

## Characterization of the Mechanical Behavior of Packaging Material Using Digital Image Processing

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Among various packaging materials polymers, polymer blends and polymer composites are ubiquitous owing to their low cost, high flexibility, lightweight and reusability. However, their behavior drastically depends on the forces especially tensile and abrasion that employs oil the materials during the packaging. Reusability of the material depends on whether the material is in its elastic or plastic region. However, according to the existing literatures, such regions are difficult to identify without having high-tech instrumentation such as a tensometer. To overcome such barrier, in this study a new prototype optical method, digital image processing (DIP), is proposed. The correlation between the colour variation of the material and its mechanical properties have been investigated. The colour of polymer materials changes in presence of applied force due to the microscopic level molecular arrangement. The traceable color change of several polymer materials in presence of applied force have been captured as a function of time using a digital camera. The captured images were processed to extract the ensemble average mean, median, standard deviation, entropy, and kurtosis in spatial domain. The changes were compared with the stress-strain relationship of the material measured using a tensometer. The kurtosis and the entropy extracted by DIP feature extraction method has some meaningful correlation with the experimentally measured mechanical properties. The correlation between the selected features and the experimentally measured parameters were obtained by quadratic regression fitting. The results obtained in this study illustrate that digital imaging and processing using a correlation algorithm could easily be used to identify the elastic and plastic region of the measured polymers over the traditional methods of extracting such data using tensometer. However, it is necessary to further validate this method for different types of polymers.

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