Pasta and Noodle Cooking Quality—Firmness

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Objective

Firmness of cooked pasta is a primary quality characteristic. This method provides an objective basis for evaluating the firmness of cooked pasta and Asian noodles. It is applicable to spaghetti, noodles, and other pasta shapes having a uniform, solid cross section. Procedures to determine cooking time and solids lost to cooking water are also described.

Apparatus

1. Texture analyzer, equipped with 5-kg weigh beam, data-integration system, and plastic (lexan preferred) tooth as described in Ref. 4.
2. Hotplate, variable output.
3. Air oven.

Procedure

Instrument setup

1. Calibrate data-integration system with tooth in place. Use either 1-kg or full-load scale.
2. Set crosshead speed to 10.0 mm/min.
3. Position upper crosshead limit so that tooth clears sample by 1–3 mm.
4. Position lower crosshead limit so that tooth is 0.5 mm from bottom plate.
5. Set recorder speed at 100 mm/min.

Preparation of sample

1. Place 300 ml distilled water into 500-ml beaker (one for each sample) and bring to rolling boil on hotplate. See Note 1. Maintain one extra beaker of boiling distilled water for makeup purposes. Graduated beakers are useful for adjusting volume of cooking water during test.
2. Weigh two 25-g portions of pasta or noodles for each sample being tested. See Note 2. Break pasta long goods or noodles into pieces approximately 5 cm long to permit free movement in boiling cooking medium.

Cooking time

1. Determine cooking time for each product by adding one of 25-g portions to beaker containing 300 ml boiling distilled water.
2. Start timer counting. Stir sample to make sure that pieces are separated.
3. Boiling stops when pasta is added. After cooking water has returned to rolling boil, maintain this condition throughout test. Partially cover beaker to help reduce evaporation and maintain consistent temperature. Use extra beaker of boiling water to maintain cooking water volume at least at 90% of original volume. See Note 2.

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4. Remove piece from cooking water at 30-sec intervals and squeeze it between two pieces of clear plastic. When center core just disappears, stop timer and record "cooking time."

Method—cooked firmness

1. Prepare samples for shear testing by cooking second portion of sample from step 2 of *Preparation of sample*. Use cooking technique described above, but do not remove any sample during cooking process.
2. When "cooking time" is reached, rapidly drain sample into Büchner funnel, retaining cooking water. Rinse sample with stream of distilled water for 30 sec (approximately 50 ml distilled water) held at consistent temperature. Combine cooking and rinse waters for determining cooking loss.
3. Immediately transfer cooked samples into container of distilled water at room temperature.
4. Load sample onto bottom plate of Instron, placing five strands of spaghetti (or equivalent width of other shapes) adjacent to one another.
5. Center sample under tooth, with axis of product at right angles to tooth. Compress to within 0.5 mm of base plate.
6. Return tooth to upper position, and wipe tooth and bottom plate clean before proceeding to next sample.
7. Repeat steps 4–6 at least twice more, using fresh subsamples.
8. Steps 4–7 should be performed at fixed times following completion of cooking to minimize changes resulting from storage in liquid medium. See Note 3.
9. Calculate maximum cutting stress by dividing maximum force value by tooth-sample contact area (in cm^2). See Ref. 4. Peak force is the maximum force achieved during cutting cycle, and work is represented by the area under curve. Mean values from results of all subsamples should be reported.

Method—Cooking loss

1. Preweigh 500-ml beaker to 0.01 g.
2. Quantitatively transfer cooking/rinse water to beaker.
3. Evaporate to dryness (constant weight) in air oven at 100 ± 1°. Drying time is approximately 20 hr but may vary with oven capacity, load, etc.
4. Cool beakers in desiccator and weigh to 0.01 g. For 25-g sample, increase in weight times 4 equals percent cooking loss.

Notes

1. Composition of the cooking medium affects cooking loss. Substituting an artificial "hard water" medium for distilled water may better relate to many

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commercial water supplies. A suggested formula is: Into 16 liters distilled water, dissolve 7.68 g Na_2CO_3, 9.60 g $NaHCO_3$, 1.92 g K_2SO_4, 1.92 g $MgCl_2$, and 5.76 g $CaCl_2$. A precipitate may form. Add about 5 ml 1:3 H_2SO_4/H_2O or a sufficient amount to clarify. Back titrate with 0.1*N* NaOH to pH 7.5. (Dilute this solution 8:1 with distilled water before using as cooking medium.)

2. Sample size of 25 g is a suggestion only. Where material is limiting, smaller samples may be used. It is important to keep ratio of cooking water to sample to at least 10:1 to ensure return to rapid boil after addition of sample.

3. Cooked firmness of pasta and noodles is sensitive to time after cooking. Firmness determinations should be made at a set time after cooking. Recommended time for determination of firmness of first subsample is 10 min after cooking. Succeeding subsamples can be tested approximately 1 min apart, although time to prepare subsamples may vary with skill of operator.

4. Other testing procedures, in particular, texture profile analysis hardness, can be used to assess the firmness of cooked products. See Ref. 1.

References

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