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Moisture Changes and Carry-Over of Wheat Milled Using the Newport Scientific CleanMill Compared to Other Mills

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ALSO IN THIS ISSUE

INTRODUCTION

- ∝-amylase activity of grains can be rapidly determined using the Hagberg Falling Number (FN) and Rapid Visco Analyser (RVA) Stirring Number (SN) methods, which require samples to be ground prior to analysis, ideally with little change to the sample moisture and no cross-contamination between samples.
- High speed impact mills cause sample drying, such that moisture must be re-determined after milling for accurate FN and SN testing. Newport Scientific has developed a CleanMill, which reduces moisture loss and cross-contamination.
- Sample carry-over in the Newport Scientific CleanMill 8000, Cereal Mill 6000, and Super Mill 1500, and their effect on sample moisture and SN values was examined.

METHOD

- Sound, whole, vitreous wheat grains of ~10% moisture ('low moisture wheat') was preconditioned to ~12% ('medium moisture wheat') and ~13.5% ('high moisture wheat'), and sprouted ('sprouted wheat').
- Samples were ground on the CleanMill 8000, Cereal Mill 6000, and Super Mill 1500. On the CleanMill 8000 and Cereal Mill 6000, sample is fed through a hopper attached to a Power Feeder. The Power Feeder rotates at 30 rpm to ensure an even feed rate into the milling chamber. The grains are ground by an impellor, rotating at 16000 rpm. The ground sample passes through a 1.0-mm screen to the cyclone and sample collection container. In addition, the CleanMill 8000 separates the ground material into a 'sampling' stream (~15 g per 300 g of grain) and a bulk 'waste' stream. Ground material in the sampling stream can be used for further tests (eg.

Left to right: Cereal Mill 6000; Super Mill 1500; CleanMill 8000.

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moisture, RVA and NIR analyses). On the Super Mill, sample is added to a hopper, and is ground between two metal discs 0.2 mm apart and rotating at 1500 rpm.

- Effect of milling on sample moisture content was determined by comparing moistures of all ground samples to the corresponding whole grains.
- Effect of carry-over on SN results was determined by successively grinding sprouted and sound wheat in duplicate, without cleaning the mill between grinding, followed by SN analyses on the RVA-StarchMaster.
- All statistical analyses were performed using Minitab Ver. 13.

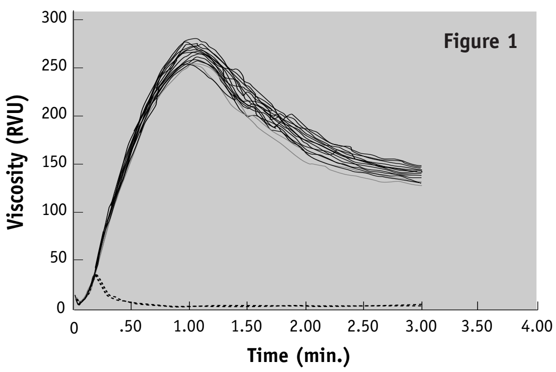
RESULTS

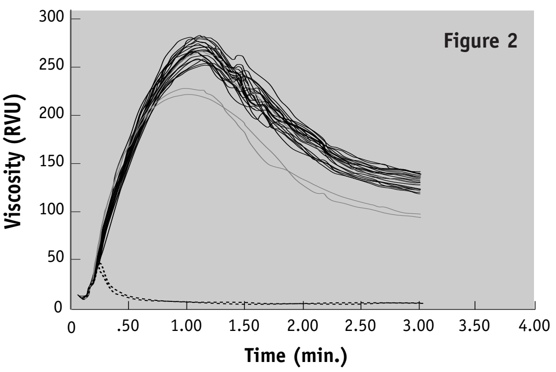
Effect of milling on moisture content

- The high speed impact CleanMill was better at retaining the original moisture content of the sample compared to the Cereal Mill. (Table 1)

Table 1
ΔMC = difference in moisture from whole grain of the corresponding wheat. All values are percentage (%) moistures.

MILL	LOW MOISTURE		MEDIUM MOISTURE		HIGH MOISTURE	
	MC	ΔMC	MC	ΔMC	MC	ΔMC
Whole grain	10.12	0.00	11.99	0.00	13.66	0.00
CleanMill	10.08	–0.04	11.61	–0.38	13.41	–0.25
Cereal Mill	9.47	–0.65	10.75	–1.24	12.50	–1.16





Effect of carry-over on SN

Milling sound wheat on the CleanMill 8000 after milling sprouted samples did not significantly reduce the SN values (ANOVA, $F=2.38$, $p>0.05$) (Figure 1).

This indicates that the CleanMill can be used without cleaning between samples when milling wheat for RVA SN evaluation.

On the Cereal Mill 6000, the SN of the first contaminated sample was not significantly different from the SN of sound wheat, however, the SN of the second contaminated sample was significantly reduced (ANOVA, $F=183.44$, $p<0.05$) (Figure 2).

This shows that continued residual build-up in the Cereal Mill can result in sample cross-contamination.

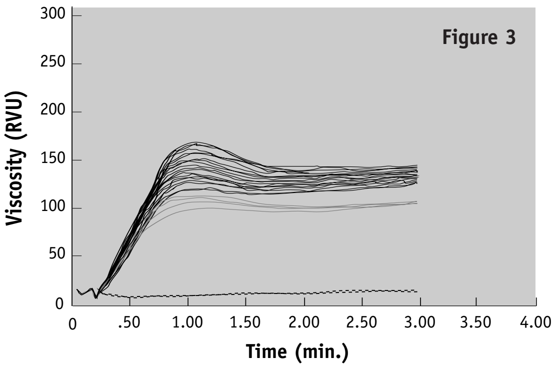
The larger particle size of samples from the Super Mill 1500 produced SN curves with different shapes to those from the CleanMill and Cereal Mill (Figure 3) as a result of reduced water absorption and swelling. Nevertheless, the effect of sample carry-over was evident, with the SN of contaminated samples significantly lower than those of the sound samples (ANOVA, $F=119.43$, $p<0.05$).

CONCLUSIONS

The CleanMill can be used as a silo mill for preparation of samples for RVA SN analyses, with minimal effects on sample moisture, allowing whole grain estimation of moisture content to be used.

Grinding sprouted wheat and sound wheat alternately, minimal carry-over was observed. Therefore the CleanMill does not require cleaning between grinds.

Elimination of the cleaning step and second determination of moisture content after grinding would greatly reduce sample preparation time for SN analyses, and therefore increase sample throughput.



Figures 1, 2 and 3

RVA SN curves for sound wheat milled before (———) and after (———) sprouted wheat (..........) on the CleanMill (1), Cereal Mill (2), and Super Mill (3).

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Pasting Profiles of Indian Flours

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INTRODUCTION

Unbranded wheat has dominated the market in India, however, the branded flour (atta) sector is currently growing at over 10% per year. Atta is whole-wheat flour of 90–95% extraction rate. It is commonly used to make unleavened bread such as chapati, puri and paratha.

MATERIALS AND METHODS

Four popular brands of atta (1. Aashirvaad Whole Wheat Atta, 2. Shakti Bhog Atta, 3. Rajdhani Premium Atta, and 4. Pillsbury Chakki Fresh Atta) were purchased in New Delhi, India. The pasting behaviour of the flours was tested on the Rapid Visco Analyser (RVA) and compared to Australian hard and soft flours.

The Indian samples had starch damage ranging from 10–12%. Extraction rate is expected to be 90–95%. The Australian hard flours had starch damage of approximately 8% (hard) and approximately 4% (soft). Extraction rate is expected to be around 76%. Each sample (3.50 ± 0.01 g, corrected for moisture content) was added to 25.0 ± 0.1 g of distilled water, and tested using a standard profile (Table 1) and the Stirring Number (SN) profile (Table 2).

Table 1
RVA test profile.

TIME	TYPE	VALUE
00:00:00	Temperature	50°C
00:00:00	Speed	960 rpm
00:00:10	Speed	160 rpm
00:01:00	Temperature	50°C
00:04:42	Temperature	95°C
00:07:12	Temperature	95°C
00:11:00	Temperature	50°C
00:13:00	End of test	–

Idle temperature: 50 ± 1°C
Time between readings: 4 s

Table 2
RVA Stirring Number profile.

TIME	TYPE	VALUE
00:00:00	Temperature	95°C
00:00:00	Speed	960 rpm
00:00:10	Speed	160 rpm
00:03:00	End of test	–

Idle temperature: 95 ± 1°C
Time between readings: 4 s

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RESULTS AND DISCUSSION

The Indian flours produced RVA pasting curves with lower overall viscosities compared to those of commercially available Australian hard (pan bread production) and soft (cake and muffin production) flours. This is expected as the RVA pasting curve is affected by both the wheat cultivar and extraction rate of the flour (Bason and Blakeney, 2007).

SNs (based on 3.5 g sample) of the Indian flours ranged from approximately 95 to 100 RVU, indicating soundness of the samples (that is, no weather damage). The SNs of the Indian flours were lower than the Australian hard and soft flours, due to the higher extraction rate.

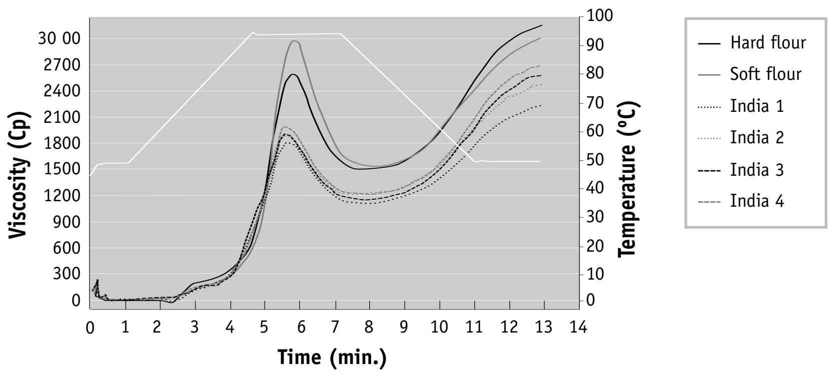

Figure 1
RVA pasting curves of wheat flour samples.

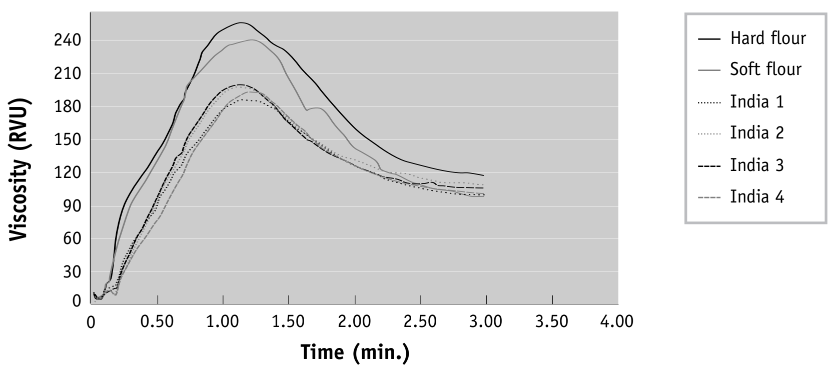

Figure 2
RVA Stirring Number curves of wheat flour samples.

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