INTERCOMPARISON OF FARINOGRAPH ABSORPTION OBTAINED WITH DIFFERENT INSTRUMENTS AND BOWLS[1]

I. HLYNKA

ABSTRACT

A method for precise intercomparison of different farinographs is described. The technique is illustrated by data on combinations of two farinograph instruments and three mixing bowls. Linear regression equations for the mobility-absorption relation were established, using the same flour. From these data precise values for absorption were evaluated corresponding to the 500 B.u. consistency. Conversely, values of consistency corresponding to a selected value of absorption were also evaluated.

One of the major uses of the farinograph in cereal laboratories is for the determination of flour absorption (1). Operationally defined, flour absorption is the amount of water required to obtain a farinograph curve that is centered about the 500 unit line at maximum consistency. With a given instrument this determination can be performed with adequate precision. However, the divergence of data obtained with different instruments or bowls points to the need for standardization of farinographs[2] and for methods of precise comparison of different instruments and bowls.

At the present time it may be considered that two methods are available for the standardization and intercomparison of farinographs. In the first, replicate data can be obtained with the same flour for each bowl or instrument, and a correction factor can be established. In the second, mechanical adjustments may be made by the manufacturers (and other knowledgeable persons) to reduce the differences between bowls. An alternate method to the first is suggested by the work recently published by the author (2). This method makes use of the linear relationship that has been established between absorption and dough mobility. Linear regression equations can be established for each instrument and bowl, and precise correction factors can then be evaluated from these equations. To illustrate the method, this paper presents data obtained with two different instruments and three different bowls.

Materials and Methods

Two different farinographs were used. Farinograph I was a new,

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[2] The AACC has a Farinograph Standardization Committee.

variable-speed machine set to operate at 62.9 r.p.m. to match another new constant-speed machine available in this laboratory. Farinograph II was an old, prewar machine manufactured in Germany. Its speed was 59.3 r.p.m.

Three farinograph mixing bowls used with each of the two machines were: a small stainless-steel-clad bowl, A; a small solid stainless bowl, B; and a large nickel-plated bronze bowl, C.

The flour used in this study was an unbleached, improver-free, straight grade sample commercially milled from a blend of Canadian hard red spring wheat. The protein content was 12.2% and ash 0.47% on a 14% moisture basis.

The constant flour weight procedure (1) was used to obtain farinograph curves at varying absorption to give a range of dough consistencies from approximately 400 to 600 Brabender units. The same flour was used for all tests.

The values of dough consistency were taken as the ordinate about which the curve on the farinograph chart was centered at maximum consistency and were read to the nearest 5 Brabender units. The data were plotted as dough mobility (2), obtained as reciprocal of consistency, against percent absorption on a 14% moisture basis.

Results

The aim of the experiments was to obtain comparable absorption-mobility data with the same flour for two different farinographs and three different mixing bowls. The data were then used to obtain precise data for intercomparison of different instrument and mixing bowl combinations.

The data for farinograph I are summarized graphically in the upper half of Fig. 1. The two small bowls, A and B, gave results that were fairly close together, while the large bowl, C, gave quite different results.

Analogous data for the same three bowls but with farinograph II, which had a slower speed, are shown in the lower half of Fig. 1. All the curves are displaced downward in comparison with the corresponding curves obtained with farinograph I, and the difference between the large bowl and the two small bowls is increased.

Table I summarizes the regression equations for each instrument and bowl combination. The precision of the data is given by the standard deviation from the regression line or the standard error of estimate shown in the last column. The precision of the data for the small bowl is very high. It may be recalled, for example, that 0.06% difference in absorption (top entry) represents only 0.03 ml. in terms

TABLE I

SUMMARY OF ABSORPTION-MOBILITY DATA FOR DIFFERENT FARINOGRAPHS AND BOWLS

INSTRUMENT AND BOWL		REGRESSION EQUATION (Absorption = m Mobility + b)	STANDARD ERROR OF ESTIMATE (As % Absorption)
Farinograph I			
Small stainless-steel-clad bowl	(A)	y = 8,334 x + 43.69	0.06
Small solid stainless-steel bowl	(B)	y = 8,353 x + 43.23	0.07
Large nickel-plated bronze bowl	(C)	y = 8,425 x + 44.99	0.14
Farinograph II			
Small stainless-steel-clad bowl	(A)	y = 7,399 x + 43.58	0.09
Small solid stainless-steel bowl	(B)	y = 7,185 x + 43.50	0.11
Large nickel-plated bronze bowl	(C)	y = 8,025 x + 45.11	0.13

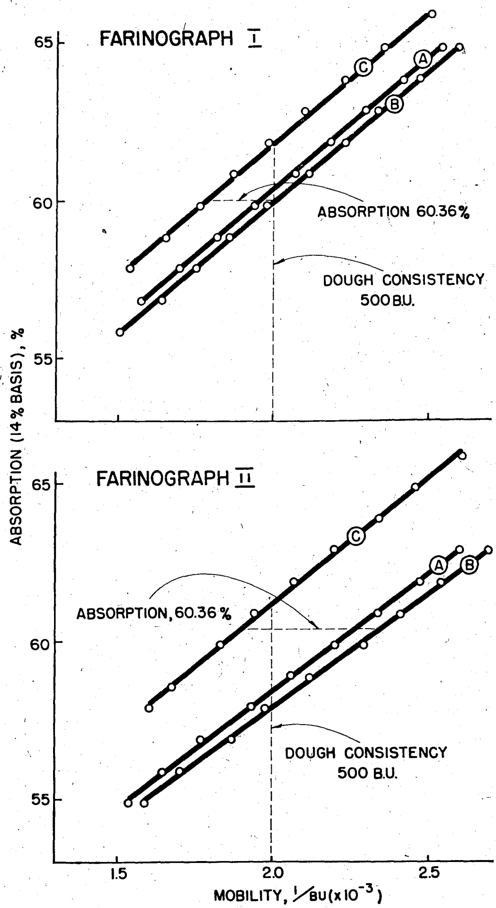

Fig. 1. Graphs of absorption-mobility relations obtained with the same flour for two different farinographs and three bowls.

of water added to 50 g. flour. On the other hand an error of 0.14% absorption for the large bowl (third entry) represents 0.42 ml. in terms of water added to 300 g. flour.

A comparison of any instrument-bowl combination may be made in two ways. The absorptions may be evaluated corresponding to a consistency of 500 B.u., shown in Fig. 1 by the vertical dashed line. Alternately, a fixed absorption (shown by the horizontal dashed line) may be selected, and the corresponding consistencies may be evaluated from the appropriate regression equations. These comparisons are summarized in Table II. The data are self-explanatory.

TABLE II

SUMMARY OF ABSORPTION AND CONSISTENCY DATA FOR INTERCOMPARISON OF FARINOGRAPHS AND BOWLS

Instrument and Bowl		Absorption (14% Basis) Calculated at 500 B.u.	Consistency Calculated at 60.36% Absorption
		%	B.u.
Farinograph I			
Small stainless-steel-clad bowl	(A)	60.36	500
Small solid stainless-steel bowl	(B)	59.94	488
Large nickel-plated bronze bowl	(C)	61.84	548
Farinograph II			
Small stainless-steel-clad bowl	(A)	58.38	441
Small solid stainless-steel bowl	(B)	57.87	426
Large nickel-plated bronze bowl	(C)	61.16	526

The method just described should make it possible to obtain data for a precise intercomparison of different farinographs or bowls in the same laboratory, or in different laboratories, provided that the same flour is used. Moreover, this method should assist in the eventual standardization of farinographs to a more uniform basis.

Literature Cited

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2. HLYNKA, I. Dough mobility and absorption. Cereal Chem. **36:** 378–385 (1959).