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Study on Advanced Utilization of Steam for Drying of Porous Material Containing Salt Aqueous Solution

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Summary

Closed drying and/or food processing systems have been required for reducing the effects on the environment and high efficiency. For these systems, heating media has high steam content due to evaporation from the material being treated. Moreover, high humid air and steam have been wielded in the field of cooking. Also the superheated steam at atmospheric pressure has been applied for drying as well as cooking.

During these treatments, when the material containing aqueous solution of NaCl as solute, the solute moves to the surface and forms deposits with the evaporation of contained water. However, the effect of heating media conditions, such as gas temperature and humidity, on these transport phenomena is not clarified.

In this study, the effects of gas (dry-bulb) and wet-bulb temperature of drying media on drying kinetics, characteristics and time were investigated experimentally. Glass bead (mean diameters of 110 and 400 μm) packed beds which contained pure water or NaCl aqueous solution were used as porous sample material. The material mass and temperature changes were measured and the surface condition changes by salt deposition/crystallization were observed during drying. From these results, depending on wet-bulb temperature, a variety of deposits were formed. When the wet-bulb temperature was lower, the material surface was covered with evenly distributed crystallized salt. In cases where water was contained, the wet-bulb temperature was lower and the drying time was shorter. In cases where NaCl aqueous solution was contained, the drying time in the case of wet-bulb temperature of 60°C was shorter than the case of 46°C due to difference of critical moisture content, at gas temperature of 160°C.