

# Biotransformation of chemical components of rare cultures under the action of the enzyme preparation Trenolin Opti DF

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**Abstract.** The technological process of processing rare crops requires the use of enzyme preparations to soften the pulp and destroy the structure of polysaccharides, as well as increase the content of sugars, namely glucose and sucrose. Biochemical indicators of the quality of the fruits of krebs and chenomelys in the varietal section have been determined. The effect of the enzyme preparation - Trenolin Opti DF on the extraction of vitamins and polyphenolic substances has been investigated. The effectiveness of the enzyme preparation was judged by the biotransformation of the chemical components of the crushed mass from the fruits of rare crops. The effect of the enzyme preparation on the output and quality of fruit juice has been established.

## 1 Introduction

On the territory of the Krasnodar Territory, significant areas are occupied by fruit and berry plantations, among which grow such rare crops as krebs, chenomelis, sea buckthorn. Little-studied fruits of chenomelys and krebs that grow are rarely used in canneries due to the hard pulp and size of the fruit. The problem of not fully using the potential of the orchard is relevant [1-3]. The fruits of krebs and chenomelys are characterized by a high content of vitamin C and P, polyphenolic and aromatic substances. Vitamins C and P, are synergistic a bonded pair that creates a chain of redox transformations. Usually, both vitamins are found in fruits together, and, as a rule, the more one of them is contained, the more of the other. Thus, the high content of flavonoids, which include vitamin P, protects vitamin C from oxidation, and its content in the finished product is not lost and retains its properties during the shelf life. The fruits of krebs and chenomelys also contain a significant amount of fiber, which prevents a faster release of juice during processing. Fiber - polisaccharide of a high degree of polymerization, with high chemical resistance. With fiber and hemicellulose, protopectin forms complexes that are insoluble in water, but easily amenable to acidic and enzymatic hydrolysis to obtain pectin for further cleavage of methoxyl groups and the formation of methyl alcohol and polygalacturonic (pectic) acid under the action of diluted alkalis or the enzyme pectinesterase. After that, polygalacturonic acid breaks down into

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galacturonic acid molecules under the action of the enzyme polygalacturonase. To increase the yield and quality of fruit juice, canneries use pectolytic enzyme preparations that reduce the water-retaining capacity of cells to secrete juice [4-8]. Enzyme preparations contribute to the breakdown of pectin substances, which makes it easier to press the crushed fruit mass and increase the juice yield and its quality (the amount of sediment decreases) [4, 9-11].

The purpose of this work is to study the possibility of improving the efficiency of processing the fruits of rare crops under the influence of biotransformation of the components of raw materials using an enzyme preparation (AF) - Trenolin Opti DF, which promotes the conversion of biologically active substances.

## 2 Materials and Methods

Objects of research: fruits of chenomelys (varieties: Apple, Large-fruited), krebs (varieties: Ranetka Kubanskaya, Ranetka Krupnaya), grown in the conditions of the south of Russia; enzyme preparation Trenolin Opti DF.

All laboratory studies were performed on the equipment of the CCU (Center for Collective Use) with technological equipment in the following areas: physiological, biochemical and microbiological studies; food safety according to generally accepted methods and GOSTs. When studying the qualitative indicators of the fruits of rare crops, they determined: soluble dry substances - according to GOST ISO 2173-2013 with a digital refractometer PAL-3 (ATAGO); total sugars - by photometric method on the photoelectrocolorimeter KPK-3-01 according to GOST 8756.13-87; fractional composition of sugars (D-glucose and D-fructose and sucrose) - according to GOST R 51440-99; vitamin C - titrimetrically according to GOST 24556-89; vitamin P - colorimetric method in the modification of L.I. Vigorov with vanillin reagent; pectin substances - carboxol according to the Sapozhnikova method. The results were statistically processed using Microsoft Office Excel.

## 3 Results and Discussion

To implement the tasks, the fruits of apples-krebs, chenomelys in the varietal section according to biochemical quality indicators were studied.

Dry substances and sugars are important for food canneries, thanks to which it is possible to judge the quality of the processed raw materials, and the consumption rates of prescription components (granulated sugar) [12-14] (Table 1).

Unlike the fruits of krebs, chenomelys is characterized by a high content of acids (5.0 - 5.5%), regardless of varietal characteristics, the fruits are characterized by a low saccharic acid index and have a very sour taste [18].

**Table 1.** Chemical indicators of the quality of fruits of rare crops

| Name Sample              | Dry Substances, % | Sugar, % | Acidity, % | S/c Index, o.e. |
|--------------------------|-------------------|----------|------------|-----------------|
| <b>Fruits of krebs</b>   |                   |          |            |                 |
| Ranetka Kubanskaya       | 19.32             | 13.53    | 1.04       | 13.64           |
| Ranetka Large            | 21.02             | 14.70    | 1.02       | 14.12           |
| <b>Chenomelys fruits</b> |                   |          |            |                 |
| Apples                   | 8.64              | 3.32     | 5.80       | 0.60            |
| Large-fruited            | 7.36              | 2.84     | 5.02       | 1.02            |

The fruits of krebs and chenomelys are rarely used for processing due to the presence of a dense skin and hard pulp. Enzymatic treatment of the crushed mass with the drug Trenolin Opti DF - a highly active pectinase concentrate purified from undesirable depectinase activity, made it possible to reduce the technological process by destroying the solid structure of the fruit, as well as to increase the yield of biologically active substances [15-17].

Laboratory studies have shown changes in the fractional composition of sugars after enzymatic hydrolysis with Trenolin Opti DF. Changes in the fractional composition of sugars in the fruits of rare crops are presented in Table 2.

**Table 2.** The content of sugars in the crushed mass of fruits of rare crops

| Cherry juice               | Content, mg/100 g |          |            |       |
|----------------------------|-------------------|----------|------------|-------|
|                            | glucose           | fructose | saccharose | Total |
| <b>Fruits of krebs</b>     |                   |          |            |       |
| Variety Ranetka Kubanskaya |                   |          |            |       |
| Control                    | 7.22              | 5.40     | 0.91       | 13.53 |
| Processed Trenolin Opti DF | 7.60              | 5.42     | 1.04       | 14.06 |
| Variety Ranetka large      |                   |          |            |       |
| Control                    | 7.30              | 6.20     | 1.20       | 14.70 |
| Processed Trenolin Opti DF | 7.62              | 6.34     | 1.36       | 15.32 |
| <b>Chenomelys fruits</b>   |                   |          |            |       |
| Apple variety              |                   |          |            |       |
| Control                    | 1.80              | 1.30     | 0.22       | 3.32  |
| Processed Trenolin Opti DF | 2.02              | 1.32     | 0.46       | 3.80  |
| Large-fruited variety      |                   |          |            |       |
| Control                    | 1.70              | 1.02     | 0.12       | 2.84  |
| Processed Trenolin Opti DF | 1.92              | 1.10     | 0.32       | 3.34  |

As a result of enzymatic hydrolysis of the crushed mass of the fruits of krebs and chenomelys, an increase in glucose and sucrose by 14.0 - 16.0% in the fruits of krebs and by 12.0 - 15.0% in the fruits of chenomelys was noted. The effectiveness of the enzyme preparation was judged by the biotransformation of the chemical components of the crushed mass from the fruits of rare crops.

The control sample for the experiments used crushed fruits obtained under the same conditions, without the introduction of the enzyme preparation Trenolin Opti DF (Table 3).

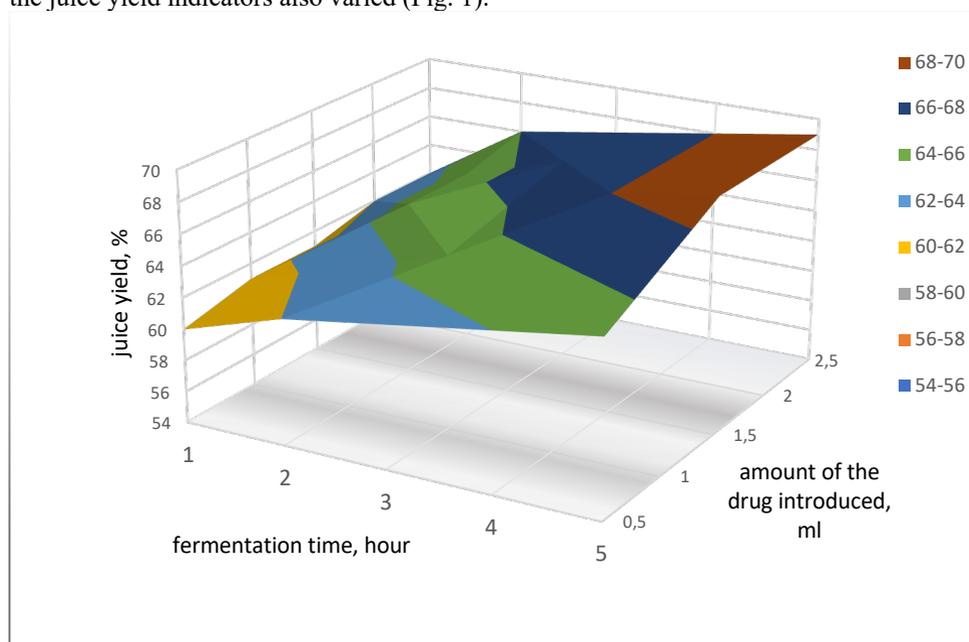
**Table 3.** Biologically active substances content in crushed mass

| Crushed fruits of rare crops | Vitamin C, mg/100g | Vitamin P, mg/100 g | Total half-phenols, mg/100 g | Soluble pectin, % |
|------------------------------|--------------------|---------------------|------------------------------|-------------------|
| <b>Fruits of krebs</b>       |                    |                     |                              |                   |
| Variety Ranetka Kubanskaya   |                    |                     |                              |                   |
| Control                      | 4.72               | 225.84              | 650.42                       | 0.30              |
| Processed Trenolin Opti DF   | 4.70               | 230.22              | 674.80                       | 0.45              |
| Variety Ranetka large        |                    |                     |                              |                   |
| Control                      | 3.40               | 208.86              | 534.82                       | 0.38              |
| Processed Trenolin Opti DF   | 3.36               | 211.42              | 566.02                       | 0.52              |
| <b>Chenomelys fruits</b>     |                    |                     |                              |                   |
| Apple variety                |                    |                     |                              |                   |

|                               |        |        |        |      |
|-------------------------------|--------|--------|--------|------|
| Control                       | 113.28 | 289.80 | 768.20 | 1.02 |
| Processed<br>Trenolin Opti DF | 114.80 | 321.92 | 800.42 | 1.24 |
| Large-fruited variety         |        |        |        |      |
| Control                       | 118.68 | 324.64 | 816.80 | 0.98 |
| Processed<br>Trenolin Opti DF | 120.02 | 352.80 | 858.22 | 1.15 |

Due to the wide spectrum of action of the enzyme preparation, during the experiments conducted, an increase in the extraction of biologically active substances was noted after using a 15% solution of the enzyme Trenolin Opti DF in an amount of 2 ml at 4 hour hydrolysis, due to the liquefaction of the crushed mass of chenomelys fruits and krebs [18-19].

Depending on the dose content of the drug Trenolin Opti DF and the time of its action, the juice yield indicators also varied (Fig. 1).



**Fig. 1** The effect of the enzyme preparation on the juice yield from the fruits of chenomelys

An increase in the yield of juice from the fruits of chenomelys of more than 65% was established. after applying a 15% solution of the enzyme Trenolin Opti DF in an amount of 2 ml per 1 kg for 6 hour hydrolysis.

## 4 Conclusion

As a result of biotransformation of chemical components of rare cultures under the action of the enzyme preparation Trenolin Opti DF, an increase in polyphenolic substances by 17-20%, vitamin *P* by 14-16.5%, vitamin *C* by 11-20%, soluble pectin by 20-35% was noted. Vitamins *C* and *P* are a synergistic bound pair of elements that creates a chain of redox transformations. The high content of vitamin *P* protects vitamin *C* from oxidation, and its content in the finished product is not lost and retains its properties during the shelf life. Laboratory studies

have also shown an increase in glucose and sucrose by 14.0 - 16.0% in the fruits of krebs and by 12.0 - 15.0% in the fruits of chenomelys. There was an increase in the extraction of biologically active substances after using a 15% solution of the enzyme Trenolin Opti DF in an amount of 2 ml per 1 kg at 4 hour hydrolysis, due to the liquefaction of the crushed mass of chenomelys fruits and krebs.

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