

# Online assessment of pear firmness by acoustic vibration analysis

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## Abstract

Firmness is an important quality indicator of fruit and is closely related to physical structures and mechanical properties. In this study, an online detection system using a laser Doppler vibrometer (LDV) was developed to acquire the acoustic vibration response signals of 'Cuiguan' pears for firmness detection. Based on compositional analysis of pear tissue, the predominant components in the process of fruit softening were crude fiber and pectin. Subsequently, different classification models for prediction of pear firmness were established based on sensory evaluation. The results showed that a back propagation neural network (BPNN) method using the elasticity index ( $EI$ ), peak value at  $f_2$  ( $A$ ) and peak area ( $S$ ) as input variables had the highest discriminant accuracy. The accuracies of the calibration and validation sets were 93.3 % and 90.5 %, respectively. Moreover, the stiffness in the peeled group obtained by a puncture test was regarded as a dependent variable in quantitative analysis due to its high correlation coefficients with sensory scores and chemical indices in postharvest. In addition, multiple regression models were compared with simple linear regression models. The highest correlation coefficient  $r_p$  of the prediction set was observed for the BPNN model. In addition, the BPNN method using  $EI$ ,  $A$ ,  $S$  and the shape index had the best prediction performance. The correlation coefficient  $r_p$  and RMSEP of the prediction set were 0.832 and 0.277 N mm<sup>-1</sup>, respectively.