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Biospeckle as a non-destructive method for strawberry quality assessment

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Abstract
Strawberries are enjoyed by consumers and are produced all over Brazil, especially in the South and in the Southeast. In the harvest and post-harvest processes, methods have been used to assess the ripening and quality of the fruit through external aspects of the product. In order to also understand the internal aspects, efforts are invested in non-destructive assessment methods. Biospeckle is a non-destructive method whose application in farming is still little studied. This paper aims to evaluate Biospeckle, through Moment of Inertia (MI), as a method for strawberry quality assessment.

Key words: *Biospeckle, non-destructive, quality assessment*

Introduction

Strawberries are produced in all regions of the country, especially in the South and Southeast regions. The several strawberry cultivations allow them to be grown in temperate and tropical climates and present different attributes, being able to target them to several consumers, such as agro-industry and final consumer.

On producing the fruit, decisions on harvesting and ripening are based, essentially, on visual and subjective aspects. Many methods are already employed to assess physical properties of the fruit, which relate to external aspects, such as size, colour, firmness, and absence of external flaws. However, internal aspects also related to the quality, such as acidity, soluble solids, and internal flaws are harder to assess. Recently, efforts have been directed to develop non-destructive methods to detect appearance, texture and flavour, and aroma.

One of the non-destructive methods developed to work with fruit is Biospeckle, whose name refer to the phenomenon which occurs when a coherent light source (laser) is directed to a biological material, showing a pattern of light and dark areas. In the case of living biological materials, the pattern found has a dynamic characteristic. Biospeckle brings information about several processes occurring in the tissues and cells, since lasers with different wavelengths can be used, which allows light to penetrate the fruit.

The results found in the literature, although few, show the possibilities for the application of Biospeckle in the assessment of the maturity and quality of fruit.. That constitutes a potential supplier of improvement for the fruit farming sector, ensuring processes which identify and classify the fruit more assertively.

The goal of this paper was to validate Biospeckle as a method for strawberry quality assessment.

Results and Discussion

It was attempted to correlate Moment of Inertia (MI), obtained through Biospeckle, to Soluble Solids (SS), Titratable Acidity, pH, water content (Um), and Firmness (E). MI was obtained by making a video for each piece of fruit and its later processing in the ImageJ© and Mathlab© softwares. 95 pieces of fruit of the Albion variety were analysed divided in two days of analysis, with 1 and 2 days of refrigerated storage of the fruit at 4ºC (treatments 1 and 2, respectively).

Chart 1 presents the results obtained for the two analysed groups according to Tukey test (5%) in the Sisvar program. Chart 2 shows the correlation between the parameters and MI, given by the coefficient of determination (R^2).

Chart 1. Summary of the results

Treat	L	a	b	E (MPa)	SS (°Brix)	pH	Acidity	Um (%)	MI
1	31.64 b	32.47 a	18.47 a	2.3 a	8.47 b	3.69 b	1 a	89.8 a	1.93 b
2	30.06 a	35.36 b	22.92 b	3.3 a	7.03 a	3.55 a	0.98 a	91.1 b	1.52 a

Chart 2. Correlation between MI and the quality parameters

	L	a	b	E	SS	pH	Acidity	Um
R^2	0.012	0.07	0.196	0.031	0.452	0.105	0.143	0.076

Chart 1 shows that only the parameters of firmness (E) and acidity did not change significantly, according to Tukey test. On Chart 2, it can be observed that, in spite of the changes, it was not possible to obtain a significant correlation between the parameters and MI, with soluble solids presenting higher correlation (0.452).

Conclusions

It was not possible to obtain a correlation between Biospeckle, through MI, to the other parameters of quality, being needed to perform further studies in order to validate Biospeckle. It is a punctual observation, since only strawberries in the commercial stage and with up to 2 days of refrigerated storage were sampled. For future studies, it is indicated to use fruit in several stages of maturity or with longer storage periods. Furthermore, it is possible to use other tools obtained from Biospeckle besides MI.

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