

Title	Microwave dielectric properties of cereal grain and oilseed
Author	Samir Trabelsi and Stuart O. Nelson
Citation	2005 ASAE Annual International Meeting, Tampa Convention Center, Tampa, Florida, 17-20 July 2005, Paper Number 056165, 2 p.
Keywords	Dielectric properties; free-space measurements; microwaves; cereal grain; oilseed; moisture; bulk density

Abstract

Measurement of the dielectric properties of moist granular materials such as cereal grain and oilseed is essential for understanding their electrical behavior and the development of nondestructive methods for determining physical characteristics such as moisture content and bulk density. For better modeling of these materials and effective use of indirect characterization methods, the dielectric properties have to be measured accurately. Dielectric data for moist granular materials are limited in the literature, particularly those measured above 2.45 GHz. Very often the data available are given at a single frequency for a limited range of bulk densities and moisture contents. Data that cover a broad frequency range were often taken with different measurement techniques with different degrees of accuracy, given the nature of granular materials. In this study, dielectric properties of cereal grains and oilseeds were measured with the same free-space measurement setup between 2 and 18 GHz and at room temperature. For better accuracy, two horn/lens antennas providing a focused beam were used, multiple reflections were minimized by selecting appropriate sample thickness, and time-domain gating was applied to filter out undesirable post-calibration mismatches. For each sample of given moisture content, dielectric properties measurements were performed at three different densities. The moisture levels were those of interest to the grain and oilseed industry. Variation of the dielectric properties of cereal grain and oilseed with frequency, moisture content and bulk density are shown and tabulated data are provided.