APPLICATION NOTE

Physical Testing - Food

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Determination of Gluten Quantity and Quality Using the Perten Glutomatic 2000

Introduction

Wheat and flour quality information is used by the milling, baking and pasta industries to produce cost effective, fit-for-purpose products. Gluten contributes to dough characteristics and influences end-product quality. Its content and quality are equally important considerations for suitability of the wheat, semolina or flour for its intended use.

The Perten Glutomatic® System is the world standard for testing gluten quantity and quality in wheat, flour, durum and semolina[1-8]. The system consists of a Glutomatic instrument (GM) to wash gluten from meal or flour, a Centrifuge (CF) to remove unbound water from the gluten ball and determine the gluten strength, and a Glutork (GT) to dry the gluten (Figure 1 and Figure 2), giving measures of Gluten Index, Water Binding Capacity, and Wet and Dry gluten contents, as defined below.

Wet Gluten Content (WGC, %)	= Total Wet Gluten (g) × 100 /Sample Weight (g)
Gluten Index (GI)	= Wet Gluten Retained on Sieve (g) × 100/Total Wet Gluten (g)
Dry Gluten Content (DGC, %)	= Dry Gluten Weight (g) × 100 / Sample Weight (g)
Water Binding Capacity (WBC, %)	= WGC - DGC

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If the gluten strength is low, more gluten will pass through the sieve, and vice versa. Higher values of WGC and GI are considered desirable for breadmaking and pasta production. It is possible for a sample to have high content of gluten of poor quality (high WGC but low GI).

Figure 1. The new Perten Glutomatic 2000 System.

The GM 2000 System (Figure 1) is an updated version of the Perten Glutomatic system, with key features including:

Modernized Design

- Modern, robust design for use at mills, silos and other grain handling QA laboratories
- Large touch screen to guide operator through analysis
- Simplified wash chamber assembly to facilitate easy cleaning

Conformance to Standards

- Follows all international standards[1-8]. Localized methods can also be configured (Figure 3A)

Automation

- Automatic initial saline delivery to simplify workflow
- One-touch sample weight input to minimize transcription errors (Figure 3B)
- Automatic results calculation and collation to simplify workflow and enhance throughput (Figure 3C)

Data Management and Security

- Sort, select and export data for LIMS integration
- Operator access security and automatic daily back up

This Application Note compares the usability, precision and equivalence of the new system to the original system.

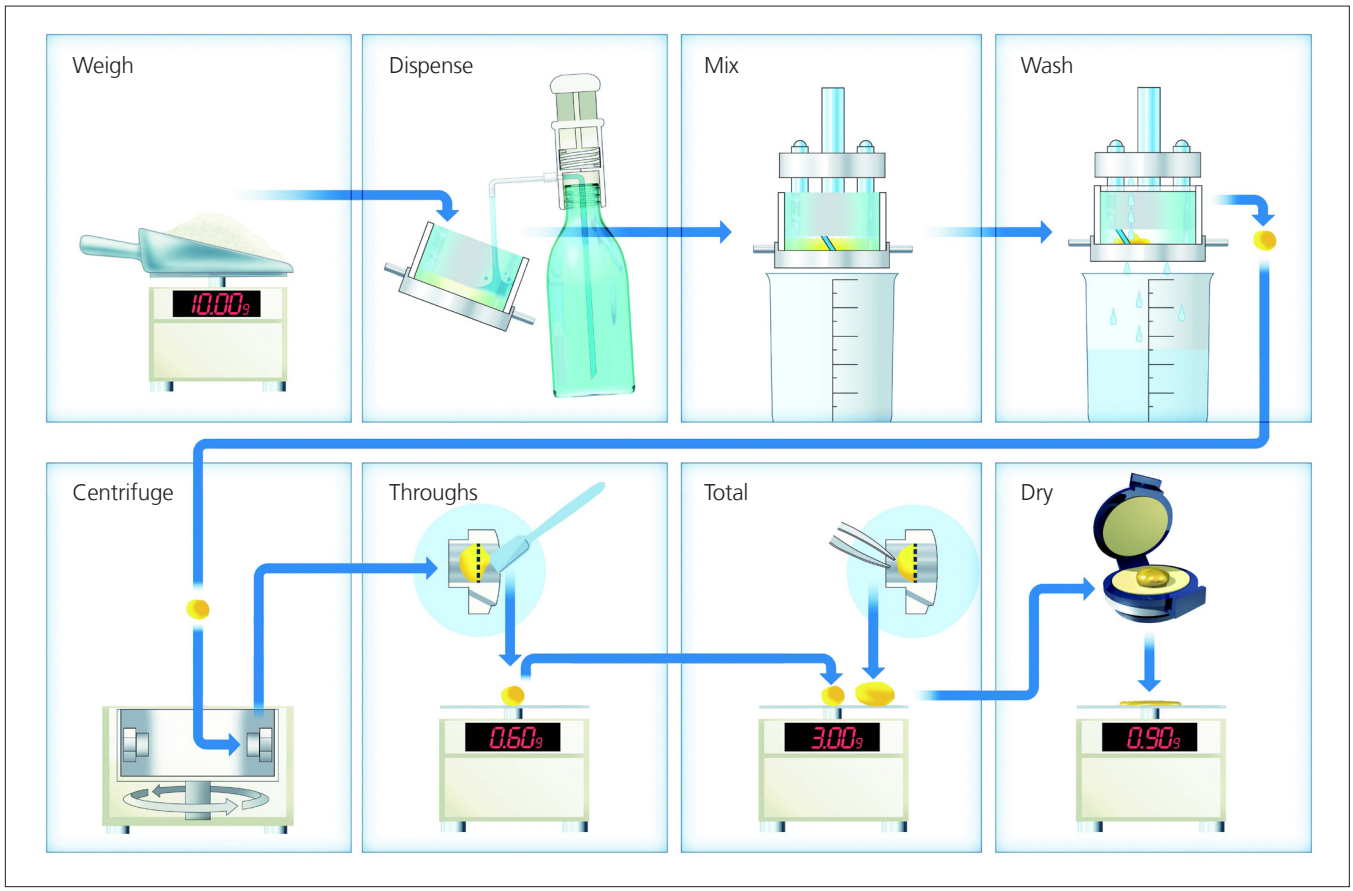

Figure 2. Procedure for determining gluten properties using the Perten Glutomatic system.

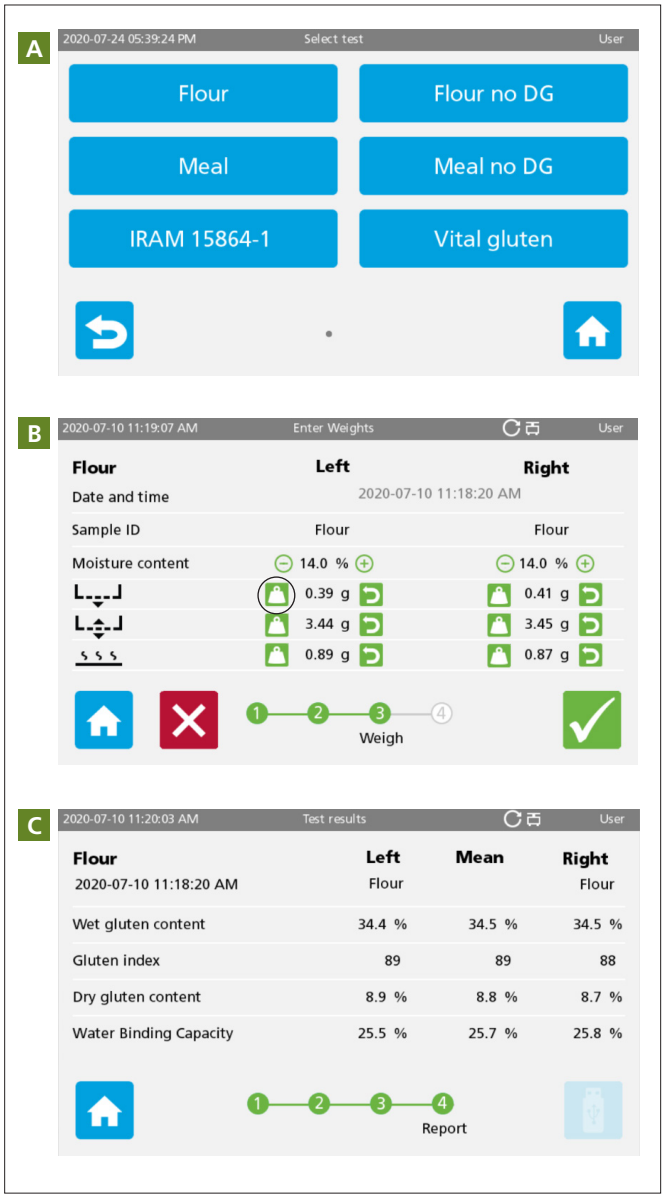

Figure 3. User interface of the GM 2000. Method/profile selection (A), sample weight entry (B) and automatic results calculation (C).

Experimental

Samples and Analyses

Seven wheat samples (four flours and three wholemeals) with wide ranging gluten properties were obtained from a commercial source. The samples were tested (in duplicates as a minimum) on one original (GM 2200) and two new (GM 2000) Perten Glutomatic systems, using AACC Method 38-12.02[1] (Figure 2) to obtain WGC, GI, DGC and WBC.

Statistics

Equivalence was determined by General Linear Model (GLM) of data from each instrument, setting GM, Sample and GM*Sample as factors, with a p value of < 0.05 for any factor showing significance. Precision was determined by GLM of data from GM 2200 and GM 2000 (pooled), setting Sample as factor. Repeatability and Reproducibility were calculated from the root mean square (RMS) values of the Error and GM model term, respectively. Reproducibility data for the GM 2200 was obtained from ICC Std No. 155.

Results and Discussion

Equivalence

Results from the new Glutomatic system were equivalent to those from the original system, with $R^2 \geq 0.93$ for all measured parameters (Figure 4). There were no significant differences ($p > 0.05$) in results (WGC, GI, DGC, WBC) between the original and new systems. However, GM*Sample interactions were significant for WGC and DGC, probably due to the small values for these parameters and the high level of precision within each instrument.

Precision

The new Glutomatic 2000 system exhibited superior precision, with similar or better within-instrument repeatability and between-instrument reproducibility than the original system (Table 1). The results indicate good measurement precision across multiple systems.

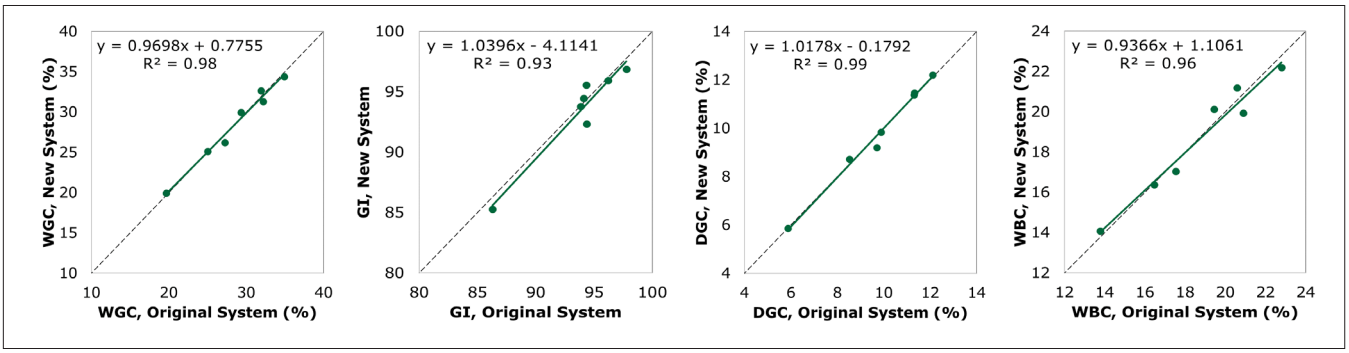

Figure 4. Comparison of results from the original and new Perten Glutomatic systems. Dashed line shows 1:1 fit.

Table 1. Precision data for the original (GM 2200) and new (GM 2000) Perten Glutomatic systems.

	WGC	GI	DGC	WBC
GM 2000 (NEW)				
Mean	28.8	94	9.9	18.9
Repeatability stdev (S_r)	0.7	1.3	0.3	0.7
Reproducibility stdev (S_R)	0.7	1.3	0.4	0.7
GM 2200 (ORIGINAL)				
Mean	28.8	94	9.9	18.9
Repeatability stdev (S_r)	0.7	2.5	0.5	0.7
Reproducibility stdev (S_R)[a]	0.6	5.5	-	-

[a]Average reproducibility results obtained from ICC Std No. 155[5].

Ease of Use

The better results of the new system are most likely attributable to fewer occurrences of flooding, aided by the automatic saline delivery and ease of access to the wash chamber allowing for improved cleaning between tests.

Conclusions

The new Perten Glutomatic system exhibits improved precision overall, while also providing equivalent results to the original system. The modern features simplify workflow and enhance test throughput, while providing the performance, connectivity, reliability and safety that modern laboratories require.

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