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Background

White salted noodles (WSN) are made from a simple flour and water dough containing 1–5% salt (NaCl) based on flour weight. WSN are very popular in Japan, Korea, and China but represent only a small portion of the noodles produced in Southeast Asia. There are distinct differences in preferences for both color and eating properties of WSN noodles among consumers in China, Korea, and Japan, as well as regional differences within each country. In Japan, WSN are further classified based on the size of the noodle strands: very thin (so-men), thin (hiy-mugi), standard (udon), and flat (hira-men) (4). Standard udon noodles are very popular in Japan and are the most common fresh noodles made in Japan. The WSN described in this report refer to Japanese udon noodles.

Introduction

Asian noodles have been recognized as an important wheat product by a wide range of food professionals and make up an average of 20–50% of total wheat flour consumption in Asia (2). No matter whether a study is focused on varietal selection in breeding, components of raw materials, formulation, ingredient application, process control, new product development, or other research issues each line of the investigation requires valid, reliable, and small-scale laboratory testing methods (5). The most important goal of any small-scale test is to achieve reproducible preparation and manufacture of noodle products.

The diversity of Asian noodle varieties and regional differences in processing equipment have meant that no internationally approved standard methods or guidelines have previously been developed and approved for noodle evaluation. However, some countries have developed official methods for their specific noodle products. One example is the Japanese udon noodle preparation method approved by the Ministry of Agriculture, Forestry and Fisheries–National Food Research Institute of Japan (3). This method has been in use for nearly 30 years (with slight modifications and improvements over the years to reflect changing commercial realities) and has proven to be useful for wheat quality assessment by researchers worldwide. The method was first translated from Japanese into English by Tanaka and Crosbie (unpublished), and copies were made available to other researchers upon request. The method was also applied when identifying wheat varieties potentially suitable for Japanese noodles by Crosbie et al. (1) and was referred to by Nagao (4) in the discussion of processing technologies for Japanese noodle products.

The AACC International Asian Products Technical Committee has adopted and modified this method as the approved Guidelines for Making and Cooking Japanese Udon Noodles method (AACC Approved Method 66-60.01).

Specific Considerations for Preparation of Japanese Udon Noodles in the Laboratory

To guide new researchers in the Asian noodle field, Ross and Hatcher (5) compiled a list of general guidelines to assist in the development of valid, laboratory-scale noodle processing protocols. However, for laboratory preparation of Japanese Udon noodles it is recommended that the following specific suggestions be considered.

1) Noodle Dough Makeup

a) Flour Moisture Content. Water addition in the noodle formula is based on a flour moisture content of 13.5%. The dough is made up on an equivalent dry solid basis. Both the actual flour weight and the water addition are adjusted based on the flour moisture content.

b) Flour Particle Size and Water Absorption. When comparing different flour samples, it is important to recognize that the millstream composition of the flour will affect the outcome of the noodle product. The guidelines specify use of 60% flour extraction, which minimizes variations in flour yield, particle size, and starch damage that could lead to heterogeneous hydration of the noodle dough.

c) Determination of Optimum Water Addition for Dough Makeup. Under normal circumstances, water addition is adjusted based on noodle dough characteristics. The goal is to achieve a homogeneously hydrated, crumbly dough that is uniformly colored and has no obvious darker wet patches or lighter drier regions. The dough should be moist to the touch. The dough crumble should be slightly cohesive when squeezed gently by hand but amenable to subsequent recrumbling through the fingers. In the guidelines, water addition is set at 32%, which works for the equipment and conditions prescribed. If other types of equipment are used, more or less water may need to be added to achieve optimum results.

d) Disolving Salt. It is common to use predissolved salts and other ingredients when mixing noodle dough because of the low moisture content of the dough. If the salt is not predissolved it is unlikely to be fully solvated in the dough. Lack of homogeneity across regions of the dough can cause problems during processing and in the finished noodle product.

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Water and Water Temperature. In the laboratory, it is recommended that distilled or deionized water be used in noodle preparation to avoid a water hardness effect on the noodle dough. Water should be kept in a water bath to reach the target crumb temperature of 25 ± 1°C.

2) Dough Mixing

A variety of mixers, both vertical and horizontal, small (200–300 g) and large (500–3,000 g), have been used in laboratory noodle manufacturing processes. In the guidelines, a horizontal Hobart N50 mixer fitted with a flat paddle is used. Despite differences in mixing geometry, a number of mixing principles can be applied to all mixers.

a) Adding Salt Solution. The correct method of adding salt solution to the flour is in a steady stream into the already operating mixer. This assists in uniform water distribution throughout the dough. Additionally, the mixer should be stopped after 1 min of mixing so the blades can be scraped down and lumps of wet dough broken up to help redistribute the water evenly throughout the crumbly dough mass.

b) Mixing Time. In laboratory noodle manufacturing, a balance needs to be struck between optimum homogeneity of hydration, water loss through evaporation, and sample throughput. Many laboratory mixing protocols specify a mixing time of 2 to 10 min when conventional laboratory-scale vertical mixers are used. Shorter mixing times, with adequate homogeneity of dough hydration, generally are favored because moisture loss is reduced and sample throughput is increased. If a different mixer is used, mixing speed and time may be adjusted to achieve the desired mixing results.

3) Dough Sheeting

The sheeting process includes dough sheet formation, thickness reduction, and slitting the sheet into noodle strands. In laboratory-scale noodle production, a variety of different noodle sheeting equipment has been used, including table-top machines; free-standing, motorized single-roll stands with adjustable roll gaps and integral slitters; and pilot-scale, multiple-roll stand machines. In the guidelines, an OHTAKE (www.ohtake.jp/product_e.html) or similar type of noodle rolling machine is used.

a) Compound Sheeting. Compound sheeting takes the dough crumbs and forms them into a cohesive sheet. For laboratory-scale machines, dough crumbs falling through the roller gap can mean a substantial loss of dough in proportion to the original quantity. Each laboratory needs to determine a process to minimize dough loss during the sheeting operation, especially when working with a small amount of flour sample. After the dough sheet is formed, it may be possible to reassess whether the water addition was correct. Dough sheets that are sticky and have long, dark yellow streaks indicate the dough is too wet. Those that have long, pale, obviously dry streaks are likely too dry, which may cause flaking during subsequent reduction sheeting.
It is essential to maintain a consistent folding pattern when forming the dough sheet, because previous studies have shown that when varying the folding pattern the gluten filament development is altered, resulting in differences in cooked noodle texture.

Resting the compounded sheet is a common practice used to relax the dough and improve its performance through subsequent reduction sheeting passes.

b) Reduction Sheet. Reduction sheeting involves step-wise reduction of the dough sheet until it reaches the final thickness specified for udon noodles. Sheet thickness should not be reduced in steps >30% during any roll pass to minimize potential damage to the gluten structure.

To improve consistency among operators making noodle dough sheets from the same sample series, it is important to standardize the amount of time (e.g., 45 sec) between each pass. This practice has been reported to significantly reduce the coefficient of variation in subsequent texture analysis of the same sample prepared by different operators.

Before being slit into noodle strands, the final roll setting is calibrated to obtain a dough sheet with the specified thickness. This ensures the sheet thickness is consistent regardless of the dough strength and allows further assessments to be made without the confounding presence of variability in noodle thickness from sample to sample. Calibration of the final role gap is achieved by taking a small piece of the dough sheet, sheeting it through the presumptive final gap, and measuring the thickness using a dial gauge. This process is repeated until the sheet is within the specifications (±0.02 mm).

c) Slitting. The remainder of the noodle dough sheet is passed once through the calibrated roll gap and directly onto the slitter without further sheeting. Slitters are often chosen based on the desired final noodle type (specified noodle width) and other practical considerations. If the noodles are destined for mechanical texture testing, consider making the noodle cross-section clearly rectangular. An obviously rectangular cross-section makes it simpler to ensure that the noodles are always presented with the same orientation to the texture measuring instrument.

Another factor to consider is whether to discard the outer few noodle strands from near the edges of the slitter, because they may have a variable width if the dough sheet does not proceed in a precisely parallel fashion through the slitter.

4) Noodle Cooking

To evaluate noodle cooking yield and textural properties, raw noodles are cooked in distilled water. This requires a different cooking time depending on the noodle type and size. For optimum results, a gas noodle cooker with sufficient water-holding and -heating capacity should be used to control the boiling process. The ratio of boiling water amount to noodle weight should be at least 12–15 parts to 1 part.

The heater is adjusted to maintain a gentle boiling action, which allows the noodles to remain floating. If the heater cannot be adjusted, running room temperature water may be used to adjust the boiling action. The position of the noodle baskets should be moved and the noodles stirred with a long stick occasionally throughout the cooking process.

5) Noodle Cooling and Rinsing

After the desired cooking time is complete, the noodle baskets are immediately taken out and cooled. The cooked noodles are rested for 15 min (covered with clean plastic wrap) and used for color and texture measurements and sensory evaluation as needed.

Acknowledgments

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References