Food Research 5 (Suppl. 1) : 144 - 151 (2021)
Journal homepage: http://www.myfoodresearch.com

FOOD RESEARCH

FULL PAPER

Prediction of quality attributes and maturity classification of pear fruit using laser imaging and Artificial Neural Network

[1,*]Adebayo, S.E. and [2]Hashim, N.

[1]*Department of Agricultural and Bioresources Engineering, Federal University of Technology, Minna, Nigeria*
[2]*Department of Biological and Agricultural Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia*

Article history:
Received: 14 April 2020
Received in revised form: 13 August 2020
Accepted: 6 December 2020
Available Online: 27 February 2021

Keywords:
Laser imaging,
Maturity stages,
Quality attributes,
Pear,
Optical properties

DOI:
https://doi.org/10.26656/fr.2017.5(S1).022

Abstract

In this study, the application of laser imaging technique was utilized to predict the quality attributes (firmness and soluble solids content) of pear fruit and to classify the maturity stages of the fruit harvested at different days after full bloom (dafb). Laser imaging system emitting at visible and near infra-red region (532, 660, 785, 830 and 1060 nm) was deployed to capture the images of the fruit. Optical properties (absorption m_a and reduced scattering m_s' coefficients) at individual and combined wavelengths of the laser images of the fruit were used in the prediction and classifications of the maturity stages. Artificial neural network (ANN) was employed in the building of both prediction and classification models. Root mean square error of calibration (RMSEC), root mean square error of cross-validation (RMSECV), correlation coefficient (r) and bias were used to test the performance of the prediction models while sensitivity and specificity were used to evaluate the classification models. The results showed that there was a very strong correlation between the m_a and m_s' with pear development. This study had shown that optical properties of pears with ANN as prediction and classification models can be employed to both predict quality parameters of pear and classify pear into different (dafb) non-destructively.

1. Introduction

Historically, quantification of fruit qualities relied on various destructive techniques that require the removal of a little quantity of fruit tissue and juicing for the measurement of SSC, total acidity, and nutritional content (Hoehn *et al*., 2003; Liu *et al*., 2010; Wold *et al*., 2004). These techniques resulted in a large amount of postharvest losses and inability to measure the whole batch as few samples from the batches are used for the measurement, which it also involves more man-hours to carry them out.

Human evaluation remains the most widely used method of fruit quality assessment. However, it has been established, that as a result of disparity in colour prejudice between individuals, eye fatigue, personal bias, lack of colour memory, and different lighting conditions often resulted in varying assessments. These factors have limited use of human evaluation to produce on a large scale universally accepted standard and for a broader spectrum of operation. Furthermore, the human eye is limited within the visible range band of the electromagnetic spectrum (400 to 700 nm), coupled with the fact that certain quality attributes are only detectable outside of the visible band. This has made human evaluation not capable enough for fruit quality attribute determinations. As a result of this situation, a lot of work has been focused on the development of instruments responsive to an expansive band of electromagnetic spectrum and building fruits quality indices. Moreover, the non-destructive features of optical techniques have allowed them to be practically engaged in online fruit quality assessment. Optical techniques utilise ultra-violet, visible, near-infrared, infrared, and x-ray radiations of the electromagnetic spectrum.

Soluble solids content (SSC) is one of the internal quality indicators in most fruit. SSC is a refractometric index which expresses the relative amount (%) of dissolved solids contained in a solution (Beckles, 2012). SSC is the total aggregate of sugars, acids, and additional microconstituents in the fruit pulp (Balibrea *et al*., 2006; Kader, 2008). SSC is a function of developmental

*Corresponding author.
Email: *segun.emma@futminna.edu.ng*