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REGULAR ARTICLE

Effect of radio-frequency treatment on quality of dates (*Phoenix dactylifera* L. cv. Deglet Nour)

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Abstract

Algeria's date palm (*Phoenix dactylifera* L.) fruit is one of the most important exported products from non-hydrocarbon sources. As other fresh or dry fruits, the dates (cv. Deglet Nour) are exposed to damage during post-harvest storage. In our study, we tested a postharvest treatment using a radiofrequency radiation as a new technique used on dates while evaluating its effect on date palm fruit quality. The results obtained reveal that the treatment was effective on the capacity of dates to maintain their pH, moisture content and ash percentage during the storage compared with the untreated dates. This treatment achieved complete disinfection of dates. From the results of this investigation, it can be concluded that the radiofrequency treatments present a practical alternative to the conventional techniques used on postharvest storage of dates.

Key words: Date palm, radiofrequency, dates storage, infestation, physicochemical properties

Introduction

Algeria's date palm (*Phoenix dactylifera* L.) fruit, which contributes about 48.25% of the total export value of agricultural and food products (Benzouche and Heriet, 2012), is one of the most important exported products from non-hydrocarbon sources. In 2010, production stood at 600.000 ton with only 3.26% used for export. As a result, Algeria is the world's third largest exporter of this fruit, especially variety Deglet Nour from Biskra province.

The dates, as other fresh or dry fruits, are exposed to damage during storage. In that event, the postharvest treatment is important phase which allows controlling insect infestations and maintaining fruit quality (Ben-Lalli et al., 2013). Many techniques were developed to carry out this treatment such as:

conventional hot air, hot-water (Hazbavi et al., 2015), cold treatment, fumigation, microwave irradiation (Manickavasagan et al., 2013), ozone treatment (Najafi et al., 2009) or treatment in controlled atmosphere (Achoura et al., 2003).

The objective of this investigation was to test a postharvest treatment using a radiofrequency radiation as a new technique used on dates while evaluating its effect on date palm fruit quality.

Materials and methods

Vegetal materials

Tests have been carried out on dates of Deglet Nour variety, which is a semi-dry variety indigenous from Biskra province

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(Algeria). These dates were harvested in 2014 in the Biskra Province and preserved without precautions before shipping to Italy as they had been naturally infested, by *Ectomyelois ceratoniae* Zell. (Lepidoptera: Pyralidae), in their original environment.

Methods

The trials were conducted in the laboratory of Stalam S.p.A. in Nove (Vicenza, Italy) using 4 samples as explained by Garbati Pegna et al. (2015) with little modification. Each sample was composed by 80 dates: the weight of the single fruits varied from 6 to 10 g and the length between 35 and 43 mm, the total weight was about 650 g. The control sample was constituted by 200 dates picked up from the original batch. Each sample was processed singularly, by exposing the dates adjusted in a single layer on a plastic tray, to radiofrequency radiations for 6 min in a 27.12 MHz, 3.5 kW lab scale RF tunnel, produced by Stalam S.p.A. and equipped with parallel-plate electrodes with adjustable distance and with a 600 mm wide shielded mouths for conveying the dates to and fro inside the irradiation chamber, to simulate the continuous process. The irradiation chamber measured 1,200 x 800 mm and was heated at 60°C with a thermostatic temperature control, the electrodes were kept at a fixed distance and the potential difference was 5,000 V.

RF treatment evaluation

After treatment, some samples were returned to Biskra without precautions. After one month of storage in ambient conditions without controlling the T° and H%, samples of treated and untreated have been analyzed in CRSTRA laboratory and they have been checked from insect presence and mortality.

pH determination

The determination of the pH value is carried out by measurement of the potential difference between electrodes immersed in a solution of aqueous pulp of ground date.

Moisture content

The moisture content was obtained by drying the sample in a conventional oven at 105°C for 24 hours in order to achieve a constant weight.

Ash determination

A samples are placed in an oven at temperature gradually increased to 500°C for 4 hours and after we were weighed the residue.

N.B:- Noting here that due the shortage of instrument before the treatment in CRSTRA laboratory, the initials value of these parameters weren't determined.

Results and discussion

The examination of all dates treated was revealed that the larva has found flattened due the high temperature (60°C) which mean that the effects of RF irradiation on larva was significant (Fig. 1).



Fig. 1. larva of *Ectomyelois ceratoniae* Zell. (Lepidoptera: Pyralidae) flattened.

pH determination

The pH parameter is one of most important value that indicates their microbial stability. Fig. 2 shows the pH determined of date fruits after being treated with radiofrequency and one month of storage. According to the histogram 01, the pH average values are 5.8 and 5.41 of dates treated and dates untreated, respectively. These results are in good agreement with what were obtained by (Hazbavi, et al., 2015) who reported that the minimum and maximum pH values before the storage were 6.08–6.14 and after 6 months of storage with 5.4% and 3.1% reduction were 5.75–5.95 for HWR-70 and control sample, respectively. Then, pH value decreased as the time of storage increased (Hazbavi et al., 2015).

Moisture content

As shown in Fig. 2, which presents the moisture content values after one months of storage, the average values are 16.56% and 21.51% of dates untreated and dates treated, respectively, with a considerable difference (4.95%). These results provide an argument about the radiofrequency effect on dates treated capacity to keep their moisture content than the dates untreated.

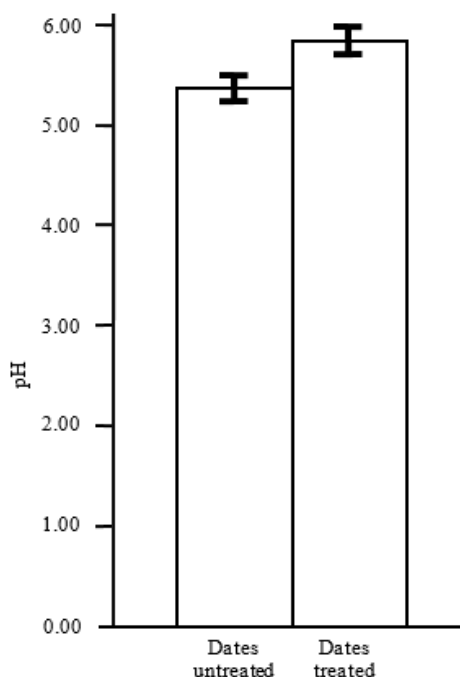


Fig. 2. pH variation.

Ash determination

Determination of the ash and mineral content of dates is important for its physicochemical properties variations during the storage. According the figure 3, which presents the percentage of ash, the analyses of dates treated and dates untreated were recorded that the percentages of ash are 23.89% and 18.50%, respectively, with 5% of difference. Then, the radio frequency radiation makes the dates to maintain their physicochemical properties.

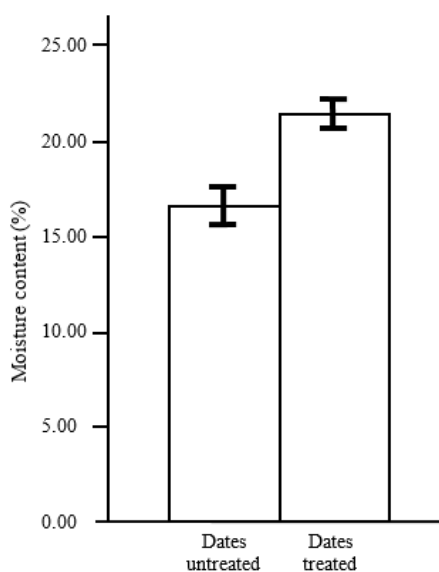


Fig. 3. Moisture content.

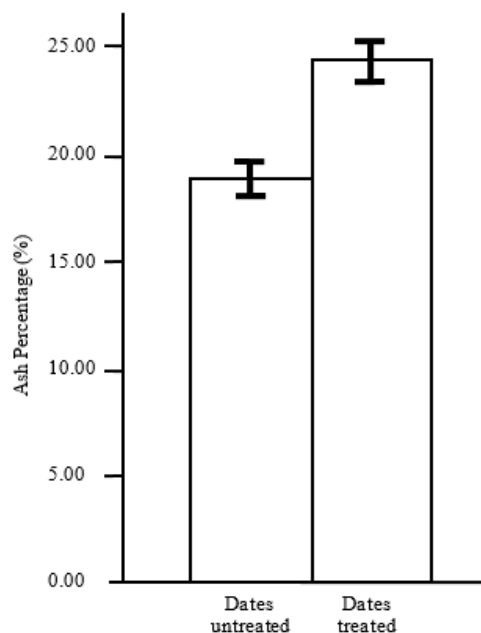


Fig. 4. Ash percentage.

Conclusion

After exposing the dates to radiofrequency during 6 minutes, it appears that the effect of this treatment has a significant change on dates (cv. Deglet Nour variety) treated and stored for one month than the sample control. The results obtained reveal that the treatment was effective on the capacity of dates to maintain their pH, moisture content and ash percentage during the storage compared with the dates untreated. Likewise, it achieved complete disinfection of dates.

To come to conclusion that, the radiofrequency treatments presents a practical alternative to the actually techniques used on postharvest treatment for the both reasons, the dates disinfection and maintaining date palm fruit storage quality, as well it allows to save a time as a cost required.

Author contributions

All authors contributed equally in the study and preparation of article. All authors approved the final version of the manuscript for publication.

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