Observation of Spaghetti Shrinkage during Drying by X-ray μCT

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During pasta drying, large moisture gradient inside the pasta cause the cracks. In this research, X-ray microtomography (μCT) was applied to study the changes and distribution of shrinkage strain in spaghetti that may cause cracks during drying. X-ray μCT is a proven efficient method for three-dimensional (3D) observations of microstructures of the food products by imaging the density distribution. Spaghetti has a homogeneous structure, so it is difficult to trace the motion of the interest point in spaghetti by using X-ray μCT. Thus, aluminum powder (#200) of which X-ray absorption is much larger than that of spaghetti was well mixed with durum semolina, and the mixture was extruded by a pasta machine. The changes and distribution of shrinkage strain during drying were determined by tracing the aluminum particles in spaghetti. Tomographic images of spaghetti dried at three given drying temperatures (50, 70 and 83 °C) were taken at three stages: initial stage, middle stage and last stage. In the radial direction, the shrinkage strain on the periphery of spaghetti cylinder was larger than on the center of spaghetti until the middle stage. Meanwhile, the center shrunk more than the periphery around the last stage. In the axis direction, the amount of shrinkage became smaller from the central axis to the periphery of spaghetti cylinder. The results from this study show that X-ray μCT is an effective technique for the microstructural analysis of spaghetti during drying.