Abstract

A thermodynamic analysis of the fluidized bed drying process of large particles is performed to optimize the input and output conditions. Energy and exergy models were used for the study. The effects of the hydrodynamic and thermodynamic conditions such as the inlet air temperature, the fluidization velocity and the initial moisture content on the energy efficiency and the exergy efficiency were analyzed. The analysis was carried out using two different materials, wheat and corn. It was observed that the thermodynamic efficiency of the fluidized bed dryer was the lowest at the end of the drying process in conjunction with the moisture removal rate. The inlet air temperature has a strong effect on thermodynamic efficiency for wheat, but for corn, where the diffusion coefficient depends on the temperature and the moisture content of particles, an increase in the drying air temperature did not result in an increase of the efficiency. Furthermore, the energy and exergy efficiencies showed higher values for particles with high initial moisture content while the effect of gas velocity varied depending on the particles. A good agreement was achieved between the model predictions and the available experimental results.