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# Determination of the Viscoelastic Properties of Apple Flesh under Quasi-Static Compression Based on Finite Element Method Optimization

Gyeong-Won KIM[1)], Man-Soo KIM[2)], Yasuyuki SAGARA[3)], Yeong-Hwan BAE[4)], In-Bok LEE[5)], Gab-Soo DO[6)], Sung-Hyoun LEE[1)] and Suk-Won KANG[1)]

*1) National Institute of Agricultural Engineering, Rural Development Administration, Korea*
*2) Division of Bio-Resources Engineering, Chungnam National University*
*3) Department of Global Agricultural Sciences, Graduate School of Agricultural and Life Sciences, University of Tokyo*
*4) Department of Industrial Machinery Engineering, Sunchon National University*
*5) Department of Bio-Systems Engineering, Seoul National University*
*6) Department of Bioenvironmental and Agricultural Engineering, College of Bioresource Sciences, Nihon University*

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A procedure for determining the viscoelastic properties of apple flesh has been proposed based on compression tests and FEM optimization. Short-term simple compression tests and long-term relaxation tests were performed with cylindrical specimens of apple flesh to measure mechanical properties, and the viscoelastic behavior was predicted using FEM optimization models. Through short-term optimization, the elastic modulus and Poisson's ratio were determined by comparing two kernel functions based on 1) shear only and 2) shear and bulk terms. Long-term stress-relaxation behavior of the specimen was reasonably predicted by two FEM optimization steps within 3.8 % error. The FEM optimization algorithms developed in this research might be applied to determine the viscoelastic properties of bio-materials and also to predict mechanical behavior of these

materials under various loading conditions.

**Keywords:** apple flesh, compression, stress relaxation, FEM optimization, vicoelastic properties



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