

Article

Studying the effect of dusting with ethyl formate on the physical traits of some Iraqi date cultivars

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Available from: <http://dx.doi.org/10.21931/RB/CSS/2023.08.04.80>

ABSTRACT

The current study aimed to use three cultivars of Iraqi dates in the date stage, Al-Zuhdi hard, Sayer semi-hard and soft Paraben) and fumigating these dates with ethyl formate to preserve them and studying the physical traits of the dates under study in three periods (the pre-storage period, the three-month post-storage period and the six-month storage period). The physical traits included (total soluble solids, pH, viscosity, relative viscosity, surface tension, density, refractive index, and electrical conductivity).

Keywords: Dates Dusting; Ethyl Formate; Al-Zuhdi; Paraben; Sayer.

INTRODUCTION

The cultivation of dates has a very important influence on the history of the Middle East. With dates, supporting a large population in the desert regions was possible. Caravan routes have existed for centuries, mainly to transport dates. The cultivation of dates became a sacred symbol of fertility, and dates were of great spiritual and cultural significance to the peoples of the Middle East. And tamarind, rich in minerals and vitamins 1, is an excellent material for producing refined sugar, molasses, sweets and fermentation products (Samarawira, 1983). Dates contain small amounts of vitamins C, B1thiamine, B2 riboflavin, and nicotinic acid, and studies have shown that dates contain powerful antioxidants. It has anti-cancer and anti-viral activities. 2 Dates are usually exposed to many pests and diseases. Therefore, attention must be paid to storing and dusting methods after harvest to preserve them. Other than fogging, ethyl formate has been successfully used in studies to control insect pests in dried fruits and stored wheat. It was found that ethyl formate, compared to phosphine, works favorably against insects that invade dates and other dried fruits. Extensive tests were conducted on grains, legumes, spices, dried fruits, nuts, and dried tubers, and it was recommended that ethyl formate be a safe general evaporator for stored food. Ethyl formate has not adversely affected the quality or flavor of processed goods. Ethyl formate has fungicidal properties in grains without affecting the viability or germination of seeds. The emergence of ethyl formate as a fogging agent is largely due to its rapid action. ³

MATERIALS AND METHODS

Date Samples Collection

Three varieties of Iraqi dates were obtained (Al-Zuhdi, Al-Birban and Al-Sayer). For the 2020 season, the dates were sorted, prepared and treated as follows: Sorting, cleaning and selecting dusting material. Ethyl formate prepared by Sigma Aldrich company was used with a purity of 97% and a volume of 500 ml for one package. After the fogging process was conducted, the process of packing and storing was completed

Preparation of Date Juice

The date juice was prepared as mentioned by ⁴ to conduct physical and chemical tests, and the preparation of the juice included the following steps:

- Preparation of dates (removing the kernels)
- Soaking in water for 24 hours at room temperature (1 kg of dates: 3 liters).

Filter The Juice with a Gauze.

- Defecation using calcium oxide at 1% of the weight of dates.
- Neutralize the pH using concentrated phosphoric acid.
Filter using filter paper No. 1.

Estimation of Total Soluble Solids (TSS)

The percentage of total soluble solids in the aqueous extract of date juice was estimated using the Abbe Refractometer supplied by Carl Fisher Company.

pH Estimation

The pH of date juice was determined with a pH meter supplied by HANNA.

Relative Viscosity Measurement

The viscosity was estimated using a breeding device (Ostwald), as 15 ml of samples were taken. Then, the time required for its flow over a certain distance at room temperature and zero degrees Celsius was estimated, according to what was mentioned (Egan et al., 1988) based on the following equation:

viscosity of water / viscosity of liquid = time of passage of water x its density / time of passage of liquid x its density

Surface Tension Measurement

The surface tension of the samples was measured at the Environment and Water Laboratories/Ministry of Science and Technology using a Sigma 703D surface tension meter supplied at room temperature.

Turbidity Estimation

The turbidity of date extract was estimated in the Environment and Water Laboratories / Ministry of Science and Technology, using a turbidity meter supplied by Lovibond Company (Germany) following the ⁴

Measurement of Relative Density

The relative density relative to the density of water was measured using a pycnometer vial.

$$\text{Density} = \frac{\text{weight of liquid}}{\text{weight of water}} \quad (1)$$

$$\text{Weight of the liquid} = \text{Weight of the density vial with the liquid} - \text{Weight of the density vial empty} \quad (2)$$

$$\text{Weight of water} = \text{weight of the density bottle with water} - \text{weight of the density bottle empty.} \quad (2)$$

Refractive Index Estimation

The refractive index was estimated using the Abbe Refractometer supplied by Carl Fisher for models at a temperature of 20 °C, according to the method used by ⁵

Electrical Conductivity

The electrical conductivity was conducted in the Environment and Water Laboratories / Ministry of Science and Technology following the Al-Mamouri method, 2017, for the conductivity in the unit (MicroSiemens/C).

RESULTS

Total Soluble Solids (TSS)

Figure (1) shows the effect of ethyl formate treatment and storage periods on the percentage of total soluble solids for date cultivars (Zuhdi, Al-Sayer and Paraben). Storage, except for the ascetic control model, which amounted to 68%, and the treatment model was ascetic, which amounted to 76%, during the three-month storage period. Significant differences were found among them, meaning that the treatment with ethyl formate did not significantly affect the values of the percentages of total soluble solids. These results were consistent with the findings of 6, where the TDS values ranged between 64%-73% for Iranian dates, and the results of 7 for Tunisian dates, where the total TDS values ranged between 65-75%. And lower than that measured by 8 for Saudi and Egyptian dates, which amounted to 89-91%. The results in Figure (1) also showed significant differences between the values of the percentages of total soluble solids for samples of cultivars during the storage periods. In the pre-storage period, the highest value of the total soluble solids ratio was for the Al- Zuhdi treatment model, which amounted to 77.7%, and the lowest value was for the Paraben treatment model, which amounted to 65%. As for the three months of storage, the highest value of the total soluble solids percentage for the treatment model was ascetic, and the lowest value was for the Paraben treatment model, which amounted to 64%, and after six months of storage, we find the highest value for the percentage of total soluble solids for Al- Sayer control model, which reached 74%. The lowest value was for the Paraben control model and the Paraben treatment model, where the value was 66% for both samples.

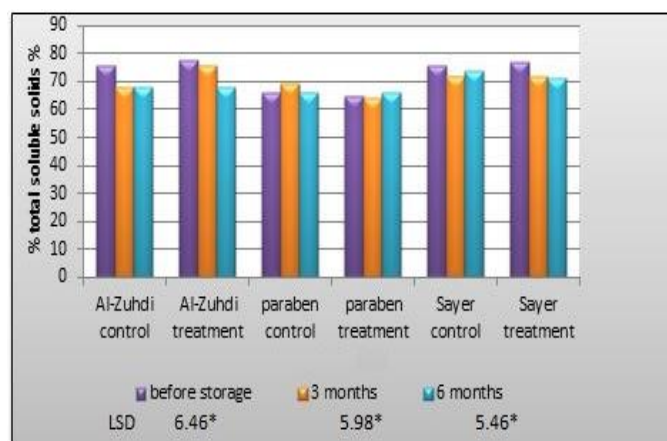


Figure 1. Effect of treatment with ethyl formate and storage periods on the percentage of total soluble solids for date cultivars

pH

Figure (2) shows the effect of treatment with ethyl formate and storage periods on the pH value of the date varieties used (Zuhdi, Al-Sayer and Paraben). We note that there are no significant differences at the probability level ($P \leq 0.05$) between the control models and the treatment models for each type of cultivar during the

storage periods, meaning that adding ethyl formate to the treatment model for each category did not affect the pH value, except for Paraben models. We find that there are differences Significant between the control model and the treatment model of the Paraben cultivar during the storage periods, where the value in the pre-storage period for the Paraben control model was 5.9, while the pH value was 7.0 for the Paraben treatment model. These results are close to the results reached by 4, where the pH value of the studied cultivar ranged between 5.49 and 6.73 and a similar approach to the results of (9) which were 6.06 for the Dakla Nour cultivar and 5.71 for the Dukla White cultivar. As for the three months of storage, we find the pH value of the Paraben control model was 6.57, the Paraben treatment model was 7.33, and the values in the six months of storage for the Paraben control model were 6.93 and the Paraben treatment model 7.6. In general, we notice an increase in all models' pH values during the storage periods. We note significant differences at the probability level ($P \leq 0.05$) between the pH values of date cultivars during the storage periods. In the pre-storage period, the highest value of the Paraben treatment model was the highest value and the lowest value of the Zuhdi control model. In three months, the highest value of the Paraben treatment model was also.

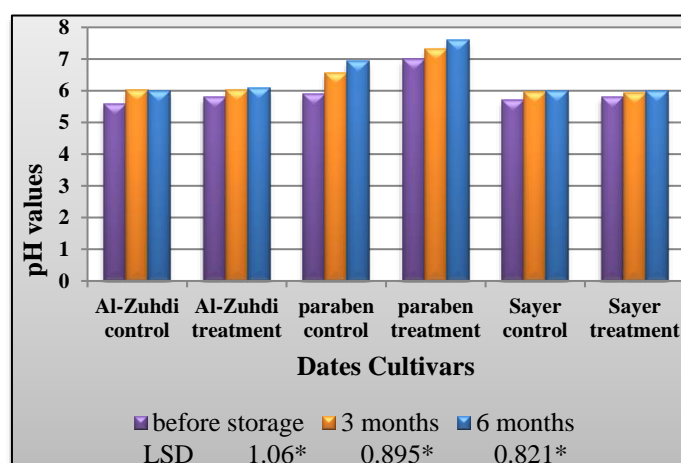


Figure 2. Effect of treatment with ethyl formate and storage periods on the pH value of date cultivars

Viscosity Estimation

Figure (3) shows the effect of ethyl formate treatment and storage periods on the viscosity values of the date cultivars under study, as there were significant differences between the viscosity values of the studied varieties at the probability level ($P \leq 0.05$) in the pre-storage period. The results show that the highest value of the wife was for the Zuhdi treatment model, which amounted to 17.976 centboys, and the lowest value was for the Sayre control model, where the viscosity value was 11,507 centboys.

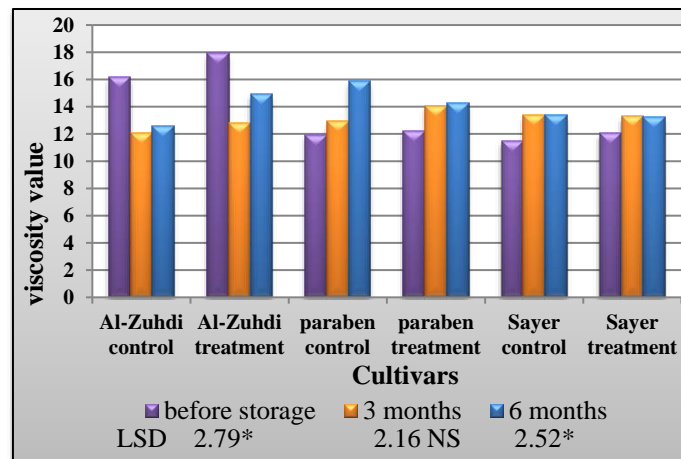


Figure 3. The effect of ethyl formate treatment and storage periods on the viscosity value of date cultivars

It is clear from the results that the addition of ethyl formate did not affect the viscosity of the studied date extracts in the pre-storage period. After three months of storage, we note that there are no significant differences between the viscosity values between the control models and the treatment models for each category, while we find significant differences between the viscosity values during the six months of storage. The highest value of the Paraben control model was 15.878 cents for boys, while the lowest value of the control model was Zuhdi and amounted to 12.565 cents for boys. Also, we find no significant differences between the viscosity values of the control models and the treatment models of the studied items during six months of storage.

Relative viscosity

Figure (4) shows the effect of ethyl formate treatment and storage periods on the relative viscosity values of the studied dates models. The results showed that the highest value of the relative viscosity was for the Sayer control model, which amounted to 0.906, and the lowest value was for the Zuhdi treatment model, where the relative viscosity value was 0.521. We note that there are no significant differences. The relative viscosity values of the control model and the treatment model for each cultivar type during the pre-storage period. It is clear from the results that the addition of ethyl formate did not affect the relative viscosity of the studied date extracts in the pre-storage period. After three months of storage, we notice that there are no significant differences between the relative viscosity values of the studied dates models, as well as between the control models and treatment models for each type of cultivar, while we find significant differences between the relative viscosity values of the studied date cultivars extracts during six months of storage. The highest value of the control model was Zuhdi and amounted to 0.822, while the lowest value of the Paraben control model was 0.651. Also, it is clear from the results that there are no significant differences between the relative viscosity values of the control models and the treatment models for the studied items during six months of storage.

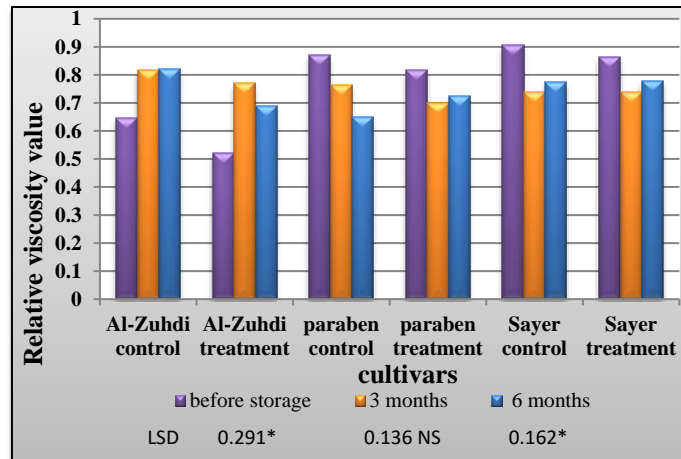


Figure 4. The effect of ethyl formate treatment and storage periods on the relative viscosity value of date cultivars

Surface Tension

The results in Figure (5) show the effect of treatment with ethyl formate and storage periods on the surface tension values of the extracts of the studied cultivars (Al-Zahdi, Paraben and Al-Sayer). ($P \leq 0.05$) in the pre-storage period. We find the highest value of the surface tension of the Sayer control model, which reached 50.78 N/M, while the lowest value of the Zuhdi control model was 37.75 N/M. The results also show no significant differences between Zuhdi's control model and Paraben's control model and between the surface tension values of the control model and the treatment model for each category.

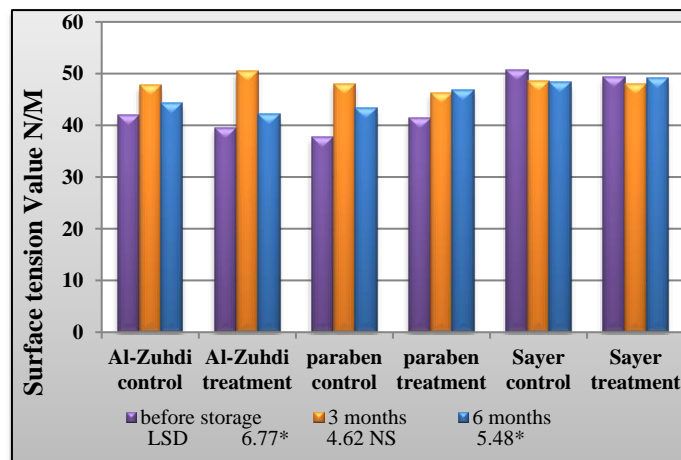


Figure 5. Effect of treatment with ethyl formate and storage periods on the surface tension value of date cultivars

That is, it shows that the treatment with ethyl formate does not affect the surface tension values of the studied models. The results also showed no significant differences between the surface tension values of the studied varieties after three months of storage and the absence of significant differences between the surface tension values of the control model and the treatment model for each of the studied cultivars. After six months of storage, we noticed significant differences between the surface tension values of the dates models, where the highest value of the Sayer treatment model was 49.19 N/M, While the lowest value of the treatment model was Zuhdi, which amounted to 42.15 N/M. After six months of storage, we did not notice significant differences between the surface tension values of the control and treatment models for each of the studied items. We generally find significant

differences between the surface tension values for each model during the storage and pre-storage periods.

Turbidity Measurement

Turbidity is a measure of the passage of light through water and is used to measure water quality for suspended colloidal substances. Turbidity is a measure of how light is scattered and absorbed. The results in Figure (6) show the effect of ethyl formate treatment and storage periods on the turbidity values of the studied date cultivar extracts (Al-Zuhdi, Paraben and Al-Sayer). The storage, where the highest turbidity value was for the Sayer control model, reached 84 NTU, While the lowest value of the treatment model was Zuhdi and amounted to 6.62 NTU. We also note in this period that there are no significant differences between the control model and the treatment model for each cultivar, as we find a decrease in the turbidity value of the treatment models in an insignificant manner, except for the Al-Sayer cultivar. As for the three months of storage, we did not find any significant differences between the turbidity values of the extracts of the studied date cultivars, while after six months of storage, significant differences were found between the turbidity values of the dates models, where the highest value of the Paraben treatment model was 56.3 NTU While the lowest value was for the Zuhdi treatment model. We also note in this storage period that, there were no significant differences between the control and treatment models for each category except for the Paraben category. The turbidity of the Paraben treatment model was 56.3 NTU.

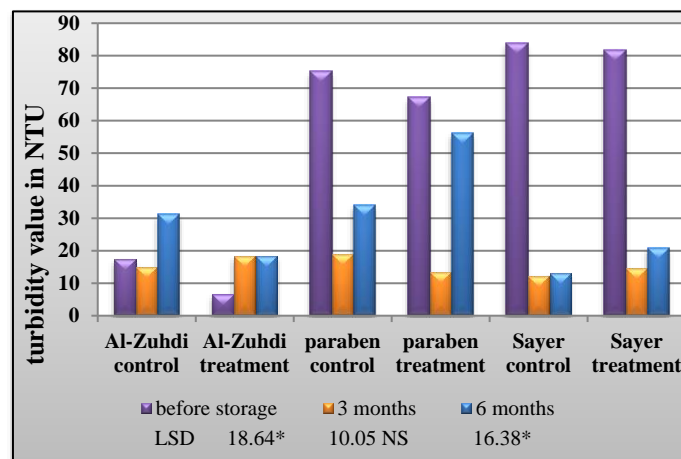


Figure 6. Effect of ethyl formate treatment and storage periods on the turbidity value of date cultivars

Density Measurement

The results in Figure (7) show the effect of ethyl formate treatment and storage periods on the density of the extracts of the studied cultivars, Where it was found that there were no significant differences between the density values of the studied cultivars models (Al-Zahdi, Paraben and Al-Sayer) during the pre-storage period and after three and six months of storage. As well as the absence of significant differences between the density values of the control model and the treatment model for each of the studied cultivars, the results show that the treatment with ethyl formate did not affect the density values of the studied models.

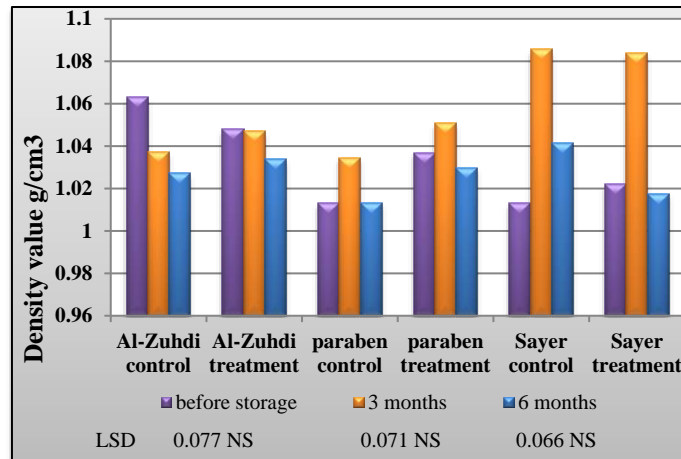


Figure 7. Effect of ethyl formate treatment and storage periods on the density value of date cultivars

Refractive Index Measurement

The results in Figure (8) show the effect of ethyl formate treatment and storage periods on the refractive index of the extracts of the studied cultivars (Al-Zahdi, Paraben and Al-Sayer). It was found that there were no significant differences between the refractive index values of the studied cultivars models during the pre-store period and after three and six months of storage, as well as the absence of significant differences between the refractive index values of the control model and the treatment model for each of the studied cultivars. Ethyl formate treatment on the refractive index values of the studied models.

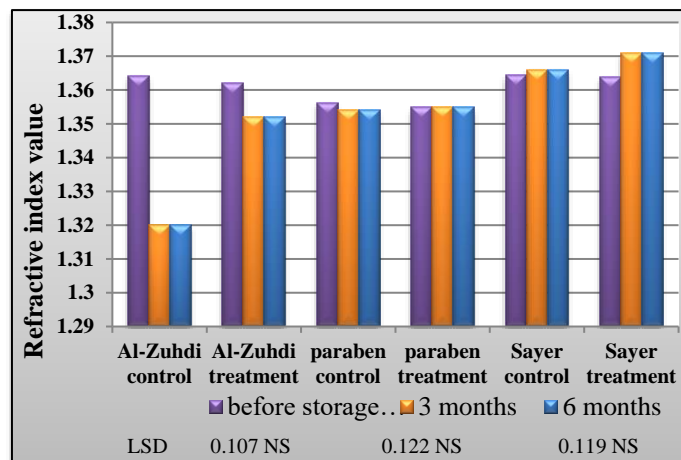


Figure 8. Effect of treatment with ethyl formate and storage periods on the refractive index value of date cultivars

Electrical Conductivity

It is the numerical expression of the ability of the solution to conduct electric current and this number depends on the total sum of the concentration and equivalence of ionized substances in the water and the temperature during the measurements, as most inorganic acids, bases and salts have good conductivity, while organic substances are usually poor conductors. The results are illustrated in Figure (9). The effect of treatment with ethyl formate and storage periods on the electrical conductivity of the studied date varieties (Zuhdi, Al-Sayer and Paraben). It was found through the results that there were significant differences in the probability level ($P \leq 0.05$) between the values of electrical conductivity results for date varieties during storage periods. Whereas, the lowest value for the control model was Zuhdi, which amounted to 2970 $\mu\text{s/cm}$, and these results were much higher than

the results obtained by (2020) for the fruits of Algerian dates, Dekla Nour and Dekla White, which were 12.85 $\mu\text{s}/\text{cm}$ for both varieties. After three months of storage, we also note that there are significant differences between the values of the models, and the highest value for the Paraben control model was also 5330 $\mu\text{s}/\text{cm}$, and the lowest value for the Zuhdi control model also amounted to 3040 $\mu\text{s}/\text{cm}$. Likewise, after six months of storage, we also note that there are significant differences between the values of the models for the studied cultivars, where the highest value for Paraben control model was 4000 $\mu\text{s}/\text{cm}$ and the lowest value for the Zuhdi treatment model amounted to 3600 $\mu\text{s}/\text{cm}$. We note from the results in Figure (9) that there are no significant differences between the control model and the treatment model for each cultivar during the storage periods, except for the Paraben cultivar.

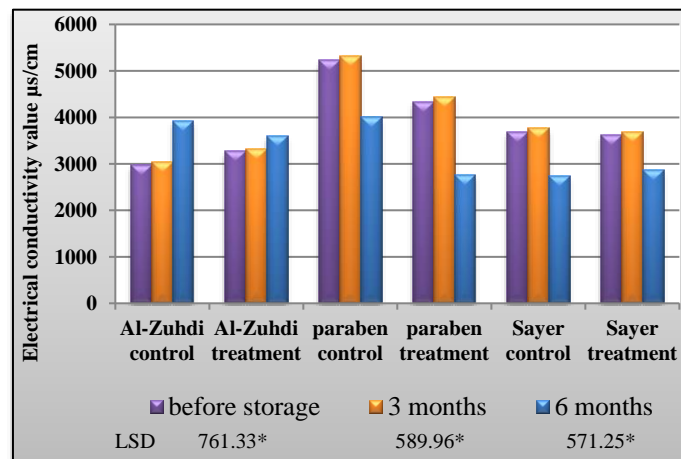


Figure 9. Effect of ethyl formate treatment and storage periods on the electrical conductivity value of date cultivars

DISCUSSION

These differences can be due to the creation of cultivars in addition to the influence of climatic conditions and date palm service factors.⁴

The lowest value of the Al-Sayer treatment model in six months was the highest value of the Paraben treatment model and the lowest value of the Zuhdi control model and Al-Sayer treatment^{10,11,12}.

We note that there are no significant differences between the viscosity values of the control and treatment models for each of the varieties during the pre-storage period.^{13,14}

CONCLUSIONS

Superiority in attributes is due to the difference between the control model and the treatment model for this item in the pre-storage period and subsequent storage periods, and the electrical conductivity values for the treatment models were lower than the values of the control models, that is, there is an effect of adding ethyl formate on the electrical conductivity of the treatment models, and we also find significant differences within the single model values. During the storage periods of three months and six months for the control and treatment models of the two cultivars, Paraben and Al-Sayer, we did not find any significant differences between the values of the models for the Zuhdi cultivar during the storage periods.

References

1. Al-Fatlawi, L. J. F. *The use of polishing methods for three types of dates and their effect on chemical, physical and sensory properties*. 2013. Master Thesis. University of Baghdad. College of Agriculture.
2. Aisha, S.; Amna, S. A. *Contribute to the study of the chemical changes of the content of the fruits of the date palm phoenix dactylifera I. (Deglet Nour and Deglet White) during the stages of its formation*. 2020. Master's thesis. Hama Lakhdar University. College of Natural and Life Sciences.
3. Al-Mamouri, S. O. H. Evaluation of the efficiency of the drinking water purification plant in the Al-Hussein neighborhood complex / Al-Hamza western district. *Journal Pure and Applied Sciences*, 2017, 6.25.
4. Abbès, F.; Bouaziz, M. A.; Blecker, C.; Masmoudi, M.; Attia, H.; Besbes, S. Date syrup: effect of hydrolytic enzymes (pectinase/cellulase) on physico-chemical characteristics, sensory and functional properties. *LWT-Food science and Technology*, 2011, 44.8: 1827-1834. DOI. 10.1016/j.lwt.2011.03.020.
5. Al-Tamim, E. A. A. Comparative study on the chemical composition of Saudi Sukkari and Egyptian Swei date palm fruits. *The Journal of American Science*, 2014, 10.6: 149-153.
6. Aljaloud, S.; Colleran, H. L.; Ibrahim, S. A. Nutritional value of date fruits and potential use in nutritional bars for athletes. *Food and Nutrition Sciences*, 2020, 11.06: 463. <https://www.scirp.org/journal/fns>
7. Djaoudene, O.; Bey, M. B.; Louaileche, H. Physicochemical characteristics and nutritional compositions of some date (*Phoenix dactylifera* L.) fruit cultivars. *Acta Univ. Cibiniensis. Ser. E Food Technol*, 2019, 23: 129-138.
8. Gu, C. *Evaluation of ethyl formate for management of both resistant and susceptible strains of *Cryptolestes pusillus* and *Cryptolestes ferrugineus**. 2020. PhD Thesis. Murdoch University.
9. Booij, I. G.; Piombo, J.M.; Risterucci, M.; Coupe, D.; Thomas, M. Study of the chemical composition of dates at various stages of maturity for varietal characterization of various of date palm cultivars (*Phoenix dactylifera* L.), *Fruit*, 1992, 47: 667-677.
10. Samarawira, I. Date palm, potential source for refined sugar. *Economic Botany*, 1983, 37.2: 181-186.
11. Al-Farsi, M.; Alasalvar, C.; Morris, A.; Baron, M.; Shahidi, F. Comparison of antioxidant activity, anthocyanins, carotenoids, and phenolics of three native fresh and sun-dried date (*Phoenix dactylifera* L.) varieties grown in Oman. *Journal of agricultural and food chemistry*, 2005, 53.19: 7592-7599.
12. Vayalil, P. K. Antioxidant and antimutagenic properties of aqueous extract of date fruit (*Phoenix dactylifera* L. Arecaceae). *Journal of Agricultural and Food Chemistry*, 2002, 50.3: 610-617.
13. Ren, Y.; Mahon, D. Field trials on ethyl formate for fumigation of on-farm storage. In: *Proceedings of the Australian Postharvest Technical Conference, EJ Wright, MC Webb and E Highley (eds), CSIRO Entomology*. 2003. p. 210-216.
14. Sabahelkheir, M. K.; Abdalla, A. H. Compositional Characterization of Endosperm (Guar Gum) of Six Guar (*Cyamopsis tetragonoloba*) Genotyp. <http://www.articlesbase.com/soups-articles/compositional-characterization-of-endosperm-2009-guar-gum-of-six-guar-Cyamopsis-tetragonoloba-genotypes-grown-in-sudan-1434734.html#ixzz1AYJ1yWk5>
15. Al-Shahib, W.; Marshall, R. J. Dietary fibre content of dates from 13 varieties of date palm *Phoenix dactylifera* L. *International journal of food science & technology*, 2002, 37.6: 719-721

Received: May 15, 2023/ Accepted: June 10, 2023 / Published: June 15, 2023

Citation: Khalaf, M.N.; Obaid, A.A. Studying the effect of dusting with ethyl formate on the physical traits of some Iraqi date cultivars. *Revista Bionatura* 2023;8 (2) 63. <http://dx.doi.org/10.21931/RB/CSS/2023.08.04.80>