

**Title** Structural properties of freeze-dried rice  
**Author** Vasiliki P. Oikonomopoulou, Magdalini K. Krokida and Vaios T. Karathanos  
**Citation** Journal of Food Engineering, Volume 107, Issues 3-4, December 2011, Pages 326-333  
**Keywords** Bulk density; Freeze-drying; Glass transition temperature; Mercury porosimetry; Porosity

#### **Abstract**

Structural properties, such as porosity, bulk density and true density, of freeze-dried rice, were investigated as affected by process conditions. Rice was boiled at different time periods and freeze-dried under various vacuum conditions. True density of dehydrated rice kernels was measured with a helium stereopycnometer, while bulk density was obtained by measuring their geometric characteristics. Porosity and pore size distribution were also measured with a mercury porosimeter. Simple mathematical models were developed in order to correlate these structural properties with process conditions. Bulk density of freeze-dried rice kernels increased with the applied pressure during freeze-drying, while porosity decreased. In addition, bulk density decreased and porosity increased with increasing boiling time. Moreover, the effect of porosity and water activity on glass transition temperature of dehydrated samples was studied using differential scanning calorimetry (DSC). Glass transition temperature decreased as moisture content and porosity increased, respectively.