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Effect of Heat Treatments on Storability and Fruit Quality of Lemon
(Citrus limon (L.) Burm., cv. Eureka)

Submitted in partial fulfillment requirement for the Master's Degree in the
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English Summary

Effect of Heat Treatments on Storability and Fruit Quality of Lemon (*Citrus limon* (L.) Burm.) cv. "Eureka"

The increasing demand for citrus fruit (and other fruits) with less or no synthetic fungicide residues has led to the development and increased uses of various heat treatments as non-chemical methods to control postharvest diseases, reduce physiological disorders and maintain fruit quality. This study has been carried out at Plant Production Department-Fruit Laboratory, College of Food Sciences and Agriculture, King Saud University, Riyadh, Saudi Arabia, to investigate the possible effects of various heat treatments on quality and fruit storability of mature "Eureka" Lemon grown locally in Commercial Orchard throughout the 2004 and 2005 seasons. Fruit were subjected to 12 various heat treatments as follows:

T1: control (untreated).

T2: hot water dips at 48°C for 3 min.

T3: hot water dips at 48°C for 6 min.

T4: hot water dips at 58°C for 1 second.

T5: hot water dips at 58°C for 15 seconds.

T6: hot air treatment at 35°C for 24 h.

T7: hot air treatment at 35°C for 72 h.

T8: dipping in hot solution of 2% NaCl w/v at 48°C for 6 min.

T9: dipping in hot solution of 4% NaCl w/v at 48°C for 6 min.

T10: dipping in solution of 2% CaCl₂ w/v at 48°C for 6 min.

T11: dipping in solution of 4% CaCl₂ w/v at 48°C for 6 min.

T12: untreated and stored at 25°C and 50 % RH to simulate the market conditions. After treatments, fruits of T1 to T11 were stored at 12°C and 90% RH.

Results of this study can be summarized as follows:

1- Heat related damage

a- There were no heat related damages to the fruit (pitting or discoloration) as a result of all various heat treatments.

2- Storage period

a- Dipping in hot water or solutions for 6 min (T3, T8, T9, T10 and T11) were superior to the others in the storage-period when they stored up for 16 weeks in the first season and 18 weeks in the second season, while T1, T2, T4 and T5 had 14 weeks of storage in both seasons.

b- Fruit of hot air treatments (T6 and T7) had 12 weeks-storage period in both seasons.

c- The shortest period of storage was recorded in T12 when it stored for 2 weeks in both seasons.

3- Decay

a- Similar results were found in dipping treatments for 6 min: T3, T8, T9, T10 and T11 in both seasons.

b- The percentages of decayed fruit were lower in dipping treatments for 6 min: T3, T8, T9, T10 and T11 when compared to the control, T2, T4 and T5 in both seasons. These results could be more valuable when taking into account the extended period of storage for T3, T8, T9, T10 and T11 in both seasons.

d- The highest percentages of decayed fruit observed in hot air treatments (T6 and T7) in both seasons after 12 weeks storage period. The percentage of decayed fruit for T7 was 50% in the first season and 47% in the second season. . The percentage of decayed fruit for T6 was 47% in the first season and 46% in the second season.

4- Weight loss

a- The highest percentage of weight loss was recorded in T12 when it reached 20.72% in the first season and 19.42% in the second season.

b- Dipping treatments: T2, T3, T4, T5, T8, T9, T10 and T11 lessened the weight loss by 0.5-2.5 % more in that of the control treatment (T1) and that was nearly up until the 14th week. T11 was relatively the best when compared to T3, T8, T9 and T10.

c- Hot air treatments came after T12 in the increasing weight loss in both season when compared to the control (T1) or dips treatment: T2 T3, T5, T8, T9, T10 and T11.

d- Solutions of CaCl₂ or NaCl had no significant effects in reducing weight loss. Furthermore, it appeared that the observed effects in CaCl₂ or NaCl treatments came from the heat itself rather neither CaCl₂ nor NaCl.

e- There was no significant effect of fast dipping in hot water for 1 second (T4) in reducing the weight loss when compared to the control. Besides, the results of T4 were similar to that of T1 (the control).

5- Juice yield

a- There were no significant differences in juice yield among all treatments.

b- There were gradual increases in juice yield over time in all treatments.

6- Total soluble solids (TSS)

a- There were gradual increases in TSS in all treatments over time (storage period). The raise in TSS for T12 was relatively sharp over 2 week's storage-period.

7- Titratable Acidity

a- There were no clear effects of all heat treatments on the titratable acidity in both seasons.

b- There were gradual increases in titratable acidity in all treatments over time (storage period).

c- The raise in titrable acidity of T12 was relatively sharp after 2 weeks of storage comparing to other treatments.

8- Vitamin C

a- There were gradual decreases in vitamin C over time in all treatments except for T12 (storage at 25°C and 90% RH) where it lost vitamin C sharply over a short period (2 weeks): 9% after 2 weeks storage and 13% after 4 weeks storage in both seasons.

b- The study found that hot air treatments at 35°C and 90% RH (T6 and T7) accelerated the loss of vitamin C during storage when compared to other heat treatments. The drop in vitamin C in both seasons was around 27-28% for T7 and was 24-26% for T6 after 12 weeks of storage while the drop in vitamin C for all treatments (except T4) was between 14-21% in the first season and 13-22% in the second season.

c- T11 (4% CaCl₂) reduced the loss of vitamin C from the initial reading up until week 14th in the first season and week 16th in the second season comparing to all other treatments.

In conclusion, we clearly observed the positive effects of dipping treatments for 6 min in keeping fruit qualities. The best result was obtained by dipping fruit in 4% CaCl₂ solution.