The Evaluation of Frozen Strawberries Quality by Studying the Kinetics Change of the Antioxidants Activity

Elisaveta Sandulachi (Corresponding author)
Technical University of Moldova, 168, Stefan cel Mare Avenue
Chisinau, MD-2004, Republic of Moldova
Tel: 373-6850-4188 E-mail: luiza_sandulachi@yahoo.com

Tatarov Pavel
Technical University of Moldova, 168, Stefan cel Mare Avenue
Chisinau, MD-2004, Republic of Moldova
Tel: 373-2232-1946 E-mail: p_tatarov@yahoo.com

Diana Croitor
Technical University of Moldova, 168, Stefan cel Mare Avenue
Chisinau, MD-2004, Republic of Moldova
Tel: 373-7944-6171 E-mail: croitordiana88@yahoo.com

Received: November 11, 2011 Accepted: November 25, 2011 Published: February 1, 2012
doi:10.5539/jfr.v1n1p225 URL: http://dx.doi.org/10.5539/jfr.v1n1p225

Abstract

This paper presents the study results on quality assessment of frozen strawberries estimating the inetics change of antioxidant activity of fruit during storage.

Fresh strawberries purchased from the trading system were used for the research. The study was conducted over 3 years. A total of 60 batches of strawberries harvested in Moldova were analyzed , from each batch were estimated three samples.

It was appreciated the content of antioxidants: L-hidroascorbic acid, anthocyanins, total polyphenols and reducing activity of fruit. The precision of the characteristics determination for oxido-reducing state of fruit samples (K, mg AA/g SH) is obtained with the trust coefficient $P< 0.01$ or $P<0.05$, deviation error limit being ± (0.2 … 0.8) % from the average values of the K indicator. The correlation of the total hydrosoluble antioxidants content (ascorbic acid, anthocyans, polyphenols) and the oxido-reducing state indicator of the fruit (K) attests the values of the Pearson coefficient (R) within 0.88 … 1.0 and has a functional dependence. The validity of frozen fruit was demonstrated by determining the probability of quality modification of frozen strawberries.

Keywords: Frozen strawberries quality, Antioxidant activity, Oxido-reducing state, Hydrosoluble antioxidants, Pearson coefficient

1. Introduction

The quality of a product is given by macronutrients and micronutrients content. To assess the nutritional value of fruit products a special attention is paid to the content of bio antioxidants – biologically active substances. From the viewpoint of the scientists from different countries, the antioxidants play a protective role in preventing the cardiovascular diseases, diabetes, gastrointestinal diseases and have a positive role on lifetime, maintaining youth and reducing the oxidative stress (Ivan, 2007; Becker et al., 2004; Proteggente et al., 2002).

In general, the current scientific studies suggests that the colored fruits and vegetables are important sources of antioxidants, provide the necessary of vitamins, minerals and fibers for a proper health, protects against the

effects of aging and reduce the risk of cancer and the cardiovascular diseases (Olsson et al. 2006; Kiss, et al. 2005; Becker et al., 2004).

These new findings confirm and expand on the results of three studies published in 2003, 2005 and 2006, which show that strawberry extracts can reduce the growth rate of human lung and liver cancer cells, and mouse skin cancer cells, to substantial extents (Olsson et al., 2006; Ramos et al., 2005; Wang et al., 2005; Meyers et al., 2003).

Strawberries are delicious fruits, with a good smell and taste, nice appearance. That is why they are requested fresh. Their sensory properties are determined by the presence of phenol substances and anthocyanins. Strawberry are an excellent source of vitamin C and manganese. They are also a very good source of dietary fiber and iodine. Plus, strawberries are a good source of potassium, vitamin B2, vitamin B5, vitamin B6omega -3 fatty acids, vitamin K, magnesium, and copper (Ivan, 2007; Wang et al., 2005; Gherghii et al., 2001). Strawberry also contain an array of beneficial phytonutrients, including flavoinoids, anthocyanidins and ellagic acid (Wang et al., 2005; Sandulachi, 2005; Gherghii et al. 2001; Proteggente et al., 2002).

Srtawberries, like other berries, are famous in the phytonutrient world as a rich surce of *phenols.* In the strawwberry, these phenols are led by the *anthocyanins* (especially anthocyanin 2) and by the *ellagutannins.* The *anthocyanins* in strawberry not only provide its flush red color, they also serve as potent antioxidants that have repeatedly been shown to help protect cell structures in the body and to prevent oxygen damage in all of the body's organ systems. Strawberries unique *phenol* content makes them a heart-protective fruit, an anti-cancer fruit, and an anti-inflammatory fruit, all rolled into one (Wang et al., 2005; Proteggente et al., 2002).

The strawberry, like many other perishable fruits suffer changes in time. Strawberries are perishable and under the action of peroxidase enzymes that contribute to the appearance of brown compounds and the loss of smell, they support permanent changes of phenol substances (their oxidation) (Tatarov et al., 2010; Sandulachi et al., 2010; Croitor et al., 2010 ; Wang et al., 2005; Gherghii et al. 2001; Duckworth, 1975).

The results (Proteggente et al., 2002) indicate that fruits soch as strawberry are an excellent source of phenolics and vitamin C and therefore possess an extremely high antioxidant potential in fact, the anthocyanins, which are the major class of phenolics inthis type of fruits, generally have demonstrated high antioxidant activity in *vitro systems.*

During storage and processing, the content of these substances is reduced according to their involvement in the process of oxido -reduction. Their evolution depends on several factors, as: the chemical composition of the fruits, parameters of the technological process, storage conditions, etc (Tatarov et al., 2010; Banu et al., 2004; Banu et al., 2003; Mihalca et al., 1986).

We need to mark that the conservation through freezing is one of the most effective method of preserving the perishable fruits quality. Commonly, strawberries are preserved by freezing and stored frozen. In industrial conditions frozen strawberries are usually kept at the temperature of -18°C (Banu et al., 2004; Banu et al., 2003). At the same time, the congealed products in storage period suffer some modification of sensory characteristics and nutritional value (Sandulachi et al., 2006; Marfart, 1996; Mihalca, et al., 1986; Saguy et al., 1980).

2. Materials and Methods

2.1 Cnemicals

Folin-Ciocalteu phenol reagent, gallic acid monohydrate, glacial acetic acid, L-ascorbic acid, sodium carbonate was obtained from EM Science, alcohol, hydrochloric acid.

2.2 Fruits

For oficial examination were used autochthonous strawberry, acquired and trade network. There were evaluated a total of 60 batches of strawberries, harvested in R. Moldova during three years. Strawberry samples were frozen and kept at the temperature of minus 18°C for 10 months. Experimental studies have been performed for the following varieties: Victoria, Sega-Segana, Frumuşica. The study was conducted both for fresh and frozen strawberries. The estimation of the reducing state of frozen strawberries was carried out in samples stored 3, 6 to 10 months. It was evaluated the dependency between the reducing state of frozen strawberries on bio antioxidants content and the influence of the technological process on the quality of strawberries.

2.3 Sample freezing

The samples were congealed in „Ghiocel" freezer at the temperature of -18^{o}C. Before congelation preventive operations were made: sorting, washing, top water –drying. The samples were packed in polisterol bags or Al/bald with weight 30.0 – 50.0g. Before being hermetically closed, the samples were treated with N_2 for