AACCI Approved Methods Technical Committee Report on the Guidelines for Laboratory Preparation of Japanese Ramen Noodles (AACCI Approved Method 66-65.01)

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Background

Yellow alkaline noodles (YAN), referred to as "ramen" noodles in Japan, represent more than 40% of all noodles manufactured in that country (3). YAN are typically made from flour, water, salt (1%), and alkaline salts (1%) based on flour weight. The most commonly used alkaline salts are a mixture of potassium and sodium carbonates. YAN are very popular in Japan, Korea, China, and many other countries in Southeast Asia. There are very distinct differences in preferences regarding both the color and eating properties of YAN among consumers in different countries, as well as regional differences within each country. Alkaline noodles also include the popular steamed and fried instant ramen; however, flour quality requirements for fresh ramen noodles are more complicated due to less stable color change in fresh ramen noodles (6). The YAN described in this report refer to Japanese ramen noodles, which were first described in a publication produced by the National Foods Research Institute, Ministry of Agriculture, Forestry and Fisheries in 1985 (8) and first translated into English by Tanaka and Crosbie (*unpublished*) (6).

Introduction

Asian noodles are commonly classified according to the raw materials, type of salts, and method of preparation used, as well as the shape of the noodle strands (6). Wheat flour noodles can be divided into two groups based on the type of salt used in the formulation. Noodles made from flour, water, and salt (NaCl) belong to a family of white salted noodles (WSN), while noodles made with alkaline salts (typically Na_2CO_3 and/or K_2CO_3) belong to a family of yellow alkaline noodles (YAN). WSN were developed in northern China, while YAN originated in southern China (Canton and Fujian Provinces). Depending on the noodle type, other ingredients such as starches, gums, eggs, and food coloring agents can be used. After the flour and other dry ingredients are mixed with the salt and alkaline salt solution to form a crumbly dough, it is passed through a set of sheeting rolls to form a dough sheet. The dough sheet is often rested to allow the gluten network to relax and the water to distribute evenly throughout the sheet. Following the resting period, the dough sheet is passed through the sheeting rollers (to reduce sheet thickness) three to five times. Through this process the gluten–starch network is developed. Next, the dough sheets are cut into strands using slotted cutting rolls (with a defined width) and then cut to the desired length. The noodles can then be processed further to produce different types. Based on the additional processing, noodles can be classified as fresh, dried, steamed, boiled, frozen, or instant noodles (6). Instant noodles can be divided further into steamed and deep-fried instant noodle and steamed and air-dried instant noodle categories. Steamed and air-dried instant noodles have recently gained increased attention from consumers seeking healthier food options (1,4).

White Salted Noodles. WSN are typically made from a simple mixture of flour, water, and salt (typically 2–8%) that produces a crumbly dough. WSN are popular in Japan, Korea, and China but represent only a small proportion of the total noodles produced in Southeast Asia. The three most popular forms of WSN are fresh, dried, and boiled, while frozen noodles and noodles with an extended shelf life have become more popular in recent years, particularly in Japan. WSN can be divided further into *so-men* (very thin, 1.0–1.2 mm), *hiya-mugi* (thin, 1.3–1.7 mm), udon (standard thickness, 2.0–3.9 mm), and *hira-men* (flat, 5.0–7.5 mm) based on the width of the noodle strands (4).

Yellow Alkaline Noodles. The most common alkaline salts used today are sodium carbonate, potassium carbonate, or a mixture of the two. The addition of alkaline salts (also often referred to as *kan sui* or lye water) results in noodles with pH values ranging from 9 to 11 depending on the ionic strength of the salts used. YAN have a characteristic aroma, flavor, and yellow color. Today there are many different types of YAN produced in Southeast Asia, including fresh (Cantonese style), partially boiled (hokkien style), and fresh or steamed with egg as an ingredient (wonton noodles). The most popular YAN in Japan are ramen noodles, which originated in China and, thus, are often referred to as Chinese noodles in Japan). "Ramen" originally referred to hand-stretched noodles in China—"Ra" means "hand-stretching," and "men" means "noodle."

Due to the wide array of Asian noodle varieties produced and regional differences in processing equipment, no internationally approved standard methods or guidelines had previously been developed for noodle making and evaluation. In 2015 the AACC International Asian Products Technical Committee adopted and modified Guidelines for Making and Cooking Japanese Udon Noodles (AACCI Approved Method 66-60.01) (7). The AACCI Asian Products Technical Committee has now adopted and modified a new method for ramen noodles from the method approved by the Ministry of Agriculture, Forestry and Fisheries–National Food Research Institute of Japan (8): Guidelines for Making Japanese Ramen Noodles (AACCI Approved Method 66-65.01).

Specific Considerations for Preparation of Japanese Ramen Noodles in the Laboratory

To guide new researchers in the Asian noodle field, in 2005 Ross and Hatcher (9) compiled a list of general guidelines to assist in the development of valid, laboratory-scale noodle processing protocols. For laboratory preparation of Japanese Ramen

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noodles, it is recommended that the following specific suggestions be considered.

1) Noodle Dough Makeup
   a) *Flour Moisture Content.* Water addition in the noodle formulation is based on a flour moisture content of 13.5%. Both the actual flour weight and the water addition are adjusted based on the flour moisture content:

      Calculation (Flour Weight) = (100 – 13.5) × 400/(100 – Moisture Content)

      Calculation (Water Amount, based on 33% water addition at 13.5%) = 133 + (400 – Flour Weight)

   b) *Flour Particle Size and Water Absorption*. 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 crumb.
   c) *Determination of Optimum Water Addition for Dough Makeup.* 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 (7).
   d) *Dissolving Salts*. Both salt and alkaline salts should be predissolved in water when mixing noodle dough because of the low moisture content of the noodle dough.
   e) *Water and Water Temperature*. In the laboratory, it is recommended that distilled or deionized water be used in noodle preparation to avoid a water effect on the noodle dough. Water should be kept in a water bath to reach the target final noodle crumb temperature of 24–26°C.

2) Dough Mixing

   In the guidelines, a horizontal Hobart N50 mixer fitted with a flat paddle is used (7).
   a) *Adding Salt Solution.* To assist uniform water distribution through the flour, water should be added in a steady stream into the already operating mixer (7).
   b) *Mixing Time*. Although in laboratory noodle manufacturing there are only a few different mixing protocols used, this guideline specifies a mixing time of 5 min in total at two different speeds: starting on speed 1 (slow) for 1 min, followed by mixing on speed 2 for 1 min, and finishing mixing on speed 1 for 3 min.

3) Dough Sheeting

   In laboratory-scale noodle production, a variety of noodle sheeting equipment has been used, ranging from table-top machines to pilot-scale equipment. In this guideline, an OHTAKE (www.ohtake.jp/product_e.html) noodle machine is used (7).

4) Raw Noodle Sheet—Color Measurement

   Noodle appearance is the first "assessment" of noodle quality made by consumers and is based on subjective evaluation at the point of purchase. Independent of the noodle type, WSN or YAN, a bright and speck-free appearance is a requirement common to all noodles. The optimum intensity of color depends on the noodle type, and any combination of creamy, white, yellow, and strong yellow is possible. For example, Japanese udon noodles should be a creamy (slightly yellow) color, Japanese ramen noodles should be a lemony yellow color, dry Chinese noodles are usually white, and Chinese hokkien noodles are usually a strong yellow color.

   Although there is no international standard method for noodle color measurement, there has been significant research that has provided guidelines for color measurement. Typically, there are two means by which noodle color is measured—the tristimulus method and the spectrometric method. The tristimulus method uses three sensors that reveal color as red, green, and blue, whereas the spectrometric method uses multiple sensors for each specific wavelength (5). The most common color components reported for noodles are L^*, measuring whiteness and brightness; b^*, measuring yellowness and blueness; and a^*, measuring redness and greenness. One reason for the lack of a standardized approach for measuring noodle color is the considerable ongoing debate on how noodles should be presented to the instrument for measurement, including the background to be used and noodle sheet thickness. In 2007 Solah et al. (10) suggested measuring the color of noodle sheets at infinite optical thickness, meaning the color measurement is unaffected by the background color—thus, using white, cream, or black tiles as a background does not impact the color readings. The color of boiled noodles can be assessed at infinite thickness using a method developed by Crosbie (2): after boiling, rinsing, and draining, 60 g of noodles were placed in a plastic jar, and the color was measured using an Agtron sample cup to compress the noodles and a Minolta CRC-310 chroma meter.

   In this method, the suggested procedure for measurement of raw noodle sheet color is as follows. After the second reduction, a piece from the noodle sheet is cut (14 cm long) and passed through the final roll gap; the sheet is cut into two halves and placed on top of each other, folded, and color is measured on all four sides (this is the 0 hr time) using a Minolta chroma meter. Once the measurement is complete, the noodle sheets are placed into the bag without stacking and kept at 25°C for 24 hr. After 24 hr color is remeasured using the method described above.

5) Noodle Cooking

   For optimum results, a gas 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.

   Preparation (boiling) of noodles is also a point often discussed and debated among researchers. Typically, there are two approaches in use today: the first is to cook all samples for the same (standard) amount of time, and the second is to cook each noodle sample to its optimum cooking time (OCT). Hatcher (5) discusses these approaches in detail, highlighting the strengths and weaknesses of both. He points out that boiling noodles to their OCT presents greater challenges for achieving consistency, because it is a subjective assessment of the disappearance of the “white noodle core” and requires a preliminary assessment of various noodles, and thus, it is both time-consuming and material (flour) intensive. Standardizing the time for noodle cooking improves method precision. Standardizing the time between noodle cooking and measurement of texture, as well as the number of strands to be used to measure noodle texture, is very important for achieving consistent and repeatable results.

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