Abstract

In this study, a multiphase porous media model was theoretically developed to predict heat and mass transfer during microwave drying process of unsaturated porous material. The study in both rectangular coordinates and spherical coordinate was conducted. The different conditions with and without gas pressure were studied in rectangular coordinate. However, the effect of gas pressure during drying process with microwave combined with infrared wave was taken into consideration. For spherical coordinates the study was to develop a mathematical model in heat and mass transfer during microwave drying process. The governing equations were numerically solved by using the finite volume method. In the simulation of the unsaturated porous materials which were composed of glass beads, water and air, all physical, thermal, transport, and dielectric properties were either derived from this experimental study and from the relevant literatures. The results show that variations of particle size, electric field intensity and frequency play important roles on overall drying kinetics. In addition, the moisture profile in the unsaturated porous material was influenced by capillary pressure in microwave drying process. These findings are significant to a further research conducted along the same line of this study as well as to the application of the porous media in the future.