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Characterizing Multiple Bubbles In An Agar Gel With Ultrasonic Spectroscopy And Optical Imaging, K.A. Ross^{1,2}, L.J. Pyrak-Nolte³, and O.H. Campanella^{4,1} *Department of Food Science, University of Manitoba,*² *Department of Physics and Astronomy, University of Manitoba,*³ *Department of Physics and Astronomy, Purdue University and*⁴ *Department of Agricultural and Biological Engineering, Purdue University* — The presence of inhomogeneities, such as bubbles or pores, affects the physical properties of any solid material. This is especially important for food products, whose textural attributes are strongly influenced by bubble/pore size distribution, bubble/pore size orientation, and air volume fraction/porosity. The main focus of this work was to use ultrasonic spectroscopy, based on the frequency dependence of the ultrasonic attenuation, to determine the pore size distribution of air bubbles in an agar gel, which may be considered a model biological system with laboratory, pharmaceutical and food applications. Different bubble size distributions were introduced into the gels by varying the mixing conditions. A fundamental spectroscopic analysis of the ultrasonic attenuation was performed to demonstrate that both the bubble size distribution and the spacing between the bubbles could be successfully determined. Since the gels are transparent, digital imaging of the bubbles could also be performed, allowing the two-point spatial correlation function to be determined and giving a direct measurement of the bubble/pore sizes and porosity. Good agreement was found between the results of ultrasonic spectroscopy and the two-point correlation function, thereby validating the ultrasound bubble sizing data. Overall, this work indicates that these techniques may be applied to a biological system containing polydisperse bubbles/pores in order to determine the structure of the system through effective characterization of bubble/pore size and porosity. This is significant as bubble/pore size and porosity affect mechanical properties and the utility of such materials, which is of technological importance.