Wet Gluten and Gluten Index

Final approval November 8, 1995; Reapproval November 3, 1999

Objective

Wet gluten is washed from whole-grain wheat meal or flour by an automatic gluten washing apparatus (Glutomatic). Then it is centrifuged on a specially constructed sieve under standardized conditions. The weight of wet gluten forced through the sieve and total wet gluten are measured. The total wet gluten is expressed as percent of sample, and the gluten index is expressed as percentage of wet gluten remaining on the sieve after centrifuging. This method is applicable to wheat meal (ground whole grain) and flour.

Apparatus

1. Glutomatic system, which includes:
   a. Glutomatic, with kneader, attachment for washing chambers, tubing and submersible filter for solvent container, and electronics for 20-sec dough mixing and 5-min wash cycle for flour and 2-min wash, a stop, and then another 3-min wash for wheat meal. See Note 1.
   b. Standard washing chambers with 88-µm polyester and 840-µm polyamide screens and screen holders. Metal chamber bottom for 840-µm screen is marked by a grooved ring.
   c. Container for washing solvent, 10-liter or other size.
   d. Dispenser, adjustable, range 0–10 ml ± 0.1 ml.
   e. Centrifuge, operating at 6,000 ± 5 rpm and equipped with gluten index cassettes. See Note 1.
2. Laboratory mill, Falling Number 3100 or KT-120 with 0.8-mm screen or mill that gives equivalent particle size with whole wheat.
3. Balance, accurate to 0.01 g.

Reagent

NaCl solution (2%). Dissolve 200 g NaCl (analytical grade) in distilled water and make to 10 liters. Prepare new solution each day. Wash solution from Glutomatic should be maintained at 22 ± 2°. Salt solution ice cubes can be used for cooling and maintaining temperature.

Procedure

Preliminary steps

1. Distance between kneader hook and screen is 0.7 mm and is factory set. If this distance is incorrect (test piece in accessory kit), contact the manufacturer for assistance.
2. Preliminary run
   a. Before starting Glutomatic, add a few drops of water into hole in front of Plexiglas body of mixing head to lubricate shaft.

doi: 10.1094/AACCIntMethod-38-12.01

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b. Attach washing chambers to Glutomatic. For testing flour procedure, press blue ON/OFF button and then green START button. Check for 20-sec dough cycle (no fluid pumped) followed by 5-min wash cycle (bayonet moves up and solvent begins flowing at beginning of this cycle). For testing wheat meal procedure, press red WASH button and then green START button. Check for 20-sec dough cycle followed by 2 min of washing and stopping of Glutomatic. Then press red WASH button and check for 3 min more washing. Solvent flow during 5-min washing should be 250–280 ml (50–56 ml/min) with liquid temperature 22 ± 2°.

3. After filling empty wash liquid reservoir, run Glutomatic for at least 2 min on wash cycle to fill system with wash liquid. Turn Glutomatic off and on to restart mixing-washing cycle.

Gluten washing

Flour

1. Place 88-µm polyester screen in washing chamber bottom without grooved ring. See Note 2. On top of screen, place plastic chamber wall. Align and attach bottom to plastic chamber wall by pushing and turning bottom clockwise.

Or use assembled washing chamber from previous run. Wash from top and bottom with running water to remove any material left from previous run. *If material on screen or between screen and bottom is not removed, take chamber apart to wash.*

2. Add wash liquid to washing chamber to wet the polyester screen. Remove excess water from screen by knocking chamber three times against cloth-covered palm of hand. Add 10.00 ± 0.01 g well-mixed flour onto screen that contains a film of liquid to prevent falling through of flour. Spread out sample over screen by shaking wash chamber in a circular motion.

3. Add 4.8 ml wash solution from dispenser while holding chamber at about a 30° angle. Direct stream of liquid against lowest side wall to prevent loss of liquid through screen. (For very weak gluten or low gluten content, liquid quantity may be reduced to 4.2 ml. For high gluten content, it may be increased to 5.2 ml.) Shake chamber gently in circular motion to spread liquid over total top surface of sample.

4. Assemble washing chamber onto Glutomatic and press green START button for automatic 20-sec dough mixing and 5-min gluten washing. Wash liquid flow rate should immediately be 50–56 ml/min. See Notes 3 and 4. Watch for up and down movement of both chambers during kneading of gluten by hook. See Note 5.

5. At end of wash cycle, lower chamber and remove gluten from chamber and kneading hook, without tearing, for placement in centrifuge. If gluten tears into

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two or more pieces, test should be repeated. After each test, take bowl from base and wash screens, bowls, and sieve holder carefully and thoroughly. If screen feels slightly oily, wash with soap and rinse thoroughly with water.

6. Proceed to instructions for wet gluten and gluten index (below).

Wheat Meal

1. Follow steps 1–3 above for flour. Assemble washing chamber onto Glutomatic and then press red WASH button before pressing green START button. A 20-sec dough mixing cycle will be followed by a 2-min washing and stopping of Glutomatic. See Note 3.

2. Remove wash chamber and transfer loose material from hook into chamber. By means of plastic coupler, attach coarse sieve chamber that is assembled with 840-µm screen and metal bottom having grooved ring. Hold wash chamber upside down and wash complete contents of chamber into coarse sieve chamber with a slow stream of tap water. Rinse tap water from surface of gluten and screen with 10–15 ml of wash solvent.

3. Place coarse sieve chamber with gluten on Glutomatic and press red WASH button for last 3 min of washing. See Note 4. Watch for up and down movement of both chambers during kneading of gluten by hook. See Note 5.

4. At end of wash cycle, lower chamber and remove gluten from chamber and hook, without tearing, for placement in centrifuge. If gluten tears into two or more pieces, test should be repeated.

Wet gluten and gluten index

1. Place wet gluten from each washing chamber into a separate gluten index sieve in centrifuge. For gluten from only one wash chamber, use a counterbalance in the other gluten index sieve.

2. Start centrifuge 30 sec after end of washing cycle by pushing green START button for automatic centrifuging at 6,000 ± 5 rpm for 1 min. See Note 4.

3. Remove gluten index sieve from centrifuge. With spatula, remove gluten that has passed through sieve as described in manual. Weigh gluten to nearest 0.01 g. Leave gluten on balance.

4. With tweezers, remove gluten on top of sieve, add to gluten on balance, and weigh as total gluten.

5. The first test of day may give erratic result. Therefore, discard first result and repeat test.

6. The difference between the results of two determinations performed simultaneously or in rapid succession by the same operator should not exceed 0.5% wet gluten contents, i.e., the results 20.0% and 20.5% are acceptable.

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Cleaning and rinsing

After final run of day, remove salt by flushing and rinsing Glutomatic with distilled water. Salt should also be removed from inside of centrifuge and from centrifuge sieves. Clean washing chamber screens with warm detergent.

Calculations

Calculate total wet gluten and gluten index as follows:

$$\text{Wet gluten, \% (14\% moisture basis)} = \frac{\text{total wet gluten (g)} \times 860}{100 - \text{\% sample moisture}}$$

$$\text{Gluten index} = \frac{\text{wet gluten on sieve (g)} \times 100}{\text{total wet gluten (g)}}$$

Notes

1. Early models of Glutomatics before serial number 1107 may be factory modified for gluten index determination (contact manufacturer for information). Special centrifuge sieves and centrifuges (Falling Number model 2015) are required for Gluten Index determination.

2. Only 88-µm polyester screens marked "Gluten Index" should be used. New screens must have the finish removed by washing ground meal twice on the 88-µm screen by the flour procedure. Use of the installation tool gives an assembled washing chamber with the polyester screen lying flat across the bottom of the chamber.

3. A slow dripping rate of the wash liquid and flooding of the chamber indicate a clogged screen. Wash the screen carefully with household detergent and a brush.

4. Glutomatics from serial No. 1136 have an internal beeping signal warning the operator when 15 sec remains of the wash cycle. Also, a beep starts at 25 sec and stops at 30 sec after the end of the washing cycle as a signal for starting of the centrifuge.

5. Erratic gluten indexes have been observed when the washing chamber is stuck in the down position in the wash cycle. The hook is prevented from kneading the gluten. This problem might be caused by a too tightly fitting chamber or by material on the Plexiglas body to which the chamber is fitted.

References

1. McDonald, C. E. 1994. Collaborative study on wet gluten and gluten index determinations for wheat flour or meal (AACC Method 38-12). Cereal Foods World 39:403.
2. Perten, H. 1990. Rapid measurement of wet gluten quality by the gluten index. Cereal Foods World 35:401.