Abstract

A mathematical simulation of uniaxial compression of oilseeds for oil extraction was developed based upon combining Terzaghi's theory of consolidation for saturated soils with Darcy's law for unsaturated flow, while incorporating the time-varying nature of the coefficients of permeability and consolidation. The model was validated for extruded soy and for sunflower seeds. Material parameters were determined experimentally and predictions of oil recovery rates made for several levels of temperature, pressure and initial sample depth.

Results indicated that while the model predicted the values of oil recovery for extruded soybean very well, the predictions were not satisfactory for sunflower seed samples. The higher error was attributed to material non-homogeneity and the presence of hulls in the sunflower seeds, which increased errors in measurement of the medium permeability function. The lack of experimental permeability data in the very early stages of pressing ($t<60$ s) was an important source of error in general. The incorporation of varying material properties in the simulations resulted in substantially more accurate predictions of quantities and trends in oil recovery with time, when compared to using constant (averaged) values of material parameters.