STUDIES REGARDING THE CHITOSAN FILM PROTECTION OF APPLES SO AS TO MAINTAIN THEIR QUALITY IN THE FRIGORIFIC STOREHOUSES

STUDII PRIVIND PROTEJAREA CU PELICULĂ DE CHITOSAN A FRUCTELOR DE MĂR, ÎN VEDEREA MENŢINERII CALITĂŢII LOR ÎN DEPOZITELE FRIGORIFICE

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Abstract. *Chitin, a natural polysaccharide having a linear structure that may be found in the shell of marine crustaceans and the internal structure of certain invertebrates, is the second biopolymer that may be mainly encountered in the nature after cellulose. Chitin may bee a sily processed into chitosan through an initial decalcification in a diluted watery solution of chlorine hydride followed by deproteinization in a watery solution of diluted sodium hydroxide. Dueto its special biological properties, biodegradability and biocompatibility, chitosan is widely used in the pharmaceutical industry, the food industry, medicine and biotechnologies. The films give fruits a special protection due to its pellicular properties, on the one hand, and anti fungal properties, on the other hand. Moreover, since they are biocompatible and biodegradable films, they may be ingested by consumers. The benefic action of chitosan on the human body has already been demonstrated by the curative properties it has.*
Key words: chitosan film, fruit quality, frigorific storehouses

Rezumat. *Chitina, o polizaharidă naturală cu structură liniară care se găseşte în carapacea crustaceelor marine şi în structura internă a altor nevertebrate, este al doilea biopolimer care se găseşte preponderent în natură după celuloză. Chitina poate fi uşor procesată în chitosan printr-o decalcifiere iniţială în soluţie apoasă diluată de acid clorhidric, urmată de o deproteinizare în soluţie apoasă de hidroxid de sodiu diluat. Datorită proprietăţilor biologice deosebite, a biodegradabilităţii şi biocompatibilităţii sale, chitosanul este larg folosit în industria farmaceutică, industria alimentară, medicină şi în biotehnologii. Peliculele conferă fructelor de măr o protecţie special deoarece pe de o parte datorită proprietăţilor peliculare, iar pe de altă parte proprietăţilor antifungice pe care le are chitosanul. Mai mult, fiind pelicule biocompatibile si biodegradabile, pot fi ingerate de consumatori. A fost deja demonstrată acţiunea benefică a chitosanului asupra organismului uman, prin proprietăţile curative pe care le are*
Cuvinte cheie: peliculă chitosan, calitate fructe, depozite frigorifice

MATERIAL AND METHOD

The apple fruits belonging to Generos, Starkrimson, Idared and Ionagold variety were subjected to a post-harvest pelicular treatment. They were immersed in a

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solution of chitosan film, concentration 3%, before placing the mincold cells. (M.B. Pérez-Gago, et colab. 2003)

After exterior moisture has evaporated, all variants were stored in the frigorific cell having a temperature of 2^0C, a relatively high humidity of 90-95% and air circulation with a speed of at least 0.25 m/s, for a circulation coefficient of 30 re-circulations/hour. (Beceanu D. 2000, 2003)

We monthly drew samples from each variant and variety which were then analysed in the lab of Technology of horticultural products department within USAMV Iaşi. (Anghel Roxana, 2009, 2010)

These samples were subjected to a series of physical determinations and chemical analyses to estimate their physiological state and biochemical content.

Thus, we determined:

- starch content by the iodine test
- the content of soluble dry substance by the refractometric method
- titrating acidity by the titrimetric method
- breathing intensity by means of Pettenkofer device
- structural-textural firmness by means of penetrometric method.

RESULTS AND DISCUSSIONS

In the first four months of refrigeration, the evolution of fruits was the following, presented in tables 1-4 and figures 1-4.

In table 1 we may notice that fruits were harvested at an optimal hydrolization degree for storage in frigorific storehouses. The hydrolysis of starch was more intense for all blank tests and we could notice an exhaustion of the starch reserve ever since February.

Table 1

The evolution of starch content (note the sample with iodine) fruit during cold storage

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	8,0	8,0	8,0	7,0	8,0	7,0	8,0	8,0
December	9,0	8,2	9,0	7,4	9,0	7,2	9,0	8,2
January	9,8	8,5	9,8	8,0	9,6	8,0	9,8	8,5
February	10	9,4	10	9,0	10	9,0	10	9,2
March	10	9,6	10	9,2	10	9,4	10	9,6
April	10	9,8	10	9,6	10	9,8	10	9,8

In table 2 we may notice the evolution of the content in soluble dry substance of the stored fruits. At the beginning of the period of frigorific storage, the blank tests had a higher content in soluble dry substance as compared to the treated variants. In the first months of storage, the content in soluble dry substance increases due to hydrolization of fruit starch. After the starch reserve has been consumed, the content in soluble dry substance decreases due to its gradual exhaustion in metabolic processes.

At the end of the period of frigorific storage, the treated variants had a higher content in soluble dry substance as compared to the blank tests.

Among all the variety under study, Starkrimson variety stood out having the highest content in soluble dry substance. Ionagold variety had the lowest content in soluble dry substance. The same trend of increase of the content n soluble substances manifested throughout the frigorific storage for all the variety under study due to the enriching with monoglucids during the gradual hydrolization of starch.

Table 2

Evolution of soluble solids content (^{0}Bx) fruit during cold storage

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	12,8	12,2	13,8	13,4	12,2	11,8	11,8	11,4
December	13,2	12,4	14,0	13,6	12,8	12,2	12,4	12,0
January	13,6	12,8	14,6	13,8	13,4	12,8	13,0	12,6
February	13,4	13,2	14,0	14,2	13,2	13,4	12,6	12,8
March	12,8	13,4	13,2	14,4	12,4	13,8	11,6	13,2
April	12,0	13,6	12,4	14,4	11,8	14,0	11,0	11,6

Table 3

Evolution of acidity titrated (g a. malic/100gproduct) fruit during cold storage

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	0,56	0,62	0,34	0,36	0,58	0,60	0,52	0,55
December	0,55	0,60	0,30	0,35	0,56	0,58	0,50	0,53
January	0,48	0,53	0,27	0,32	0,44	0,51	0,42	0,48
February	0,40	0,47	0,22	0,29	0,37	0,45	0,35	0,42
March	0,38	0,44	0,21	0,25	0,33	0,38	0,31	0,36
April	0,36	0,38	0,20	0,21	0,27	0,33	0,25	0,30

Titrating acidity (tab. 3) had the same decreasing trend during the frigorific storage, with the observation that at the end of the storage period, the blank tests had a much lower content in organic acids than the treated variants. Generos variety stood out having the highest acid content (0.38 g malic acid/100 g product).

Structural-textural firmness (tab. 4) is relatively good in the first months of frigorific storage and we could notice its faster decrease in January and February. We must mention that the treated variants exhibit a better firmness as compared to the blank test, all variety having lower values of this parameter.

Table 4

Evolution structuro-textural firmness (UP / 5sec) during cold storage

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	25	23	20	18	28	26	27	24
December	28	24	24	20	32	28	30	26
January	33	27	28	25	38	31	34	30
February	38	30	32	28	42	36	39	34
March	40	34	36	32	44	38	41	36
April	42	38	38	35	45	40	43	39

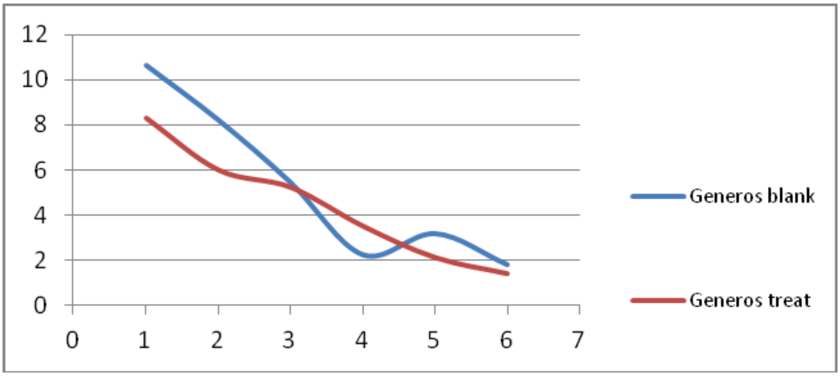

Fig. 1 –Respiration intensity of Generous variety during cold storage

The diagram of breath intensity for Generos variety (fig. 1) showed the climacteric point for the blank test in February. The descending trend of values for this parameter indicates that the metabolism of fruits is much slowed down. For the treated variant we could notice that the intensity of breathing was lower than for the blank test ever since the first month and then it increases linearly but it does not reach its climax.

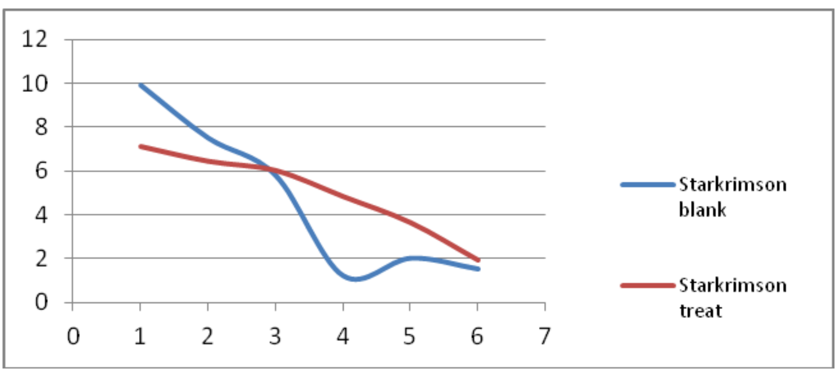

Fig. 2 – Respiration intensity of Starkrimson variety during cold storage

We could also notice the climacteric point for the blank test of Starkrimson variety (fig. 2) in February. Under the influence of the pellicular treatment, fruits had a lower metabolism and this decrease was steady throughout the frigorific storage.

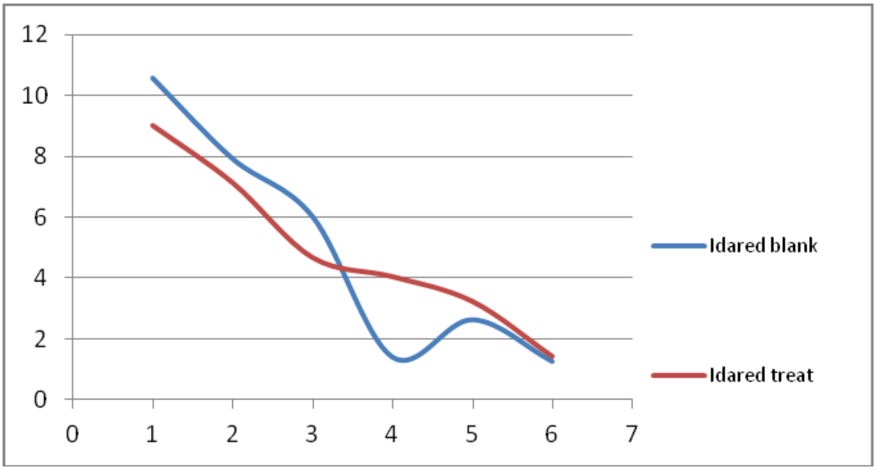

Fig. 3 – Respiration intensity of Idared variety during cold storage

In case of Idared variety (fig. 3), we could notice a relatively intense decrease of breathing intensity for both variants, but in different period. For the blank test, the decrease is constant in the first four months (until February), when fruits enter the climacteric phase, and the treated variant the decrease is intense in January - April.

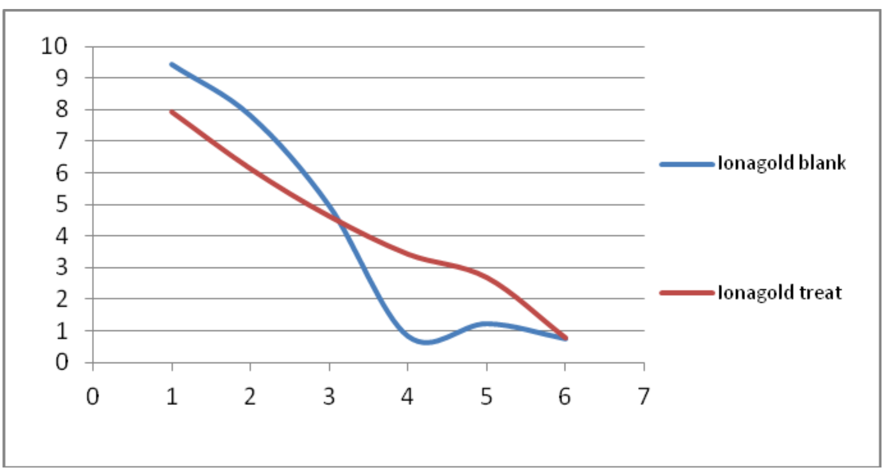

Fig. 4 –Respiration intensity of Ionagold variety during cold storage

For Ionagold variety (fig. 4), the metabolism of the treated fruits was lower than for the blank test in the first months of storage until February, when untreated fruits entered their climacteric phase.

CONCLUSIONS

The chitosan film treatment in concentration of 3% applied to Generos, Starkrimson, Idared and Ionagold apple variety helped maintaining a high quality of fruits.

Considerable differences were registered ever since the first month of frigorific storage both between variety and variants.

The degree of starch hydrolization was more intense for the blank tests, so that in the first three months the starch reserve got exhausted.

This has led to a considerable increase of the content in soluble dry substance followed by an abrupt decrease of this parameter since simple glucides were consumed in the metabolic processes.

At the end of the period of frigorific storage, we may notice a higher content in organic acids for the treated variants as compared to the blank test.

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