ASAE S368.4 DEC2000 (R2017)
Compression Test of Food Materials of Convex Shape

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Reviewed by the ASAE Physical Properties of Agricultural Products Committee; approved by the Food Engineering Division Standards Committee; adopted by ASAE as a Recommendation December 1973; revised and reclassified as a Standard December 1979; reconfirmed and revised editorially December 1984; reconfirmed December 1987, December 1988; revised March 1990; revised editorially April 1994; revised March 1995; reaffirmed December 1999; revised editorially February 2000; revised December 2000; reaffirmed February 2006, February 2008 for one year; reaffirmed December 2012; Corrigendum 1 issued February 2013; reaffirmed November 2017.

Keywords: Compression, Food, Test

1 Purpose and scope

1.1 This Standard is intended for use in determining mechanical attributes of food texture, resistance to mechanical injury as a result of static loading, and quasi-static force-deformation behavior of food materials of convex shape, such as fruits and vegetables, seeds and grains, and manufactured food materials.

1.2 Compression tests of intact biological materials provide an objective method for determining mechanical properties significant in quality evaluation and control and maximum allowable static load for minimizing mechanical damage. The results apply to quasi-static loading rather than impact loading. The equations given are adapted from the theory of contact between convex surfaces made of elastic materials. Most food and biological materials exhibit non-linear behavior at larger (e.g., 5% strain or greater) deformations. Furthermore, to completely characterize the material, a study of its viscoelastic behavior is needed. However, these simplified tests give information that can be used to quantitatively determine the differences caused by factors such as variety, drying temperature, storage technique, maturity, and processing technique. The applicability of the analysis can be validated by plotting the log of applied force as a function of the log of deformation. If the equations are valid, the slope of the line should be 1.5 (Fridley *et al.*, 1968; Arnold and Mohsenin, 1971).

1.3 Compression tests on food materials are routinely conducted using fully automatic test equipment such as the Instron Universal Testing apparatus. Factors such as sample conditioning prior to testing, loading geometry, and loading rate can influence the results of such tests. Therefore, it is desirable to standardize testing and reporting procedures so that data from various sources can be more easily compared.

1.4 Determination of compressive properties requires the production of a complete force-deformation curve. From the force-deformation curve, stiffness; apparent modulus of elasticity; toughness; force and deformation to points of inflection, to bioyield, and to rupture; work to point of inflection, to bioyield, and to rupture, and maximum normal contact stress at low levels of deformation can be obtained. Any number of these mechanical properties can, by agreement, be chosen for the purpose of evaluation and control of quality.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below. Standards organizations maintain registers of currently valid standards.

ASTM E4-94, Practices for Force Verification of Testing Machines

ASTM E83-94, Practice for Verification and Classification of Extensometers