resulted in increasing tendency of the extract content (equal to 0.5 -1.5%), while the carbohydrates contents were ca 0.20 - 0.45% higher in comparison to the references samples. The extract content increased statistically significantly when the dose of enzymatic preparations increased, however the kind of preparations did not affect the extract content in the examined juices. The application of enzymatic preparations caused a significant increase of total carbohydrates content in juices in comparison to the reference samples. The further increase of preparation dose resulted in an increase of carbohydrates content, but these differences were not statistically significant.

Table 4. Total acidity of juices (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley	Fakir parsley	Mean value (preparation or reference sample)
Control sample	-	0.36	0.36	0.36
Rohapect D5-L	0.32	0.36	0.35	0.355
	0.40	0.36	0.35	
Pectinex BE	0.32	0.36	0.36	0.37
	0.40	0.38	0.38	
Mean value (variety)	-	0.364	0.36	-

The content of the dry matter in juices obtained by the use of enzymatic preparations was higher then that in the control sample and it increased with the increase of the doses of preparations.

Table 5. Dry matter content in juices (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley	Fakir parsley	Mean value (preparation or reference sample)
Control sample	-	22.75	23.25	23.0
Rohapect D5-L	0.32	23.23	24.08	23.89
	0.40	23.76	24.52	
Pectinex BE	0.32	24.66	25.72	25.3
	0.40	24.90	25.93	
Mean value (variety)	-	23.86	24.7	-

Both of the preparations applied caused the reduction of pectins content in the examined juices with the highest reduction in the juice obtained from parsley var. "Berlinska". Almost double loss in the content of pectins was observed in the sample of juice obtained by the PECTINEX BE preparation, while in the juice from parsley "FAKIR" the same level of pectin content reduction was observed in juice samples obtained by the ROHAPECT D5-L preparation. In both cases an increase in the preparation dose had a statistically significant effect on the content of pectins in examined juices.

Table 6. Carbohydrates content in juices (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley	Fakir parsley	Mean value (preparation or reference sample)
Control sample	-	6.00	7.00	6.50
Rohapect D5-L	0.32	6.20	7.25	6.73
	0.40	6.25	7.25	
Pectinex BE	0.32	6.20	7.30	6.81
	0.40	6.30	7.45	
Mean value (variety)	-	6.19	7.25	-

The acidity of juice changed only slightly and it is difficult to notice a relationship between the dose of enzymatic preparation and the content of the organic acids. Only the PECTINEX BE preparation applied in the dose of 0.40 ml/ 0.5 kg of raw material caused statistically significant increase of juice acidity.

Table 7. Pectin content in juices (%)

Preparation	Preparation dose [ml/0.5kg]	Berlińska parsley	Fakir parsley	Mean value (preparation or reference sample)
Control sample	-	0.94	0.81	0.87
Rohapect D5-L	0.32	0.91	0.70	0.70
	0.40	0.79	0.41	
Pectinex BE	0.32	0.81	0.80	0.70
	0.40	0.49	0.71	
Mean value (variety)	-	0.78	0.68	-

CONCLUSIONS

1. The juice obtained from parsley root var. FAKIR was characterised by more beneficial chemical composition, that is by higher contents of dry matter, extract and carbohydrates.

2. Higher yields of juices from parsley root of both varieties were observed when the PECTINEX BE enzymatic preparation was applied. An increasing dose of this preparation did not have a statistically significant effect on the yield of juice.

3. Enzymatic preparations applied in this study caused an increase of the contents of dry matter, extract and carbohydrates in examined juices. Further increase of the preparation doses resulted in the further increase of dry matter, and the extract content.

4. The enzymatic preparations applied in this study did not affect the acidity of juices, except for juices obtained with PECTINEX BE preparation with the dose equal to 0.40 ml/ 0.5 kg of raw material where a statistically significant increase in the juice acidity was observed.

5. In the samples of juices obtained with enzymatic preparations the reduction of pectin content was found, in particular when higher doses of preparations were applied.

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Submited: 13.11.1998

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