

Development of new tools for quality evaluation of pasta

Abstract of Doctoral Thesis

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Typical types of cooked spaghetti in Japan were examined for moisture distribution by magnetic resonance imaging (MRI). Moisture content was calculated based on the correlation between spin-spin relaxation time (T_2) and moisture content of standard gel samples. Boiled samples of dried and frozen spaghetti had a moisture gradient from the surface to the core and a distinct low moisture region at the center. On the other hand, the moisture content of long-life spaghetti was almost homogeneous. In mechanical tests of dried and frozen spaghetti, higher force was observed at the region corresponding to the low moisture core, which means that the state known as “al dente” was detected. The luncheon spaghetti and long-life spaghetti exhibited soft and brittle texture caused by higher moisture content at the core.

Moisture distributions and mechanical properties of ordinary dried spaghetti were compared to those of two quick boil spaghetti samples (spaghetti with a V-shaped groove and spaghetti with three windmill-shaped grooves). The quick boil spaghetti samples had lower total moisture content than ordinary dried spaghetti after cooking. The T_2 images of MRI during boiling showed that the region around the tips of their grooves absorbed water and swelled particularly rapidly resulting in closure of the grooves. Moisture distributions of the two quick boil spaghetti samples were not concentric. The force-strain curves of the two quick boil spaghetti samples, therefore, varied depending on the shearing direction. Thin high moisture region at the surface of boiled ordinary dried spaghetti did not have a large effect on the mechanical properties.

As mentioned above, visual evaluation of the textures of pasta using MRI was realized by correlating the data of the moisture distribution to those of the mechanical test.

One hundred twelve commercial dried long pasta collected from all over the world were classified into four groups according to similarities in their sensory characteristics after boiling. A total of fifty samples were selected from each group as representative samples, and they were evaluated sensorially by highly experienced and trained panels to generate expressions. As a result of the consolidation of them by the panel discussion, the final lexicon consisted of 35 terms (5 for appearance, 11 for aroma/flavor, and 19 for texture) were obtained. Twenty-six terms of them were classified as general descriptor, and 9 terms as specific descriptor. In addition, detailed definitions and concrete references were determined for each term. Principal component analysis (PCA) was

conducted for results obtained in a trial evaluation of eight representative samples using the general descriptors, and the data was reviewed correlating the physical and chemical analysis data to the sensory characteristics. As a result, all of the general descriptors were found to be appropriate to differentiate the sensory qualities among the samples.