



Sensory Evaluation of Oranges Varieties Treated with Different Doses of Gamma Radiation



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Gamma radiations have been used to extend the shelf life and improve sanitations treatments without significant effects on quality characteristics of fresh fruit. This practice could be used as an alternative of the traditional post harvest treatment. Irradiation can be a mean of ensuring safety of fresh fruit and can prevent fruits from spoilage. On the other hand, radiation can modify sensory characteristics of fruits reducing their acceptance by consumers depending on the dose.

The objective of this work was to evaluate the effect of this treatment on quality parameters by sensory evaluation and physicochemical analysis of the orange juice. In the present study orange varieties Nova, Navel and Salustiana were exposed to 0,35 and 0,60 kGy. Control samples consisted of non-irradiated fruits.

Irradiation experiments were conducted using irradiation equipment from Ezeiza Atomic Center (CAE), year 1968, cobalt 60 source, 800000 ci. For each variety we combine irradiation + heat treatment (3 min, 30°C). All samples were stored at 3-5°C, 80%HR for 20 and 40 days. Sensory evaluation was carried out using a 1-9 hedonic scale, with naive respondent panels. The sensory attributes evaluated were overall acceptance, acidity and color of juices. For physicochemical evaluation, pH, acidity and soluble solids were tested. Analysis of Variance (ANOVA) was used to analyse the data.

Sensory responses were matched to physicochemical analysis data but no correlation was found.

Sensory evaluation results showed that for Nova and Navel varieties, irradiation had no significant ($p < 0,05$) effect on the ratings of any of the sensory attributes at 20 days of storage, but both of it showed a significant difference ($p < 0,05$) in overall acceptance at 40 days of storage.

Significant differences ($p < 0,05$) in overall acceptance were observed for Salustiana variety only at 20 days of storage.

Key words: shelf - life, orange juice, irradiation



INTRODUCTION AND OBJECTIVES

Irradiation can be a means of ensuring safety to fresh fruit and can, at the same time, prevent fruits from spoilage. On the other hand, depending on the dose, radiation can modify sensory characteristics of fruits reducing their acceptance by consumers.

One of the worst issues that the citrus industry has to deal with is the spoilage of the fresh fruit due to mould and bacteria growth. Therefore, applying sanitation treatments in the post - harvest citrus industry is natural in order to control post - harvest disease. Due to the steadily increasing market of orange exportation, the extension of the post harvest life without compromising quality of the fresh fruit has become an important issue, as international market requires a supply of high quality fruit.

For these purposes, exposure of fresh fruit to low doses of gamma radiation in combination with other treatments has been considered as a means of controlling post harvest disease and of extending shelf life. The latter is an alternative to traditional post harvest treatment in order to increase the shelf life of the exportation of citric fruits.

These aspects are of great interest for the Uruguayan citrus industry since Uruguay is an important world orange exporter.

The aim of this study is therefore, to evaluate the effect of irradiation in combination with other post harvest treatments on quality parameters by sensory evaluation and physicochemical analysis of the orange juice.

MATERIALS AND METHODS

Samples

Orange's varieties: Navel, Nova and Salustiana oranges.
Irradiation equipment: Ezeiza Atomic Center (CAE), year 1968, cobalt ⁶⁰ source, 800000 ci.
Storage conditions: 3-5°C, 80%HR for 20 and 40 days.

Table 1: Applied treatments

Code	Treatment	Doses
0	Control sample	Non irradiated
1.1	with PHT	0,35 kGy
1.2	without PHT	0,35 kGy
2.1	without PHT + HT	0,35 kGy
3.1	with PHT	0,60 kGy
3.2	without PHT	0,60 kGy
4.1	without PHT + HT	0,60 kGy

PHT: Post-harvest treatment
HT: heat treatment (3 min, 30°C)

Methods

Instrumental methods: Soluble solids content (ISO2173:2003(E), Refractometric method), Titratable acidity (ISO/FDIS 750:1998(E)), pH (ISO 1842:1991(E)).

Hedonic sensory method: 9 points scale, 50-naïve respondent's panel.

Test site: Standard room (ISO 8589:1988 (E)).

Data Analysis: Two-way analysis of variance (ANOVA) was applied to the data of each attribute (explained below).

Sensory Analysis

Samples were prepared the day of the evaluation by squeezing fresh fruit before the sensory testing. All samples were randomized, coded and served at room temperature. Three attributes were studied in a total of seven samples of juice: overall acceptance, colour and acidity. These attributes were evaluated according to a hedonic scale from 1 to 9 points.

RESULTS

Sensory evaluation results showed that for Nova and Navel varieties, irradiation had no significant effect ($p < 0,05$) on the ratings of any of the sensory attributes after a 20-day storage. However, both of them showed a significant difference ($p < 0,05$) in overall acceptance after a 40-day storage. For Nova variety, the control sample received significantly higher scores than the irradiated samples. For Navel variety, samples without post - harvest treatment exposed to 0,3 and 0,6 kGy had rated higher scores than the other treatments. The sensory evaluation of acidity for Navel variety after a 40-day storage indicated that samples without post - harvest treatment exposed to 0,6 kGy also had rated higher scores than the other treatments.

Significant differences ($p < 0,05$) in overall acceptance were found for Salustiana variety only after a 20-day storage. The higher score was given to those samples exposed to 0,6 kGy and with post - harvest treatment.

Physicochemical results showed that for Nova and Salustiana varieties, significant differences were found between the control sample and the irradiated ones for soluble solids, acidity and pH after a 20-day storage.

No significant differences were found among the different irradiation treatments for Navel variety in terms of soluble solids, acidity and pH after a 20-day storage.

Differences in all of the physicochemical parameters were found for Nova and Salustiana varieties but no correlation was found after a 40-day storage.

After 40 days of storage, significant differences in acidity and pH were found between the different treatments for Navel variety.

Non-irradiated samples showed higher values of pH and lower values of acidity than irradiated samples. Samples exposed to 0,6 kGy and without post - harvest treatment had higher acidity values and lower pH values than the other treatments.

No significant differences were found in terms of acidity and pH for samples exposed to 0,3 kGy for Nova variety with the storage time. However, results for samples exposed to 0,6 kGy showed that the post harvest treatments had different effects on the values.

In terms of soluble solids for Navel and Salustiana varieties, storage time did not affect the values. Significant differences were found for acidity values, which decreased with time.

In general, no correlation was found when sensory responses were matched to physicochemical analysis data. Only in terms of acidity, Navel variety was highly correlated with overall acceptance for the samples exposed to 0,6 kGy and without post harvest treatment.

Fig. 1: Overall acceptance after 20-day storage



Fig. 2: Overall acceptance after 40-day storage



Fig. 3: Acidity after 40-day storage



Fig. 4: Soluble solids after 40-day storage



CONCLUSIONS

These results indicate that for Nova and Navel varieties, exposure of oranges to 0,3 and 0,6 kGy doses, affects none of the studied fruit sensory attributes after a 20-day storage.

Irradiation of Salustiana oranges does affect the fruit sensory quality in terms of overall acceptance only after 20 days of storage. After 40 days of storage, non-irradiated samples and samples without post - harvest treatment exposed to 0,3 and 0,6 kGy, both for Navel variety, were preferred.

Physicochemical results showed that irradiation had different effects on the values depending on the variety. No correlation was found for any analyzed parameters.

No significant quality losses were induced by irradiation. As a consequence, irradiation can be an alternative to conventional post-harvest treatments.

Nevertheless, we must keep on working on this result to achieve more experience on this topic.

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