Cereals Canada – Methods of Analysis

All results are corrected to a 13.5% moisture basis (mb) for wheat and a 14.0% mb for flour or semolina unless otherwise specified. AACC Approved Methods are from the Cereals and Grains Association: Approved Methods of Analysis, 11th Edition.

ALVEOGRAPH — AACC APPROVED METHOD 54-30.02

Alveograph values (corrected to 15.0% mb) are determined using the AlveoLab according to AACC Approved Method 54-30.02 using light mineral oil. Samples are evaluated one week after milling. The following curve parameters are measured: P (height x 1.1) is the resistance of the dough to deformation; L (length) is a measure of dough extensibility; P/L is the curve configuration ratio; W is the amount of work required to inflate the dough into a bubble; Ie (elasticity) measures the ability of the dough to return to its original shape; G (swelling) relates to the volume of air necessary to inflate the bubble until rupture.

AMYLOGRAPH — AACC APPROVED METHOD 22-10.01

Amylograph peak viscosity is determined using a Viscograph-E according to AACC Approved Method 22-10.01 with modifications. Flour (65 g, 14% mb) and distilled water (450 mL) are placed in a bowl, mixed with a whisk and then added to the Viscograph-E.

ASH — AACC APPROVED METHOD 08-01.01

Ash content is determined using AACC Approved Method 08-01.01. Samples are weighed into previously dried silica dishes (600°C, min 1 h). The samples are then incinerated overnight in a muffle furnace (600°C), cooled in a desiccator and then weighed.

BAKING, PILOT – NO TIME DOUGH (NTD) — INTERNAL METHOD

White pan bread is processed in a pilot scale bakery using a NTD baking procedure. Formulation, processing conditions, and equipment used are typical for commercial bread production.. All ingredients are mixed using a spiral mixer (2 min on slow speed, then on second speed until the dough is fully developed). The dough is then rested (10 min, ambient conditions), scaled into pieces (640 g) and rounded by hand. The dough balls are rested (10 min), shaped using a commercial sheeter and moulder, panned and fully proofed (37°C, 85% RH). The samples are baked in a reel oven (200°C, 25 min).

BAKING, PILOT – SPONGE & DOUGH — INTERNAL METHOD

White pan bread is processed in a pilot scale bakery using a sponge and dough baking procedure. Formulation, processing conditions, and equipment used are typical for commercial bread production. The sponge ingredients (a portion of flour, water, yeast, and yeast food) are prepared in a spiral mixer and then fermented in a proofing cabinet (27°C, 75% RH, 4 h). To prepare the dough, the fermented sponge and the remaining ingredients are mixed using a spiral mixer (2 min on slow speed, then on second speed until the dough is fully developed). The dough is then rested (10 min, ambient conditions), scaled into pieces (640 g) and rounded by hand. The dough balls are rested (10 min), shaped using a commercial sheeter and moulder, panned and fully proofed (37°C, 85% RH). The samples are baked in a reel oven (200°C, 25 min).

BAKING, TEST – COOKIES — AACC APPROVED METHOD 10-53.01

The evaluation of soft wheat flour quality is based on AACC Approved Method 10-53.01 with modifications. Dry ingredients are mixed, added to shortening and mixed in a KitchenAid stand mixer with paddle attachment to form a creamed mass. A portion of the creamed mass is mixed (2 min) with the wet ingredients (white corn syrup substituted for high-fructose corn syrup) before adding flour and mixed (2 min) to form a homogenous dough. The dough is divided into eight equal pieces, lightly rounded, placed on a cookie sheet and rolled to thickness (7 mm) using gauge strips. Cookies are cut using a round cookie cutter (60 mm), baked in a reel oven (205°C, 8 min), and cooled (30 min, ambient conditions). The width (W) and thickness (T) from the average of six cookies are calculated and used to determine the spread factor (W/T).

BAKING, TEST – NO TIME DOUGH (NTD) — AACC APPROVED METHOD 10-10.03

Test baking using a NTD method is based on AACC Approved Method 10-10.03 with modifications. All ingredients are placed in the bowl of a water-jacketed National MFG. Co. Swanson pin mixer (20°C, 118 rpm) which is controlled with software to measure mixing time (min) and energy (W) input. The dough is mixed 10% past peak time and placed in a covered bowl and allowed to rest (10 min, ambient conditions). The dough is scaled (165 g), rounded by hand and allowed a second rest (10 min, ambient conditions). The dough is sheeted, moulded, panned and proofed (37°C, 85% RH) to a fixed height. Samples are baked in a reel oven (204°C, 20 min).

BAKING, TEST – LONG TIME FERMENTATION (LTF) — AACC APPROVED METHOD 10-10.03

Test baking using a LTF method is based on AACC Approved Method 10-10.03 with modifications. All ingredients are placed in the bowl of a water-jacketed National MFG. Co. Swanson pin mixer (15°C, 118 rpm) which is controlled with software to measure mixing time (min) and energy (W) input. The dough is mixed 10% past peak time and scaled (165 g), rounded by hand, and allowed to rest in a fermentation cabinet (37°C, 85% RH; 105 min). After the initial fermentation, the first punch is performed by sheeting, tri-folding and placing the dough back into the fermentation cabinet for a second rest period (37°C, 85% RH; 50 min). The second punch is handled the same way as the first punch and the dough is placed back into the fermentation cabinet (37°C, 85% RH; 25 min). After 180 minutes of total fermentation time, the dough is sheeted, moulded, panned and proofed (37°C, 85% RH) to a fixed height. Samples are baked in a reel oven (204°C, 20 min).

COLOUR – BREAD CRUMB — INTERNAL METHOD

Assessment of the crumb colour of a bread slice is performed using the Minolta colorimeter (D65 illuminant, 2° standard observer angle) according to manufacturer's instructions. Two slices of bread are placed on the light projection tube and the measurement is taken. The L* value (0 = black to 100 = white), which indicate the brightness of the crumb, is measured.

COLOUR – FLOUR/SEMOLINA (DRY) — INTERNAL METHOD

Assessment of flour/semolina colour is performed using a granular material attachment and the Minolta colorimeter (D65 illuminant, 2° standard observer angle) according to manufacturer's instructions. Samples are evaluated one week after milling. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = red); b* (-b* = blue to +b* = yellow).

COLOUR – FLOUR/SEMOLINA (WET) — INTERNAL METHOD

Assessment of flour/semolina colour is performed on a slurry of flour/semolina and water using the glass ended attachment according to AACC Approved Method 14-30.01 with respect to flour weight, volume of water, mixing time and waiting time. Colour is measured one week after milling. The Minolta colorimeter (D65 illuminant, 2° standard observer angle) is used according to manufacturer's instructions and the following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = redness); b* (-b* = blue to +b* = yellow).

COLOUR – NOODLE DOUGH SHEET — INTERNAL METHOD

Colour of a noodle sheet (see *Noodle Processing* for details) is measured using a Minolta colorimeter (D65 illuminant, 2° standard observer angle). The dough sheet is folded into six layers and stored in a covered container at ambient conditions. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = red); b* (-b* = blue to +b* = yellow). The average of five colour measurements, taken at five spots on the dough sheet surface at 3 and 24 h r from the start of mixing, are reported.

COLOUR – SPAGHETTI — INTERNAL METHOD

A Minolta colorimeter (D65 illuminant, 2° standard observer angle) is used to measure the colour of dried spaghetti strands (see *Spaghetti Processing* for details). Strands are mounted on standard white cardboard (7.5 cm x 7.5 cm) using double sided tape. The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = red); b* (-b* = blue to +b* = yellow).

COOKING LOSS – SPAGHETTI — AACC APPROVED METHOD 66.50.01

Cooking loss is determined according to AACC Approved Method 66-50.01 with modifications. Dried spaghetti (30 g, 1 cm length) is cooked in boiling distilled water (300 mL) to its optimal cooking time (OCT) which is defined as the time when the center core of the spaghetti just disappears when pressed between two Plexiglas plates. After the OCT is reached, the spaghetti is drained and rinsed (100 mL distilled water). The cooking container is rinsed with an additional 100 mL distilled water, and the cooking and rinse water are retained in a previously weighed beaker. The cooking water is evaporated (130°C, 24 h) and the remaining residue is weighed and expressed as a percentage of the initial spaghetti weight.

CRUMB STRUCTURE – BREAD — AACC APPROVED METHOD 10-18.01

Crumb structure is evaluated using C-Cell imaging (Model CC.400 with V3.4 software) according to AACC International Method 10-18.01. An average of the measurements taken on two slices of bread from the centre of the loaf are reported.

EXTENSOGRAPH — AACC APPROVED METHOD 54-10.01

Extensographs are performed using the Extensograph-E according to AACC Approved Method 54-10.01 with the exception that the dough test pieces are not stretched at 90 min, only re-formed. Results are reported for the stretches completed at 45 and 135 min. The Extensograph-E is calibrated so that a 100 g load is equivalent to 80 BU. Samples are tested one week after milling. The following parameters are measured: R_{max} is the maximum height (maximum resistance) of the curve; E is a measure of extensibility; A is the area under the curve (energy).

FALLING NUMBER (FN) — AACC APPROVED METHOD 56-81.03

Falling Number is determined using the FN1000 with the Shakematic 1095 according to AACC Approved Method 56-81.03. For evaluation of wheat FN, a sample of wheat (minimum of 250 g) is ground using the FN3100 laboratory mill with 0.8 mm screen.

FARINOGRAPH — AACC APPROVED METHOD 54-21.02

Farinographs are performed using the Farinograph-TS or Farinograph-AT with either the large bowl (300 g) or small bowl (50 g) according to AACC Approved Method 54-21.02 using constant flour weight. Flour is tested one week after milling. The following parameters are measured: water absorption is the amount of water needed to center the curve on the 500 BU line (± 20 BU) at maximum consistency (peak); dough development time (DDT) is the time for the dough to reach maximum consistency (peak); stability is the amount of time that the top portion of the curve is above the 500 BU line; mixing tolerance index (MTI) is the drop in BU of the top of the curve at DDT to the top of the curve 5 min after DDT.

FIRMNESS – SPAGHETTI — AACC APPROVED METHOD 66-52.01

Spaghetti firmness is determined according to AACC Approved Method 66-52.01 with modifications. Dried spaghetti (12 strands, 5 cm length) is cooked in boiling water (250 mL, 9 min). After cooking, the spaghetti is drained on a fine sieve. A TA.XTPlus texture analyzer with a blade (TA-47) is used to measure firmness (45 s and 115 s after cooking). This assessment is completed in duplicate and the average of the four measurements is reported for each sample.

FLOUR YIELD, AS IS – LABORATORY MILLING — INTERNAL METHOD

Wheat for milling is cleaned using a dockage tester with standard screens and then conditioned (20-24 h for CWRS, CPSR and CWRW; or 4 h for CWSWS and CESRW) to a target moisture content (16.5% for CWRS; 16.0% for CPSR and CWRW; 14.5% for CWSWS and CESRW). Milling is done using a Bühler laboratory flour mill using preset feed rates and roll gap settings for all common wheat classes. After milling, the bran and shorts fractions are put through a Bühler bran finisher and any additional flour released is added to the original flour and used for calculation of the final flour yield based on total products.

FLOUR YIELD, CORRECTED TO 0.50% ASH BASIS – LABORATORY MILLING — INTERNAL METHOD

Correction of flour milling yield to a 0.50% ash basis is done to show milling yields on a constant ash basis which allows for a better comparison among wheat samples with different extraction rates and flour ash contents. The correction is based on an estimate derived from a laboratory mill ash curve where each 0.01% difference in flour ash content is equal to a 0.50% extraction adjustment. It is calculated as follows:

$$\text{Milling yield, 0.50\% ash basis} = \%\ \text{milling yield (as is)} + \frac{0.50 \times (0.50 - \text{flour ash content, 14.0\%mb})}{0.01}$$

GRANULATION — AACC APPROVED METHOD 66-20.01

Semolina granulation is determined using a Ro-tap sieve shaker according to AACC Approved Method 66-20.01 with modifications. Samples are sieved for 10 min and then each sieve is weighed. Results are reported on an as is basis.

LOAF AND SPECIFIC VOLUME – BREAD — AACC APPROVED METHOD 10-14.01

The BVM 6600 bread volume meter is used to measure loaf volume according to AACC Approved Method 10-14.01. Loaf weight is also determined. Specific volume is calculated as the ratio of loaf volume to loaf weight and reported in g/cm^3.

MAXIMUM CUTTING STRESS – NOODLES — INTERNAL METHOD

Noodles (16 strands, 10 cm length) are assessed for texture by cooking in boiling distilled water (500 mL) at two different cooking times (3.5 min, 5.0 min). After each cooking time, the noodles are drained, cooled in distilled water (22°C, 1.5 min) and placed on a sieve. The cooled noodles are lined up on the sieve and transferred to the TA.XTPlus base plate within a specific amount of time (3.75 min) prior to taking a measurement. A TA.XTPlus texture analyzer with a blade (TA-47) is used to measure maximum cutting stress. An average of two measurements is reported for each sample at each cooking time.

MIXOLAB — AACC APPROVED METHOD 54-60.01

Mixolab assessment is determined using the Mixolab 2 according to AACC Approved Method 54-60.01. Flour is tested one week after milling. The following parameters are measured: water absorption (WA) is the amount of water needed to form dough with a consistency of 1.1 ± 0.05 Nm at the C1 torque; C1 torque (C1) is initial peak dough consistency; time to T1 (T1) is the time needed to reach C1; Stability is the time around C1 where the torque is greater than C1-11%; CS time; is the time required for the consistency to drop by 50% after heating has started; C2 torque (C2) represents the lowest point of the curve; C3 torque (C3) is the maximum torque obtained after C2 during the heating phase; C4 torque (C4) is the minimum torque obtained after C3; C5 torque (C5) is the torque at the end of the test.

MOISTURE CONTENT – BREAD — AACC APPROVED METHOD 62-05.01

The moisture content of a sample of bread is determined according to AACC Approved Method 62-05.01 and AACC Approved Method 44-15.02 (one-stage).

MOISTURE CONTENT – GROUND WHEAT/FLOUR/SEMOLINA — AACC APPROVED METHOD 44-15.02

The moisture content of ground wheat/flour/semolina is determined according to AACC Approved Method 44-15.02 using the single stage procedure (130°C, 1 h).

MOISTURE CONTENT – WHEAT — MANUFACTURER METHOD

The moisture content of whole kernel wheat is determined using the AM5200-A.

NOODLE PROCESSING – INSTANT — INTERNAL METHOD

Ingredients are mixed (100 rpm, 10 min) using a pilot scale Ohtake vertical vacuum mixer. The noodle sheets are prepared using a pilot Ohtake noodle line starting with a gap setting of 5.1 mm. The dough sheet is then subjected to four reduction passes (2.0, 1.5, 1.2, 1.0 mm) and cut into noodle strands after the final pass. The cut noodle strands are continuously fed into a traveling net conveyor and cooked with steam while passing through a tunnel steamer. Noodles are cut into predetermined lengths to make one serving size. Noodle portions are deep-fried in canola oil in a bench top fryer and then cooled to room temperature prior to packaging.

NOODLE PROCESSING – YELLOW ALKALINE NOODLES (YAN) — INTERNAL METHOD

YAN are processed using a laboratory scale Ohtake vertical mixer and laboratory scale Ohtake sheeter. A flour and salt solution are mixed (100 rpm, 10 min) and rested (15 min). Sheeting begins with a gap setting of 3.5 mm and then the dough sheet is laminated at the same gap setting and rested (30 min) on a noodle roller in a plastic bag. The dough sheet is subjected to four reduction passes (2.0, 1.4, 1.1, 1.0 mm) and the final gap setting is adjusted to ensure the resulting dough sheet has a thickness of 1.4 mm. A section (180 cm) is cut from the dough sheet and assessed for colour (see *Colour – Noodle* for details). The remaining dough sheet is cut into noodle strands using a No. 10 cutter to produce noodles with a width of 3.0 mm. To produce dried YAN, cut noodles are placed on rods and hung to dry in an Ohtake pilot dryer room (35°C, 7 h).

NOODLE PROCESSING – WHITE SALTED NOODLES (WSN) — INTERNAL METHOD

WSN are processed using a laboratory scale Ohtake vertical mixer and laboratory scale Ohtake sheeter. A flour and salt solution are mixed (100 rpm, 10 min) and rested (15 min). Sheeting begins with a gap setting of 3.5 mm and the dough sheet is laminated at the same gap setting and rested (30 min) on a noodle roller in a plastic bag. The dough sheet is subjected to four reduction passes (2.0, 1.5, 1.2, 1.1 mm) and the final gap setting is adjusted to ensure the resulting dough sheet has a thickness of 1.4 mm. A section (180 cm) is cut from the noodle sheet and assessed for colour (see *Colour – Noodle* for details). The remaining dough sheet is cut into noodle strands using a No. 10 cutter to produce noodles with a width of 3.0 mm. To produce dried WSN noodles, cut noodles are placed on rods and hung to dry in an Ohtake pilot dryer room (35°C, 7 h).

PARTICLE SIZE INDEX (PSI) — AACC APPROVED METHOD 55-30.01

Wheat kernel hardness is assessed by determining the PSI using AACC Approved Method 55-30.01 with modifications. Whole kernel wheat, with moisture content between 11.0-13.0% (see *Moisture Content – Wheat* for details), is ground using an UDY Cyclone grinder (1.0 mm screen) and a feed rate regulator (52 rpm). Ground wheat is sieved using a Ro-tap sieve shaker.

PROTEIN CONTENT — WILLIAMS ET AL. 1998

Protein content is measured using a combustion nitrogen analysis (CNA) method with the LECO FP-828 according to Williams *et al*. (Protein testing methods. In, Wheat Protein, Production and Marketing. Proceedings of the Wheat Protein Symposium. Saskatoon, SK. University of Saskatchewan Press. March 9-10, 1998. pp. 37-47). Drift corrections are done using EDTA. Conversion factors of N x 5.7 (wheat) or N x 6.25 (other cereals and pulses).

SEMOLINA YIELD – LABORATORY MILLING — INTERNAL METHOD

Wheat for milling is cleaned using a dockage tester with standard screens and then conditioned (16-20 h). Milling is done using a Bühler laboratory semolina mill using preset feed rates and roll gap settings. After milling, the semolina is purified using Namad laboratory purifier. Break flour is added to purified semolina and the total amount is reported as semolina yield. To calculate total yield, sizing flour is added to purified semolina and break flour blend. Semolina yield is calculated based on total products.

SHOCK TEST – BREAD — INTERNAL METHOD

A shock test is performed to determine how bread dough can tolerate the mechanical stress or abuse present in a commercial production line. A fully proofed bread dough is dropped in its pan from a specified height (3.0-3.5 cm) onto a solid, flat surface and evaluated for signs of collapsing. Specific volume (SV) is measured using the BVM 6600 bread volume meter (see *Loaf and Specific Volume – Bread* for details). Results are recorded as the SV of the shocked loaf compared to the SV of the non-shocked loaf to determine dough recovery in the oven.

SOLVENT RETENTION CAPACITY (SRC) — AACC APPROVED METHOD 56-11.02

SRC is assessed by determining the weight of solvent that can be held by a wheat flour sample after centrifugation according to the AACC Approved Method 56-11.02. Four different solvents, sodium carbonate, sucrose, lactic acid and distilled water are used. Results from the sodium carbonate SRC relate to starch damage, sucrose SRC relates to pentosan characteristics, lactic acid SRC relates to glutenin characteristics and distilled water SRC relates to all previously mentioned characteristics.

SPAGHETTI PROCESSING – LABORATORY SCALE — INTERNAL METHOD

A Namad laboratory pasta extruder with a Teflon die (1.80 mm diameter) is used to process spaghetti. Semolina and water (variable absorption) are mixed with a paddle mixer (12 min) then the dough is extruded under vacuum. Spaghetti is dried in a Bühler batch dryer using a high temperature drying cycle (85^{o}C, 5.5 h).

SPECK COUNT – SEMOLINA — INTERNAL METHOD

Speck count in semolina is determined using rar-SpeckCnt software. A sample of semolina is placed in a square sample holder (17.5 cm x 17.5 cm) with a glass top and compressed to approximately 1 cm thickness. The sample holder is scanned using a flatbed scanner to provide a 10 x 10 cm image which is counted for specks using the software. The specks identified are categorized by their darkness (low, medium, high) and size (small, medium, large). Total specks, dark specks and large specks are recorded for each test which is done in quadruplicate. The average of the results is determined, divided by two and expressed as the number of specks per 50 cm^2 of semolina.

STARCH DAMAGE — AACC APPROVED METHOD 76-33.01

Starch damage is measured using the SDmatic2 according to AACC Approved Method 76-33.01 and reported in UCD on an as is basis.

STARCH PASTING PROPERTIES – RVA — AACC APPROVED METHOD 76-21.02

Evaluation of the starch pasting profile of flour is performed using the RVA 4500 according to AACC Approved Method 76-21.02 (STD1, 13 min profile). The following parameters are measured: peak viscosity is the maximum viscosity during the heating cycle; peak time is the time at peak viscosity; pasting temperature is the temperature where a rapid increase in viscosity occurs; hot paste viscosity is the minimum viscosity observed during the heating period; breakdown is the difference between peak and hot paste viscosities; final viscosity is the viscosity at the end of the test; setback is the difference between final and hot paste viscosities. Viscosity measurements are reported in cP.

STEAMED BREAD PROCESSING – LABORATORY SCALE — INTERNAL METHOD

Ingredients are placed in a GRL-1000 mixer and mixed at slow speed (45 rpm, 0.5 min) and then at a higher speed (105 rpm) until dough is developed. The dough is rested (15 min), sheeted (20 passes, 5.5 mm gap) and then rolled into a cylinder. Six dough pieces are scaled (150 g each) and rounded by hand. The dough pieces are placed in a covered steaming tray, proofed (45 min, 32°C, 85% RH), and steamed (25 min, 100°C) in a commercial steamer.

STEAMED BREAD EVALUATION — INTERNAL METHOD

Steamed breads are weighed and measured for height and width. Volumes are determined by rapeseed displacement. The colour of the steamed bread skin is measured by a Minolta colorimeter (D65 illuminant, 2° standard observer angle). The following parameters are measured: L* (0 = black to 100 = white); a* (-a* = green to +a* = red); b* (-b* = blue to +b* = yellow). Breads are subjectively scored using an internal method for physical attributes of exterior appearance, crumb structure and colour, texture and overall acceptability.

TOTAL BREAD SCORE (TBS)– BREAD — INTERNAL METHOD

Pan bread is subjectively scored using an internal method to obtain the TBS. TBS is the sum of the score of external loaf characteristics (symmetry, crust character, crust colour, and break and shred) and the score for internal crumb characteristics (crumb colour and crumb structure).

WET AND DRY GLUTEN CONTENTS & GLUTEN INDEX (GI) — AACC APPROVED METHOD 38-12.02

Wet and dry gluten contents and gluten index values are determined using the Glutomatic 2000 with the Gluten Index Centrifuge 2015 and Glutork 2020 according to AACC Approved Method 38-12.02. The single-stage washing procedure is used for flour while the two-stage washing procedure is used for semolina/ground wheat. Flour/semolina samples are tested one week after milling.

YELLOW PIGMENT CONTENT — FU ET AL. 2013

Semolina yellow pigment content is determined according to Fu *et al*. (2013. J. Cereal Sci. 57: 560-566; doi: 10.1016/j.jcs.2013.03.007).

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