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ASPECTE PRIVIND INFLUENȚA ATMOSFEREI MODIFICATE ASUPRA STOCĂRII PE TERMEN SCURT A COACĂZELOR NEGRE

ASPECTS REGARDING THE INFLUENCE OF THE MODIFIED ATMOSPHERE ON THE SHORT-TERM STORAGE OF BLACKCURRANTS

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Abstract

A number of previous studies have established that the transport and storage of fruits at low temperatures are insufficient and it's important to ensure optimal compounds of the gaseous medium, characterized by certain concentrations of oxygen, carbon dioxide and nitrogen. The experiments show the results obtained to mixed cultivars of blackcurrants (*Ribes nigrum L.*) maintained at modified atmosphere of carbon dioxide, using various CO_2 concentrations and stored for different periods of time. The main objective of the research was to correlate the concentration of carbon dioxide with the duration of the experiments in order to reduce losses. A high concentration of carbon dioxide in the storage environment determines a direct influence upon the inhibition of pathogens development and the CO_2 concentrations don't produce essential chemical transformation in fruits in order to influence negatively their quality. The total losses were minimal for the sample where was used a concentration of 20% CO_2.

Cuvinte cheie: coacăze negre, dioxid de carbon, păstrare.
Key words: blackcurrants, carbon dioxide, storage.

1. Introduction

The term of capitalization (Gherghi A., 1994; Tudor A.T., 1995) is defined in The Great Agricultural Encyclopedia (1943) as „the care that the manufacturers and sellers should have in order to present and deliver / promote their goods; most of them need a special care from harvest till delivery, not only regarding content but, in the term of preservation, packaging, transport and storage as well ".

Blackcurrants have a high degree of perishability and are difficult to storage.

The effects of gases with inhibitory effect on the metabolic activity of fruits and pathogens during storage have been studied by many researchers. The experiments showed that both - the low level of O_2 and high concentrations of CO_2 - reduce the breathing rate.

The nutraceutic values and physic- chemical characteristics of blackcurrants are pointed out as regard the soluble carbohydrates content (15g/100 g), energetic value (60-85 kJ / 100 g edible part), water content (77-87%), soluble dry matter (15.5 to 16.8%), titrated acidity (2.6 to 2.8%), vitamin C (180 mg / 100 g), ascorbic acid (88,20mg/100g).

Laboratory tests with blackcurrant were made to create the possibility of substantiating their behavior in different modified atmospheres, rich in carbon dioxide (10% CO2, 20% CO2 and 30% CO2) and determining whether these atmospheres can be used to storage these fruits.

2. Material and methods

The research was conducted on blackcurrants fruits – mixed varieties, using as equipment: cold rooms, hermetically sealed packs to maintain the carbon dioxide concentration of experiences (Fig.1), Ryan recording thermometer, INFRALIT gas analyzer with fan (measuring the range between 0-50% CO2), headspace O_2/CO_2 gas analyzer OXYBABY (Fig. 2), accurate balance (with accuracy of 0,001 kg).

The research method consisted of analytical and comparative analysis regarding the behavior of blackcurrants fruits in normal and carbon dioxide modified atmosphere,,at cold" (in a chamber of ~ 2^0C temperature) and in normal laboratory atmosphere (at a temperature of approx. 25^0C).

There have been developed the following variants:

V_1 – Modified atmosphere with 5% concentration of CO_2
V_2 – Modified atmosphere with 10% concentration of CO_2
V_3 – Modified atmosphere with 15% concentration of CO_2

V_4 – Modified atmosphere with 20% concentration of CO_2
V_5 – Modified atmosphere with 30% concentration of CO_2
V_6 – Normal atmosphere

3. Results and discussions

Various observations, measurements and analyses were made relating to:

- Initial and final aspect of fruits and organoleptic analyses
- Fruit's firmness
- Weight reduction (the fruits were weighted at the beginning and the end of the experiment)
- Depreciation degree of fruits
- Fluctuation of CO_2 concentration depending on the temperature and time period
- Chemical composition of the fruits at the beginning and the end of the experimental
- Phyto-sanitary health condition of fruits

Table 1 and Chart 3 show a positive modification of the weight reduction percentage, proportionally with the carbon dioxide concentration and its substantial reduction comparatively with the normal atmosphere: 1.71 times (concentration of 5% in CO_2) to 1.42 times (concentration of 20% in CO_2).

At a concentration of 30 % in carbon dioxide the losses were more reduced comparatively to the normal atmosphere approximatively twice, but slightly higher than the variants with 10%, 15% or 20% CO_2 concentration. Also, it appears that the weight reduction to the variants in modified atmosphere had not notable differences.

Regarding the depreciation, the evolution is rather similar with the evolution of losses, being lower in modified atmospheres comparing with the normal atmosphere (from 3.54 times in the atmosphere with CO_2 concentration of 5% and 2.23 times in the atmosphere with CO_2 concentration in of 20%), as is shown in table 2 and chart 4.

The statistical analyses, from the point of view of assurance degree, show the same positive evolution of the weight reduction percentage and depreciation degree proportionally with the amount of the carbon dioxide concentration.

The chemical analyses shown in Table 3 indicate that the experiences with carbon dioxide modified atmosphere after 233 hours (9.7days) at 2°C produced not essential chemical transformation in blackcurrants, in order to modify their quality.

It can be seen that:

- dry matter occurred changes between 0.2 % the variant with 15% carbon dioxide and 0.9% the variant with 30% carbon dioxide, while the normal atmosphere recorded 0.2 % ;
- changes in total sugar content were between 0.32% to the variant with 30% carbon dioxide and + 0.21% to the variant with 20% carbon dioxide, while the normal atmosphere recorded 0.62% ;
- changes in reducing sugar content were between -0.18% to the variant with 5 % carbon dioxide and +0.16% to the variant with 20% carbon dioxide, while normal atmosphere recorded +1.03%;
- changes in acidity were between -0.01% to the variant with 15 % carbon dioxide and +0.02% for to variant with 20% carbon dioxide, while normal atmosphere recorded no difference.

Vitamin C got significant losses (between 6.96% to the variant with 20% carbon dioxide and 22.84% to the variant with 15% carbon dioxide), while normal atmosphere recorded an increase of 16.88%. Because the content of vitamin C cannot achieve an increase in the normal atmosphere is necessary to analyze more this compound in the future.

The phytopathology aimed to establish the phyto - sanitary/ health condition of blackcurrants.

The observations and determinations have pointed out the following data in Table 4

4. Conclusions

Blackcurrants were kept in carbon dioxide modified atmosphere (5%, 10%, 15%, 20% and 30%) approximately 10 days (233 hours) at 2°C temperature. During the experiments have been noticed that all modified atmospheres generate the following phenomena:

- diminish the weight reduction proportionally with the increasing of carbon dioxide amount;
- ensure a better fruit firmness;
- concentrations of 5, 10 and 20% in CO2 reduce greatly the pathogenic fungus attack (*Botrytis cinerea*);
- at 30% CO2 concentration, the percent of fruits attacked by the pathogenic fungi was very small, but when the samples were brought again to the unmodified atmosphere, the fruits showed a quick evolution of the browning phenomenon. For this reason, this concentration is better to be avoided;

- the experiences with carbon dioxide modified atmosphere after 233 hours (9.7days) at 2°C produced not essential chemical transformation in blackcurrants, in order to modify their quality.

Based on above conclusions, the blackcurrant storage must be done in a 20% modified carbon dioxide atmosphere for best results.

References

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Tables and figures

Table1. Weight reduction black currants in modified atmosphere

Variant	Symbol	Weight reduction after 233 hours (9,7 days)	Insurance grade (%)
Modified atmosphere of 5% CO_2	V_1	1.71	84.86
Modified atmosphere of 10% CO_2	V_2	1.54	85.63
Modified atmosphere of 15% CO_2	V_3	1.50	85.96
Modified atmosphere of 20% CO_2	V_4	1.42	86.23
Modified atmosphere of 30% CO_2	V_5	1.60	85.08
Normal atmosphere	V_6	3.12	77.55

Table 2. Depreciation degree of blackcurrants in highly modified carbon dioxide atmosphere at 2^0C temperature and after 233 hours (9.7 days)

Variant	Symbol Key	Softened fruits (%)	Assurance degree (%)	Fruits with mold attack (%)
Modified atmosphere of 5% CO_2	V_1	3.54	87.11	-
Modified atmosphere with 10% CO_2	V_2	3.28	88.70	-
Modified atmosphere with 15% CO_2	V_3	3.11	89.02	-
Modified atmosphere with 20% CO_2	V_4	2.23	91.02	-
Modified atmosphere with 30% CO_2	V_5	2.36	90.92	-
Normal atmosphere	V_6	7.74	77.31	0.48

Table 3. Chemical changes in blackcurrants experiments regarding their behavior in highly modified carbon dioxide atmosphere after 233 hours (9.7 days) at 2°C temperature

Symbol	Dry matter %			Total Sugar %			Reduced Sugar %			Acidity %			V. C mg/100g		
	in.	end	dif.	in.	end	dif.	in.	end	dif.	in.	end	dif.	in.	end	dif.
V_1	8.2	7.4	-0.8	5.84	5.51	-0.33	4.95	4.77	-0.18	0.93	0.85	-0.08	151.04	137.34	-13.7
V_2	8.2	-	-	5.84	-	-	4.95	-	-	0.93	-	-	151.04	-	-
V_3	8.2	8.0	-0.2	5.84	5.92	+0.08	4.95	5.07	+0.12	0.93	0.92	-0.01	151.04	128.24	-22.84
V_4	8.2	7.5	-0.7	5.84	6.05	+0.21	4.95	5.11	+0.16	0.93	0.95	+0.02	151.04	144.08	-6.96
V_5	8.2	7.3	-0.9	5.84	5.52	-0.32	4.95	4.98	+0.03	0.93	0.85	-0.08	151.04	136.24	-14.8
V_6	8.2	8.0	-0.2	5.84	6.46	+0.62	4.95	5.98	+1.03	0.93	0.93	0	151.04	167.92	+16.88

Table 4. Phyto-sanitary condition of blackcurrants in modified in carbon dioxide atmosphere after 233 hours (9.7 days) at 2°C temperature

Product	Fruits affected by pathogens					
	Normal atmosphere	5 % CO_2	10 % CO_2	15 % CO_2	20 % CO_2	30 % CO_2
Black currants fruits	36.5 *Botrytis cinerea*	31.3 *Botrytis cinerea*	28.1 *Botrytis cinerea*	10.3 *Botrytis cinerea*	8.4 *Botrytis cinerea*	4.0 *Botrytis cinerea*

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Fig. 1. Hermetically sealed packs with blackcurrants

Fig. 2. Gas analyzer OXYBABY

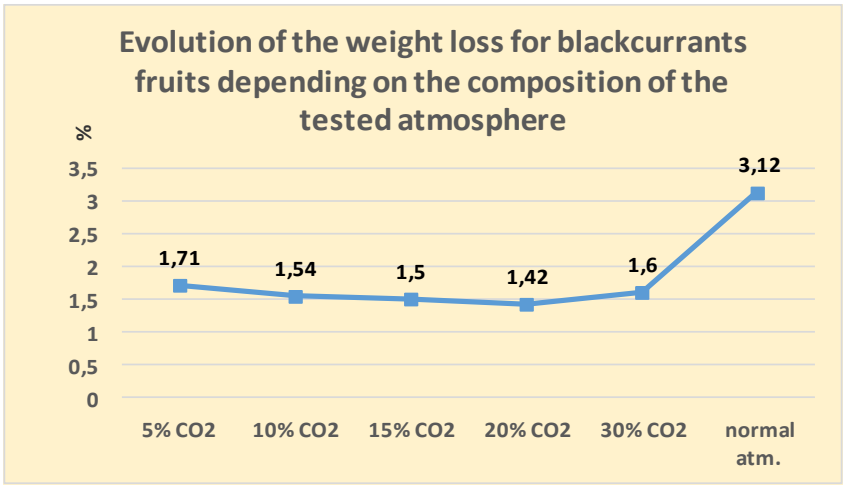

Fig. 3. Weight reduction of blackcurrants depending on chamber atmosphere

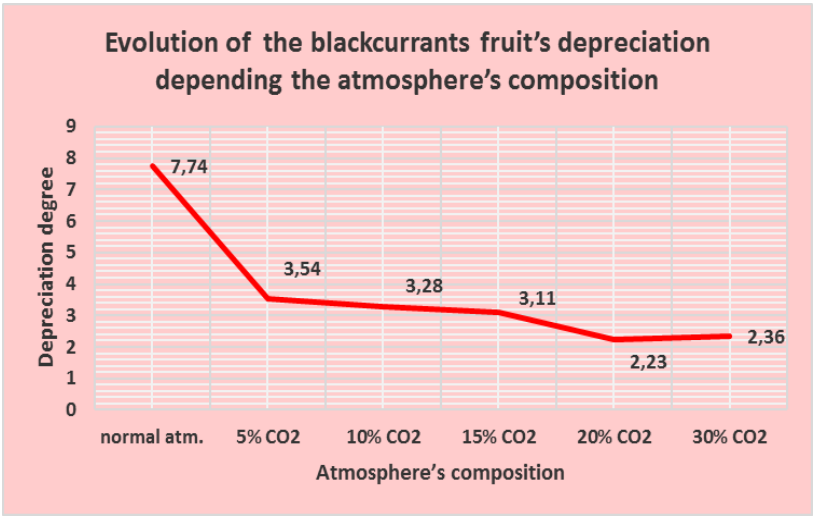

Fig. 4. Evolution of the blackcurrants fruit's depreciation depending on the atmosphere's composition