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The effect of acoustic system variables on sound signals of Melon varieties

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Introduction

Cucumis melo includes a wide range of varieties. The acoustic is production, transmission and energy received form medium vibrations. Acoustic or sonic tests applies for grading productions, ripening determination of fruit firmness and sorting of broken eggs and so on in agriculture. Currently these methods are generalized for measuring non-spherical fruits properties. The primary objective of the present research was to investigate the effect of acoustic system variables such as impact places, impactor material type, pendulum angle and sound level meter position on acoustics response of two different melon varieties, including *Zard-Eyvanekey* and *Sousky-Sabz*. These results can be useful for designing acoustic implements related to agricultural products.

Materials and Methods

This research was conducted on 65 samples of *Zard-Eyvanekey* and *Sousky-Sabz* varieties (export varieties). A laboratory recording system used to acquire the acoustic impulse information that was comprised a mechanical excitement mechanism (an impactor such as pendulum), sound level meter, a lap-top computer and software to control the experimental setup and to analyze its results (Cool Edit Pro 2.0 Software), and melon-bed. The impactor consists of diameter and long copper rod 3 mm and 256 mm, respectively. The ball mass was 72.13 gram. The acoustic signal was sensed by a sound level meter (SLM) type 2270 B&K company Denmark. The samples locate on soft cushion for keeping because this bed prevents vibration distortion and causes free vibration. We consider three measurements on equator or mid-section of each fruit (approximately 120 degree) for diminishing inherent diversity of sample shapes. The sound level meter was placed at a distance of 2-5 mm from the fruit surface. The effects of sound level meter, impactor ball and pendulum angle on sound signals were investigated. The effects of other parameters were analyzed by factorial test in randomized complete plot by three replications for each sample. The treatments were 36 and 65 melons of each variety were selected.

Results and Discussion

The average samples peaks were 10576 and 28663 at 90 and 180 degrees respect to impact place, respectively. Other factors such as impactor ball type (steel), impact angle (70 degrees) and variety type (*Zard-Eyvanekey*) were constant. The resonance frequency was 123.05 Hz for both SLM position. The averages of peak sound pressure level were 55.29 and 52.38 dB at 90 and 180 degrees positions, respectively. It concluded that the change of sound pressure meter (SLM) position of 90 to 180 degree caused to increase sound pressure level but had no effect on reach the time to peak and resonance frequency. The effect of impactor ball material and impact angle of pendulum on recording signals approximately resemble up and did not state here. The factor levels were sound level meter position respect to impact place (two levels), impactor ball material (three levels) and impact angle of pendulum (three levels). We found that effect of sound level meter position; ball material and impact angle variables on sound pressure level values and interaction effect of sound level meter × impact angle on FFT magnitude was significant at 1% level in both varieties. None of the variables and interactions has effect on the resonance frequency in both varieties. It can be concluded from tables that resonance frequency was more suitable than sound pressure level and FFT magnitude in acoustic tests. The increment of angle caused to increase impact velocity because the length and mass of pendulum rod were constant. We can state the above conclusion about impact velocity (excitement velocity) too, e.g. the impact velocity (excitement velocity) had no

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effect on resonance frequency while it effected on sound pressure level and FFT magnitude. This conclusion coincides to others researchers.

Conclusions

The impactor ball, pendulum angle, sound level meter position and variety type factors did not showve significant effect on resonance frequency but they had significant effect on FFT magnitude and sound pressure meter. Because of the high pressure level and measurement easily, it was recommended the position 90 degrees of microphone respect to impact place for acoustics measurements. The maximum sound pressure levels were 54.43, 54.81 and 55.11dB for glass, steel and plastic, respectively. Other factors such as SLM position (180 degrees respect to impact), impact angle (70 degrees) and variety type (Zard-Eyvanekey) were constant. Because of receiving high pressure level from impact angle of 70 degrees respect to 20 and 45 degrees, it was recommended for acoustics measurements. It can be used the lower angles by considering the low background sound.

Keywords: Acoustic, Impulse response, Melon, Resonance frequency