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CHEMICAL AND MIXOGRAPHIC PROPERTIES OF DIFFERENT WHEAT FLOUR MILL STREAMS

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Different flour mill streams viz. break-1, break-2, break-3, break-4, sizing, reduction-1, reduction-2 and straight grade flour obtained from two flour mills were analyzed for chemical and mixographic properties. Significant variation in chemical composition and rheological properties among different flour mill streams was found. The flour of break-4 stream exhibited the highest, whereas reduction-2 stream gave the lowest percentage of fat, ash and crude fibre contents. These contents increased from 1stto 4th break flours, whereas decreasing trend for these chemical characteristics was observed in reduction flour streams. The wet and dry gluten contents were also the lowest in flour of break-4 stream. The lowest and highest protein contents were observed in sizing and break-4 streams, respectively. The chemical components i.e. moisture, ash, protein, fat, fibre and alkaline water retention capacity were found relatively higher in break flour stream than reduction flour stream. The flour obtained from break-4 stream showed higher mixing time as compared to other flour mill streams. Peak height percentage increased from break-1 to break-4 flour .Identical trend in chemical and mixographic properties was noticed for different flour mill streams among samples of both flour mills.

Key words: flour mill streams, mixographic properties

INTRODUCTION

Cereals are the principal source of protein and calories for the inhabitants of Pakistan. Among cereals, wheat *(Triticum aestivum)* contributes more than 70% of the total carbohydrates and protein requirements in the average daily diet. In Pakistan, wheat milling is one of the biggest industries. The milling system is very complex. The processing conditions before and during milling influence the quality of flour. Kent-Jones and Amos (1967) demonstrated that a large number of wheat flour streams of varying degrees of purity and quality are available in normal roller milling system. These various flour streams can therefore, be mixed as desired and such a product is known as "Straight grade flour". Kryuk and Nareiko (1973) and Black *et al.* (1981) reported that differences in chemical and rheological properties among various flour mill streams may exist. Endo *et al.* (1987) found that the chemical and rheological dough properties might be affected by distribution of wheat flour components during milling. Pyler (1988) reported that different streams are derived from different portions of endosperm with varying degree in refinement which differs in protein and ash content. The variation in chemical and rheological properties among different flour mill streams exists which ultimately affects the baking properties of the finished products (Ahmad, 1996). Butt *et al.* (1997) studied milling and baking properties of spring wheats and described different traits useful in the milling process such as kernel texture and the extraction of straight grade flour yield which vary significantly among wheat cultivars. Therefore, the present study was carried out in order to assess the chemical composition and mixographic properties of different flour mill streams.

METHODOLOGY

The flour of different flour mill streams was collected from two roller flour mills viz. Usman Flour Mills and Ittefaq Flour Mills located in the vicinity of Faisalabad city. Seven different flour mill streams were collected from break-1, break-2, break-3, break-4, sizing, reduction-1 and reduction-2 stream of milling. Straight grade flour, a blend of all flour mill streams, was also collected and used as control. The samples were analyzed for moisture content, ash, fat, crude fibre, crude protein, wet and dry gluten content and alkaline water retention capacity according to their respective methods described in AACC (1983). The physical properties of dough were determined by running the flour samples through mixograph according to AACC (1983).

RESULTS AND DISCUSSION

The straight grade flour and different flour mill streams were analyzed for chemical composition and the results are given in Tables 1 and 2 for Usman and

Table 1. Chemical properties of different flour streams collected from Usman flour mills

	Chemical characteristics (%)							
	Moisture	Ash	Crude fat	Crude fibre	Crude protein	Wet gluten	Dry gluten	AWRC
St. grade flour	11.05b	0.65d	1.27c	0.12c	12.05c	42.38d	12.12d	59.84c
Break-I	11.06a	0.61 c	1.13c	0.09dc	11.48d	45.59c	13.70c	56.19h
Break-2	11.54a	0.68c	1.29c	0.11 cd	12.03c	46.60b	14.75b	57.08g
Break-3	10.38c	0.99c	1.70b	0.19b	12.95b	47.67a	15.68a	58.79c
Break-4	10.36c	1.70a	1.94a	0.30a	13.12a	32.22h	10.63h	66.50a
Sizing	10.25c	0.60c	1.21 d	0.06et	10.40g	37.24g	11.65'9	57.73f
Reduction-I	11.25b	0.53f	1.01 f	0.05b	10.93f	39.35f	12.36f	59.26d
Reduction-2	11.02b	0.44g	0.94g	0.04f	11.30c	40.40c	13.00c	61.12b

AWRC = Alkaline water retention capacity; means carrying the same letters in a column arc not significantly different from each other.

Table 2. Chemical properties of different flour streams collected fromIttefaq flour mills

	Chemical characteristics (%)							
Mill stream	Moisture	Ash	Crude fat	Crude fibre	Crude protein	Wet gluten	Dry gluten	AWRC
St. grade flour	11.75d	0.58c	1.35c	0.11 c	11.15c	31.02c	12.05a	61.08c
Break-I	12.05b	0.50d	1.04c	0.06d	10.80c	30.75d	11.00d	56.75h
Break-2	11.90c	0.57c	1.34c	0.11 c	11.16c	33.00b	11.60c	'57.29g
Break-3	11.30c	1.14b	1.60b	0.16b	12.27b	35.37a	'2~27b	59.22c
Break-4	10.75f	1.57a	2.60a	0.25a	12.95a	25.51 h	8.08h	67.22a
Sizing	10.22g	0.48d	1.19d	0.08cd	10.04g	27.66g	9.32g	57.52f
Heduction-I	11.69d	0.47d	0.99c	0.06d	10.60f	29.10f	9.71f	60.03d
Reduction-2	12.25a	0.40c	0.73f	0.06d	11.06d	30.14c	10.25c	62.00b

AWRC = Alkaline water retention capacity; means carrying the same letters in a column are not significantly different from each other.

Table 3. Mixographic properties of different flour mill streams collected from Usman and Ittefaq flour mills

Mill stream	Usman flour mills		Ittefaq flour mills	
	Mixing time (min.)	Peak height (%)	Mixing timetrninl	Peak height (%)
St. grade flour	2.25	75	2.0	65
Break-I	2.5	75	3.5	60
Break-2	2.0	80	3.0	60
Break-3	1.5	85	2.5	65
Break-4	1.5	90	1.5	75
Sizing	2.0	75	2.0	65
Reduction-I	2.0	78	2.0	70
Reduction-2	2.0	80	2.5	75

Ittefaq flour mills respectively. The ash, fat and fibre contents were found to be significantly higher in flour samples collected from break-4 followed by break-2 and break-3 (Tables 1 & 2) of both flour mills. These contents were lower in reduction-2 flour stream. It was also found that the chemical components were lower in reduction flours as compared to break flours. The difference in above contents between break flour and reduction flour streams may be due to the fact that the objective of break roll system is to separate the bran and germ from endosperm. Thus, the material which goes to reduction roll system contains more endosperm and less quantity of bran, being already removed during break roll systems (Davis, 1997).

The crude protein contents were observed to be the highest in flour samples collected from break-4 followed by break-3, while the lowest amount of protein content was observed in flour samples collected from sizing irrespective of the differences in flour mills of Usman or Ittefaq (Table 3). The straight grade flour with the exception of flours obtained from break-2, break-3 and break-4 mill streams, exhibited significantly higher protein content as compared to the flour obtained from other mill streams. Since the bran is relatively rich in protein, therefore, the brany portion in break-3 and break-4 mill streams may be the cause for higher protein content in these streams (Tables 1 & 2). Moreover, the protein content rises from center to periphery of endosperm in grain and the later break flours contain peripheral rather than central portion of endosperm (Pyler, 1988). Jones and Zeigler (1969) delineated that protein content progressively rises from first to last break stream. The results in Tables 1 and 2 further showed that wet and dry gluten contents were significantly lower in flour samples collected from break-4. The results for gluten content in flour mill streams showed similar trend in flour from both flour mills. The straight grade flour of both flour mills contained higher gluten as compared to the flour obtained from mill streams of break-4, sizing, reduction-1 and reduction-2. The lowest gluten content in break-4 sample is ascribed to the presence of more bran which is removed during the determination of gluten.

The results regarding alkaline water retention capacity (AWRC) showed that break-1 had minimum while break-4 showed the maximum value for AWRC for samples of both flour mills. With the exception of break-4 and reduction-2 flours, the water retention capacity of straight grade flour was higher compared to other flour mill streams. However, the results pertaining to AWRC in all flour mill streams are within desirable limits of 54% according to the findings of Horubalova *et al.* (1974). The mixographic characteristics given in Tables 1 and 2 showed that the flour of break-4 stream collected from both flour mills gave the lowest mixing time. The mixing time in case of the flour mill streams collected from Ittefaq Mills (Table 1) was relatively higher as compared to the respective flour streams of Usman Mills (Table 2). The flour obtained from break-1 showed higher mixing time as compared to those of other flour mill streams. It was observed that peak height percentage increased from lst to 4th break flour in both flour mills. The lowest mixing time in break-4 mill stream may be attributed to the presence of low gluten content. It may also be ascribed to the presence of more bran in this fraction which interfered during mixing and thus increased the peak height.

The results regarding mixographic properties are consistent with the results of Preston *et al.* (1982) who found wide variation in mixographic properties due to differences in individual mill streams. It may be concluded from the present study that wide variation exists in chemical and mixographic properties among different flour mill streams which may reflect the end use quality. It is therefore suggested that individual flour mill streams may be tested in order to assess their suitability for different bakery products.

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