

# Modified atmosphere packaging of fresh cut tender Jackfruit for extended shelf life



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## Abstract

Changes in physicochemical properties of fresh cut tender jackfruit during storage can be related to change in its colour as well. Colorimeter measurements are best for the samples with homogeneous colour. However, for samples with non-homogenous colors or large sizes (like fruits and vegetables), the colorimeters are inappropriate and inaccurate. The aim for this study to quantify the amount of browning in fresh cut tender jackfruit slices by using image analysis technique and justify the results by comparing them with existing techniques like sensory examination, enzyme activity, and colorimeter. It can be concluded from the results that browning in fresh cut tender jackfruit slices grew more rapidly in control and normally packed groups for sensory test and enzyme assay. Correlation coefficient as high as 0.963, represent that image analysis system is an accurate and highly consistent method to quantify the color of fruits and vegetables.

## Introduction

The aim of this study is to precisely and accurately quantify the amount of browning in fresh cut tender jackfruit slices during storing them in modified atmospheric storage and by using image analysis technique and justify the results by comparing them with existing techniques like sensory test, enzyme activity, and colorimeter.

## Material and Methods

Tender jackfruits (*A. heterophyllum* L.) were plucked from the trees in National Institute of Technology, Rourkela campus, Orissa, India. While collecting samples, it was ensured that all jackfruits were of at same maturity. The Jackfruit samples collected were green, fresh and without mechanical injuries or microbial infections. Later sanitization was carried out with the help of chlorinated water (100ppm). Jackfruits were peeled and cut manually with sharp and serrated stainless steel knives. The peel and non-edible latex part were separated. The edible part was sliced ( $4 \times 3 \times 2$ cm). Then slices were dipped in chilled chlorinated water (30ppm) for 5 minutes for sanitization (Saxena et al., 2009). To compare the browning among tender jackfruit slices, the slices were divided into the following treatment groups: Without any package (Control); Normal packaging sealed with sealing machine (Normal); Modified atmosphere packaging packaging (MA-Pack); Vacuum packaging (V-Pack) The samples were packed in 0.05 mm polyethylene film and stored in normal conditions ( $27 \pm 3$  °C) for 10 days.

Browning index (BI) - Spectrophotometric method (Saxena et al., 2009).

Sensory evaluation - 9 point hedonic scale (Larmond, 1977)

Colourimeter (CIE) - colourflex EZ (Hunter Associate Laboratories Inc., Reston, Virginia, USA).

Image analysis - DSLR camera (24.3 MP Nikon D-5300, D-SLR, Minato, Tokyo, Japan). MATLAB image processing toolbox

## Results

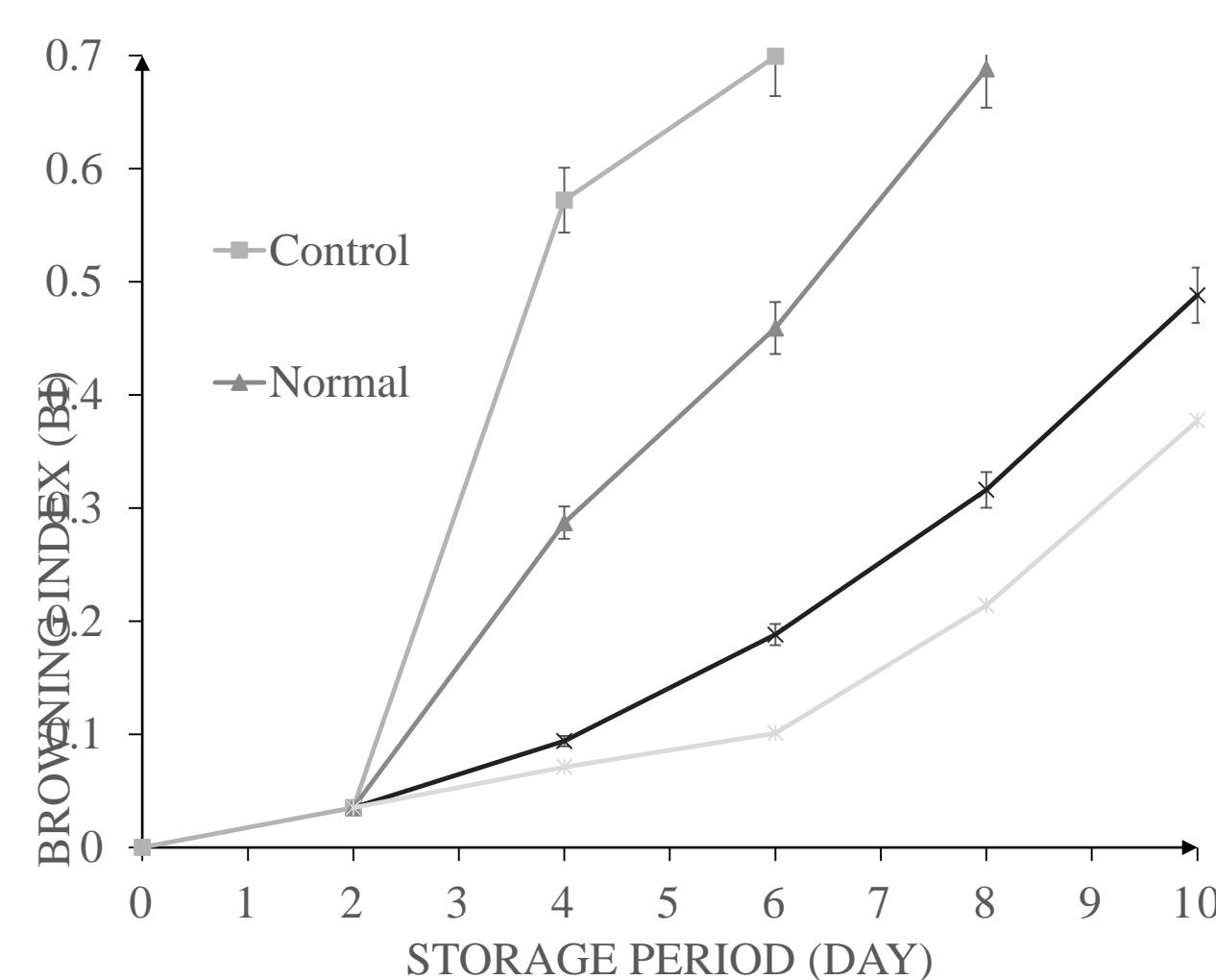


Fig. 1: Browning Index values of tender jackfruit slices during storage when packed in different packaging conditions.

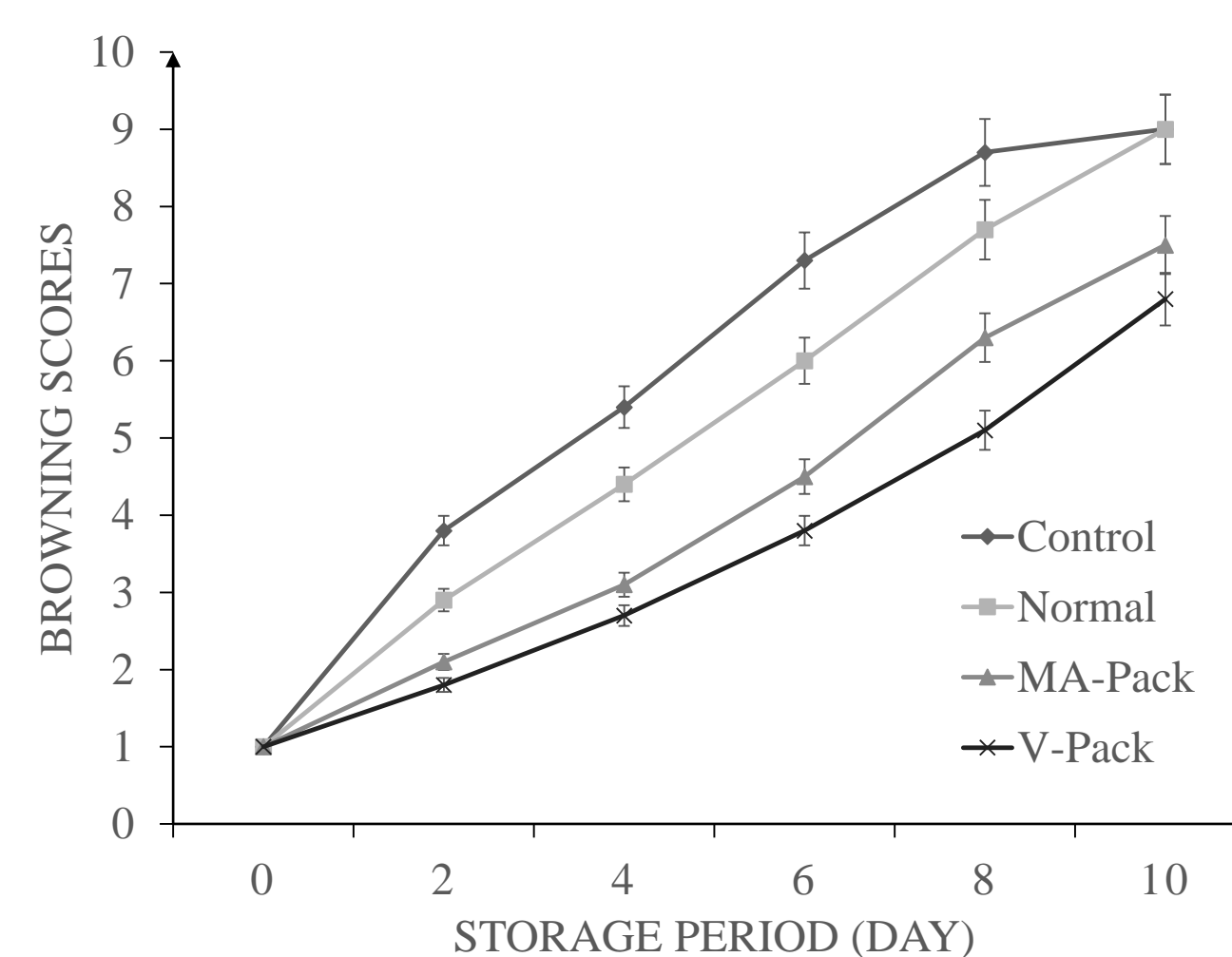


Fig. 2: Browning scores for sensory analysis of tender jackfruit slices during storage when packed in different packaging conditions.

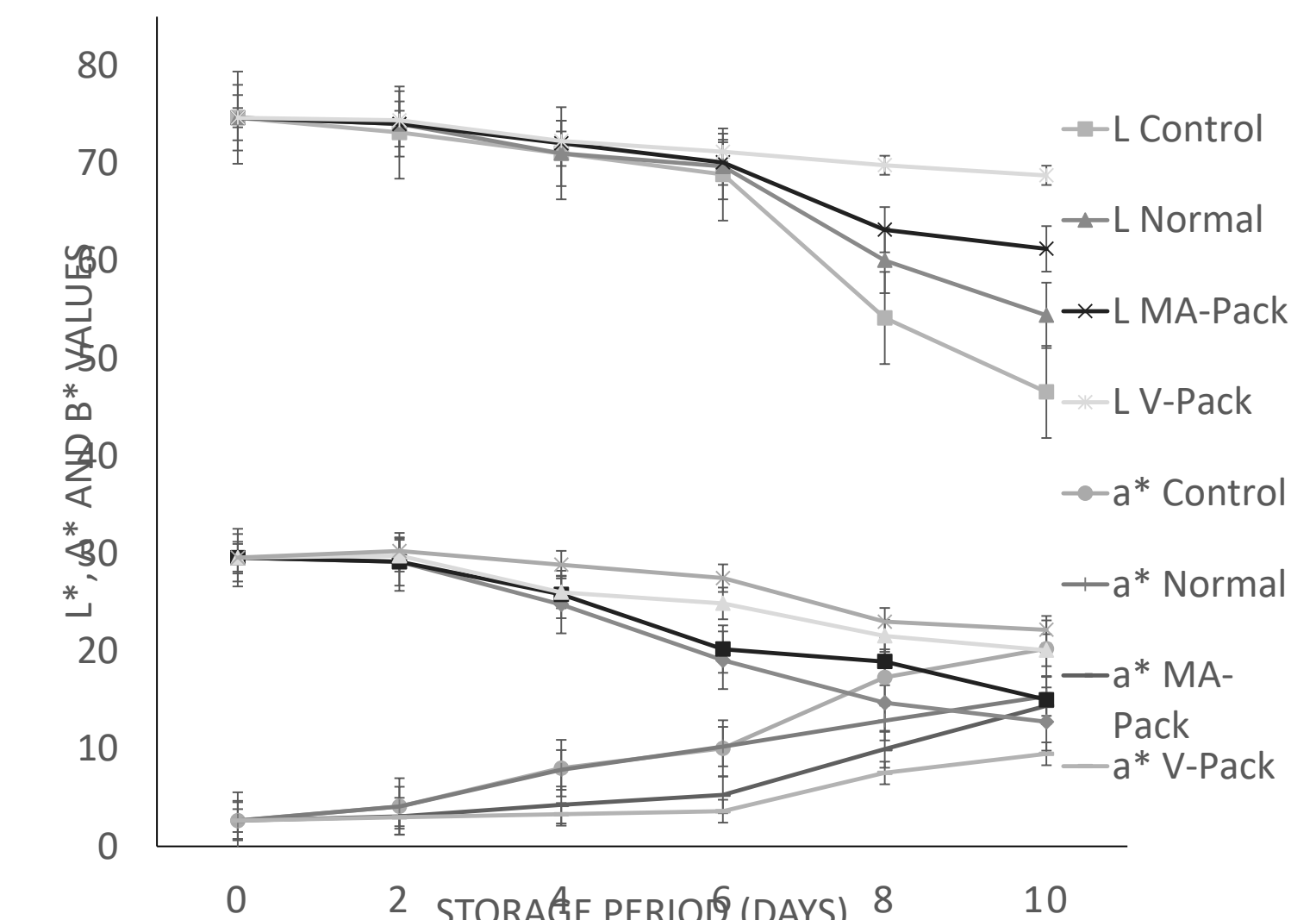


Fig. 3: Changes in L\*, a\* and b\* Values of tender jackfruit slices during storage when packed in different packaging conditions determined from image analysis.

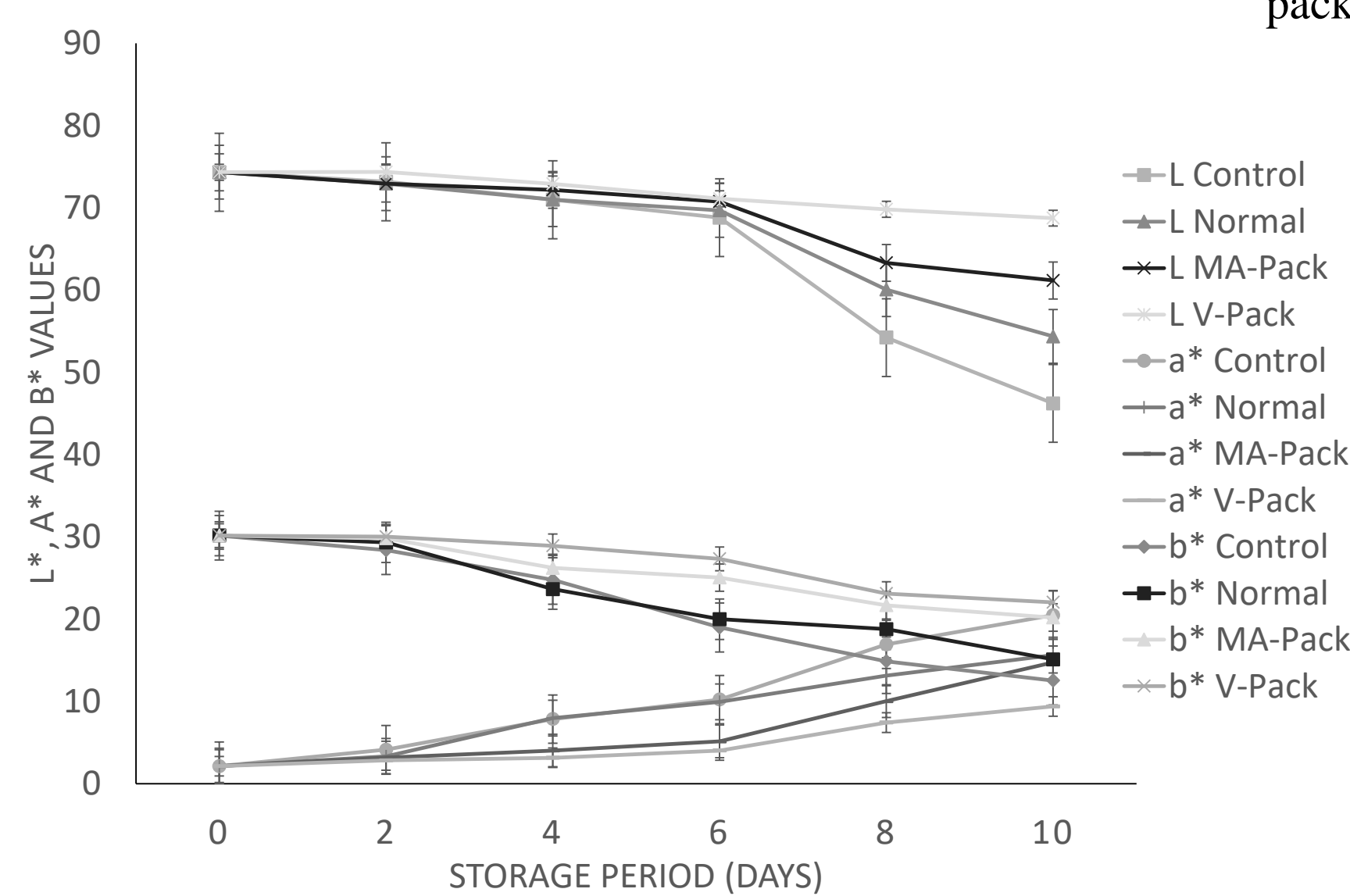


Fig. 4: Changes in L\*, a\* and b\* Values of tender jackfruit slices during storage when packed in different packaging conditions determined by using colorimeter.

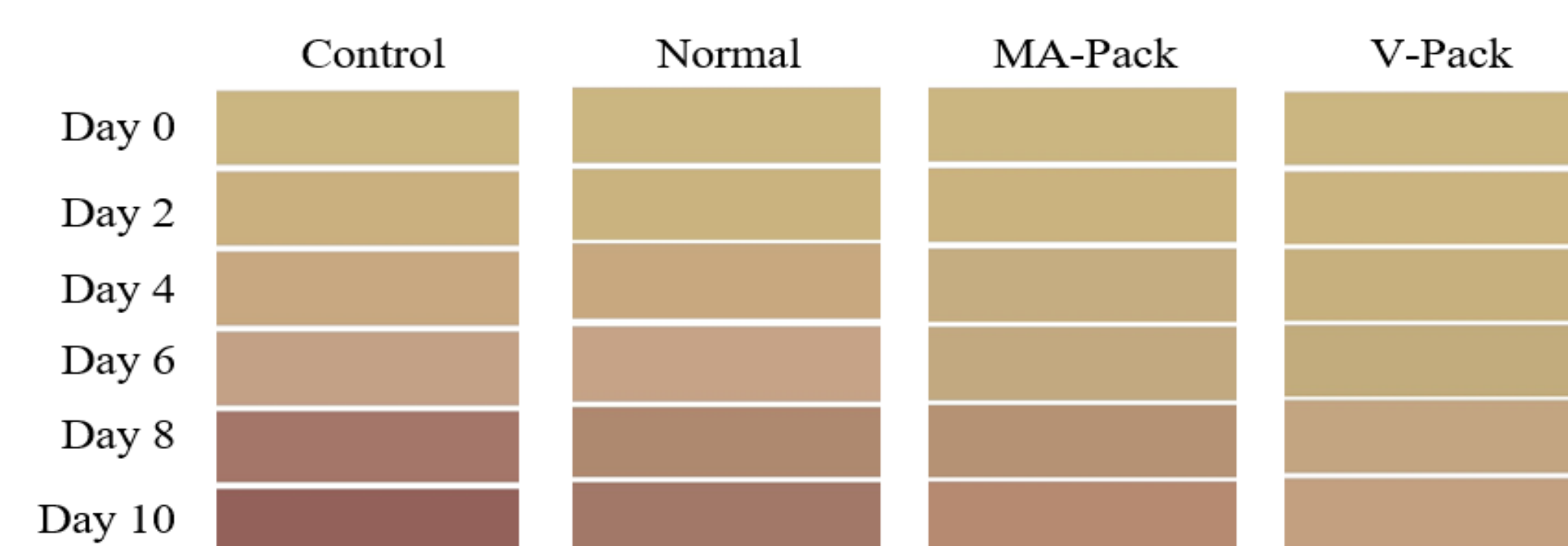


Fig. 5: Colour developed from L\*, a\*, and b\* values which were generated from RGB values by using image analysis.

## Conclusion

The high correlation coefficient from the study showed that image analysis is reasonably accurate to analysis of the colour and browning in fresh cut tender jackfruit slices during storage. The study affirmed that the browning of fresh cut tender jackfruit slices grew more rapidly in control and normally packed groups than MA-pack and V-pack groups. The change in colour values ( $\Delta E$ ) for the control and normally packed groups were higher for every single investigative technique, and for the vacuum packed group the change in colour values ( $\Delta E$ ) were moderate. From the image analysis and sensory evaluation results, the RGB and CIE L\* a\* b\* values demonstrated a high correlation coefficient to each other (more than 0.9). CIE L\* a\* b\* values by using a colourimeter, demonstrated high correlation coefficients. Image analysis can be utilized to acquire the colour data from the whole surface of samples. Besides, it is conceivable to express different colour values and limit errors which is not possible in the manual inspection. Additionally, the study is expected to distinguish the changes in colour values by the degree of brightness. The other outcome of the study was that by using vacuum packaging one can reduce the rate of enzymatic browning in fresh cut tender jackfruit slices. The shelf life of fresh cut tender jackfruit slices was increase to 10 days from 2 days when vacuum packed in 0.05mm polyethylene film.