ADVANCED TECHNOLOGIES BY CONDITIONING VEGETABLES AND FRUITS USI NG HEAT TREATMENT

Roxana-Mihaela ANGHEL[1]

[1] University of Agricultural Sciences and Veterinary Medicine Iaşi
e-mail: *roxanam77@yahoo.fr*

Fruits and vegetables are seasonal products. Maintaining product quality fresh longer requires application of appropriate technologies for the entire course on it go through from producer to consumer.

In addition to sealing cover Films and other postharvest treatments, the range of environmental technologies in recent years are placed in centers of fruit and vegetables conditioning in the U.S., Spain, Latin America, Israel and Hawaii.

Heat treatment using hot water, vapor superheated water and / or electromagnetic radiation.

Although known since 1929, with Baker's attempt to remove some pathogens on fruit with water vapor, heat treatment became economically unprofitable in with the advent and development of fungicides and pesticides.

Key words*: quality fruit and vegetables, heat treatment postharvest*

Lately is remarkable a growing interest to introduce the technology of heat treatment as an alternative to chemicals products.

The heat treatment are unsuitable for of perishable products such as asparagus, nectarines, vegetables, whose life and postharvest marketing is reduced.

MATERIAL AND METHOD

Near studying of literature in this field, containing scientific articles published in international symposia or professional journals and doctoral work, I consulted various websites of foreign non-governmental agencies which have the object of food stuffs research.

Final or partial results of research undertaken by the Departments of Agriculture Research in addition to prestigious universities in the United States and Spain are presented in this article.

RESULTS AND DISCUSSIONS

Fruits and vegetables may be heat treated in different ways, using conventional treatments, hot water, overheated steam, dry air, but also more advanced technologies such as infrared heating with electromagnetic radiation or heat treatment. They are established depending on the nature of the products,

thermo-physical properties, the magnitude and the pathogens witch have to be removed.

Conventionals models heating, heat transfer is directly related to product moisture.

Shellie and Mangan (2000) found that a lesser amount is sufficient heat when using hot water treatment because the decrease in O_2 and increased CO_2 on fruit during immersion in water may impose an additional stress on fruit and such tolerance may change the product. Thus there is a thermal sensitivity of the fruit.

Heat treatment with hot water is the best way to provide heat on fruit (Tang et al., 2000). It is used to prevent degradation caused by pathogens and can be successfully applied to apples, avocados, citrus and plums.

Time of treatment varies from 2 to 5 minutes at a temperature of 50 - 55^0C.

This technique was initially used to eliminate pathogenic fungi on fruit surfaces, which are usually located on fruit and layers of bark product. (Lurie, 1998). To destroy pathogenic fungi are used relatively high water temperatures (46-60 °C) for 30 seconds - 10 minutes. Later this treatment was used to remove other pathogens and even insects. For insect treatment temperatures used are between 43 and 49 °C for 30 to 120 minutes. Commercial cost of treatment with hot water is 10 times cheaper than overheated steam treatment. (Fallik, 2004).

The method was successfully used to treat cherries against moths. Treatment was applied immediately after harvest of cherries, but a heat treatment was necessary to maintain their quality.

The cherry has obtained a delay of pathogenic fungi attack without suffering quality fruit by applying a heat treatment with hot water at a temperature of 45 ^{0}C for 15 minutes.

Some fruits are intolerant to heat treatment with hot water. For example, even for 3 minutes in water kept at a temperature of 45 ^{0} C strawberries become more susceptible to attack by pathogens due to inhibition of respiration during treatment.

For heat sensitive products must be low temperature treatment and time keeping fruit in water. One solution would be to increase temperature gradually during heat treatment, or apply the heat treatment regularly.

Another possibility is to combine points, block treatment with other treatments. For example, to control *Monilinia fructigena* attack and *Rhisopus stolonifer* in peaches and nectarines, water was added to a quantity of ethanol. (Margosan et al., 1997).

In Florida, treatment with hot water at 55^0C for 3 minutes is used in the quarantine station mango fruit. Also treatment with superheated steam is used to treat the mango fruit in Mexico and papaya fruit in Hawaii. (Ben-Yehoshua and Porat, 2005).

In recent years treatment with hot water are increasingly used, especially in conjunction with brushing fruit.

Technique was developed as part of a flow conditioning technology fruit on the sorting line (Porat et al., 2000) and was adapted for cleaning and disinfecting

sweet peppers, mangoes, melons, tomatoes, kumquats, oranges and litchis. Is in progress a similar technology for sweet potato filling.

In Israel there are approximately 250 units of wrapping fruit and vegetables using this method. Also, in Spain and in many countries of southern Latin America, this method is used from 2003.

Exposure to high temperature attenuates some fruit ripening processes. Ethylene production is reduced due to inhibition of enzymes.

The heat treatment can influence the flavor of the fruit by reducing volatile substances, because of their impairment. Also, high temperatures can lead to lower acidity titrated and increased soluble solids content. It extends the ratio carbohydrate / acidity, fruit can be sweeter. It was shown that heat treatment induces a natural resistance of fruit.

Along with the heat treatment of fruit may also be treated with a fungicide. Although heat treatments have the potential to destroy insects or pathogens, they do not have residual effects, in turn can affect the treated product. To overcome these problems, it is recommended to combine this with other heat treatment using biological compounds, other physical treatments or controlled atmosphere. Possible combinations of treatment to maintain quality of the fruits can be the waxing or applying edible coating.

Nevem and Mitcham (1995) have found that a combination of controlled atmosphere and heat treatment using warm water is effective in cherries, apples and pears.

In addition to conventional heat treatment combinations, are currently investigating new treatments based on thermal radiation. Electromagnetic radiation have a greater efficacy in the treatment of quarantined and infrared radiation could be used for surface decontamination.

The Department of Biological Systems Engineering, Washington State University, are currently developed principles for development studies and post-harvest treatments. They are based on the effect of microwave and radiofrequency to destroy pathogens on fruit.

Department of Agriculture and Environmental Protection Agency in Hawaii currently investigating alternative methods of heat treatment to replace methyl bromide treatment for disinfecting fruit.

CONCLUSIONS

Various treatment technologies for fruit and vegetables using hot water or steam were known from the beginning of last century. Appearance of chemicals, fungicides and pesticides, with a lower production cost, leading to replacement of organic treatments. Excessive pollution of soil, water and air for decades have destructive effects on the human body.

Using natural treatments for removal of post-harvest pathogens on fruits and vegetables, as an alternative to replace chemicals used for the same purpose, is a priority in most research programs in agriculture and food worldwide.

Significant results were reported in this area and there are countries such heat treatment is used successfully.

BIBLIOGRAPHY

1. Ben-Yehoshua, S., Porat, R., 2005 - *Heat treatments to reduce decay*. In: Environmentally Friendly Technologies for Agricultural Produce Quality, (S. Ben-Yehoshua, ed.). CRC Press, Boca Raton, FL, USA.
2. Fallik, E., Maalekuu, K., Elkind, Y., Tuvia-Alkalai, S., Shalom, Y., 2004 - *The influence of harvest season and cultivar type on several quality traits and quality stability of three commercial sweet bell peppers during the harvest period.* ***Adv. Hort. Sci.***
3. Lurie, S., 1998 - *Physical treatments as replacements for postharvest chemical treatments*. International Society for Horticultural Science. SUA.
4. Lurie, S., 2006 - *The effect of high temperature treatment on quality of fruits and vegetables.* International Society for Horticultural Science. SUA.
5. Porat, R., Daus, A., Weiss, B., Cohen, L., Fallik, E., Droby, S., 2000 - *Reduction of postharvest decay in organic citrus fruit by a short hot water brushing treatment*. Postharvest Biol. Technol.
6. Shellie, K.C., R. L. Mangan., 2000 - *Postharvest disinfestations heat treatments: response of fruit and fruit fly larvae to different heating media*. Postharvest Biology and Technology. United States Department of Agriculture, Agricultural Research Service, Crop Quality and Fruit Insect Research Unit.
7. Tang, J., J.N., Idediala, S., Wang, J.D., Hansen, R.P., Cavalieri, 2000 - *High-temperature-short-time thermal quarantine methods.* Postharvest Biology and Technology Vol. 21, 129-145, 2000.
8. Tang, J., Mitcham, E., Wang, S., Lurie S., 2007 - *Heat treatments for postharvest pest control.* Washington, SUA.
9. *** - FSTA - Food Science and Technology Abstracts.
10. *** - American Chemical Society's Journal of Chemistry.
11. ***, 2009. - *www.effost.org*. – European Federation, accessed august-september.