Effects of Transportation Vibration on Antioxidant System of Fragrant Pear During Storage

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Keywords: Pear Storage, Antioxidant System, Transportation Vibration, Different Levels of Roads, Impact Analysis

Abstract: It is necessary to establish a scientific antioxidant system in the storage process of fragrant pears based on different grades of roads, and it is also found that the impact of transportation vibration of different grades of roads on the antioxidant system in the claim process of fragrant pears is different in the transportation practice. Therefore, in this paper, through the experimental simulation, the actual effect of the movement vibration of the semi-trailer on the antioxidant system in the storage process of Fragrant Pear under different transportation vibration environment such as highway, first-class highway, second-class highway and third-class highway is discussed. Finally, the specific analysis results are given. The main hope is to provide safety guarantee for the transportation and storage of fragrant pear through scientific analysis.

1. Introduction

Generally speaking, comparing the results of vibration treatment with that without vibration treatment under different road conditions is totally different. For example, the respiratory rate, total phenol content, decay index, VC content and other indicators of Xiangli during 28 days storage at 23 ℃ room temperature will change significantly. According to the results of past practice, after 28 days of storage, the changes of various indexes of Xiangli under different levels of road vibration background were larger, which were lower than that of the control group. Compared with high-speed and first-class roads, the second and third-class roads have more significant effects on the respiration and decay rate of fragrant pears. They will directly destroy the antioxidant system, leading to the significance of antioxidant system $p < 0.05$. This shows that the respiratory function of Xiangli Pear during storage is obviously accelerated under the vibration, and its antioxidant protection system and antioxidant activity are significantly reduced. This is because the lipid oxidation of Xiangli cell membrane is obvious, which directly destroys the integrity of cell membrane, which is also the main reason for accelerating the rapid decline of Xiangli. Because of the deviation of secondary and tertiary road conditions, the transportation vibration is relatively obvious, so the transportation vibration is large and the storage period is short.

2. Fragrant Pear and Its Transportation

Fragrant pear is one of the special agricultural products in Xinjiang, among which Korla Fragrant Pear is the most famous. Because of its delicious nutrition, crisp, fragrant and delicious, it is deeply loved by people. In order to expand the scale and scope of production, Xinjiang Xiangli hopes to be exported to areas outside Xinjiang, which involves long-distance transportation. In the process of commercial transportation, perishable products are often transported by car and semi-trailer. Xinjiang is far away from other cities outside Xinjiang. In the long-term transportation process, there is no way to avoid the fruit damage caused by stress. The damaged fruit can not resist the adverse environment. The fruit ripens rapidly and becomes old, which eventually accelerates the speed of fruit decay and directly causes the economic loss of fruit farmers. So at present,

  DOI: 10.25236/iaeec.2020.019

transportation vibration simulation technology has appeared in China, in-depth research on the specific impact of transportation vibration on the transportation and storage of fragrant pears, at the same time, consider the direct impact of vibration transportation on the oxidation protection system, and seek to propose targeted and effective methods to reduce the external damage and internal quality of fragrant pears [1].

3. Experimental Analysis of the Effect of Different Levels of Road Transport Vibration on the Antioxidant System of Fragrant Pear During Storage

3.1. Experimental Materials and Equipment

In terms of experimental materials, we selected fragrant pears from Xinjiang Korla Region, which are specially purchased mature and have the same color and size, without any mechanical damage and pest infection as the experimental materials.

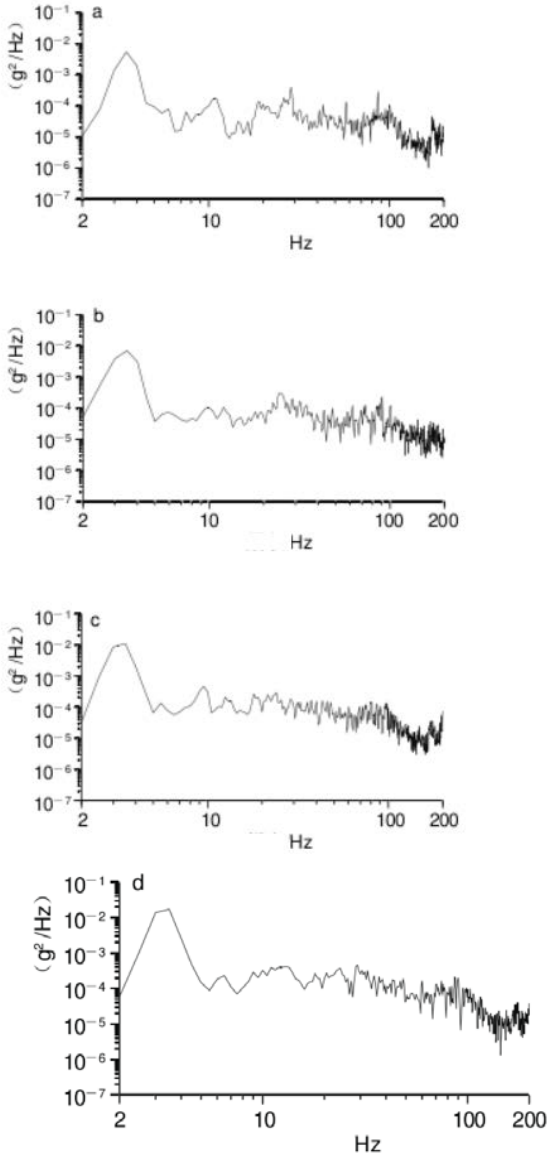

Figure 1 Power spectral density of semi-trailer driving for 15 hours on highway, class I highway, class II Highway and class III Highway (driving speed is 61-90km / h)

The materials prepared for the experiment also include Folin phenol reagent, ascorbic acid, Fe3 + reduction capacity kit, phosphoric acid, phenolphthalein, sodium phosphate, hydrochloric acid, sodium hydroxide, potassium chloride, anhydrous ethanol and other chemicals.

In terms of experimental equipment, we have prepared shaking table experimental system, UV spectrophotometer, electronic balance, etc. In the process of the experiment, the simulation

equipment is mainly used to simulate the transportation vibration process under different road level background, and the transportation vibration data is recorded in the simulation process. The semi-trailer is used as the transport vehicle, with a rated load mass of 20t. During the test, the load mass is about 13T, and the transport distance is set as 1000km. In the process of transportation vibration measurement, according to the past practice results, after 28 days storage, many indexes of Xiangli under different levels of road vibration background changed significantly, which were lower than the control group. It is also necessary to install Hua acceleration sensor at the rear end of the trailer car, which is about 1m from the rear plate of the car to the last section. It mainly collects vibration data every 3 minutes through the transportation acceleration sensor, and the length of data recording is about 2S. After the vehicle arrives at the destination, the test equipment is removed and the test results are input into the computer system. After data processing, the acceleration spectrum is obtained. The following is the power spectral density diagram obtained in class I, class II, class III and expressways, that is, the spectrum diagram of Xiangli transport vehicle vibration table simulation vibration (vehicle running speed is 61-90km / h), as shown in figure [2].

3.2. Experimental Method

Place the fragrant pears to be transported in the transport vehicle, pack them according to the actual transport packaging, and separate each fragrant pear with corrugated paper, and control the quality of each box at about 10kg. Then we divided the experimental group into two groups: the control group without any treatment and the experimental group with vibration treatment. The Hami melons of the experimental group were placed on the vibration table and vibrated on the 4-level road for 15 hours respectively. After the vibration experiment, they were stored at 23 ℃ for about 28 days. The indexes were tested every 7 days on average and 4 times. In the process of testing, it is necessary to define an important index in the transportation vibration process of fragrant pear, i.e. rotten index:

$$\text{Decay index}=\frac{\sum(\text{Number of fruits}\times\text{Decay level})}{\text{Total number of fruits}}$$

Then determine the total phenol content, VC content and antioxidant enzyme activity of fragrant pear. Finally, measure the antioxidant activity, process the data of the experiment, measure three parallel indexes respectively, analyze the square difference with Duncan algorithm, compare multiple differences, and draw the corresponding curve content [3].

3.3. Experimental Results

As shown in Figure 2, the respiration rate of fragrant pear will gradually increase with the increase of vibration frequency, which indicates that the respiration of fragrant pear will gradually increase with the increase of storage time. In the experimental group, the respiration rate of Xiangli was relatively high. After 28 days storage, the respiration rate of Xiangli in the experimental group was 1.41, 1.71, 2.13 and 2.31 times of that in the control group ($P < 0.05$). This indicated that it promoted the respiration of fragrant pear seriously in the transportation and storage under the transportation vibration environment, and this result was more significant on the second and third class highways than on the first class highways and expressways ($P < 0.05$). Generally speaking, ordinary fruits and vegetables are protected against adversity by increasing their respiration. If their respiration rate is too high, it will lead to the automatic generation of reactive oxygen free radicals. At this time, it seriously promotes the oxidation of cell membrane, leading to the serious destruction of cell integrity, which directly accelerates the aging degree of fruits [4].

Analysis of the effect of vibration treatment on rotten index of fragrant pear

The vibration treatment experiment is shown in Figure 2.

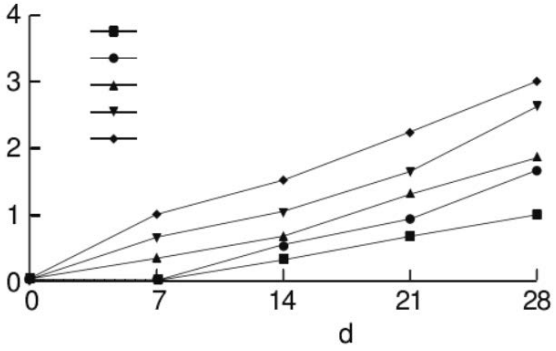

Figure 2 Analysis of the effect of vibration treatment on the decay index of fragrant pear

Fig. 2 shows that the rotten index of fragrant pear will increase gradually in the process of transportation and storage, and will increase further in the later stage of storage. So the longer the storage time is, the more the ripeness will increase, and the pear fruit will always be in the aging state, which is more obvious in the control group than in the experimental group. In the process of the experiment, the simulation equipment is mainly used to simulate the transportation vibration process under different road level background, and the transportation vibration data is recorded in the simulation process. The semi-trailer is used as the transport vehicle, with a rated load mass of 20t. During the test, the load mass is about 13T, and the transport distance is set as 1000km. In the process of measuring transportation vibration, Hua acceleration sensor needs to be installed at the rear end of the trailer carriage. The installation position is about 1 m from the rear plate of the carriage to the last section, which shows that the immune ability of Xiangli fruit to resist pathogens is gradually weakening, so its decay index will gradually increase. According to the test results, under the condition of transportation vibration, the rotting speed of fragrant pear will be accelerated, and the influence of vibration treatment on the rotting index of fragrant pear will increase gradually on the 4th class highway (the highest on the 3rd class highway). If 28 days storage is selected, the rotten index of pear transported by the second and third class roads has the highest influence, reaching the third class rotten degree. This shows that the second and third class roads are too bumpy, which causes mechanical damage to fragrant pears and accelerates the decay speed of fragrant pears. In contrast, due to the better road conditions and faster transportation speed, the transportation and storage effect of Xiangli is relatively good, and there is no rot phenomenon.

In addition to the above two points, the effect of vibration treatment on the total phenol content, VC content, antioxidant enzyme activity and so on of fragrant pear is relatively obvious. Of course, there will be differences between the control group and the experimental group in terms of comparison, and the transportation and storage effect of the experimental group is better [5].

4. Conclusion

According to the changes of hard indexes such as storage time, transportation conditions and highway conditions, the soft indexes such as anti-oxidation characteristics, decay index and respiration rate have great influence on the transportation and storage of fragrant pears. In this paper, through the analysis of different levels of highway experiments, it is found that the impact of highway transportation vibration treatment on the transportation and storage of fragrant pear is the smallest.

Acknowledgements

1) 2017 NSFC project "Numerical Study on the post ripening characteristics of Korla Fragrant Pear Based on maturity and its impact on transportation and storage quality" (316604757)

2) 2019 Xinjiang production and construction corps science and technology special commissioner innovation and entrepreneurship plan project "Korla Pear classification and damage prevention identification technology research and promotion demonstration" (2019cb037)

3) 2019 project of President fund of Tarim University "Research on damage identification system of Fragrant Pear Based on electrical characteristics" (tdzkcq201902)

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