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# MILLING WHEAT FUNCTION OF QUALITIES

**Iuliana Banu**
"Dunarea de Jos" Galati University, 111, Domneasca St., 800201, Galati, Romania

## Abstract

*Flour fractions resulted at every technological passage is different qualitatively and quantitatively. The quality of these fractions is influenced by the quality of cereals, the way they have been prepared for being ground, the way the devices are maintained at parameters of normal functioning and by the way the process of milling is led. The purpose of this article has been to realize some (basic) mixtures of flour fractions that are combined in different proportions in order to make up varieties of flour with different technological properties, with special destination imposed previously.*

***Keywords**: wheat, milling according to quality, varieties of flour, optimal quality*

## Introduction

Irrespective of the technological phase that they make part of, several flour fractions are separated at each sieving passage. The quality of these fractions is influenced by the quality of cereals, the way they have been prepared for being ground, the way the devices are maintained at parameters of normal functioning and by the way the process of milling is led. The flour fractions are mixed, and generally, because of the quality and economical constraints, we obtain standardized varieties of superior and inferior flour. In most of the cases, the combinations are realized through subjective decisions based on the experience and knowledge of the mill technician.

As a rule, a variety of flour is permanently made up of the same flour, collected at the sieving passages. They are changed only in cases of damage when one or more sieves are broken. In this case, another fraction of flour is generally introduced provided that it is qualitatively similar to the one taken out of the process of making the variety. If none of the fractions can replace the one that is taken out, it is left apart even if the basic variety is to be obtained in a reduced percentage, until the damage is repaired. Deviations from the optimal patterns of composing types of flour are equally accepted in the case of some problems related to the quality of the raw material.

In the specialized literature (Villanueva et.al. 2001), milling function of qualities is defined in different ways:

- Posner and Hibbs (1997) – "the separation of numerous flour fractions in a milling system with several types of flour, based on the contents of proteins, the colour of the flour and the mineral contents"
- Panter (1988) – " system of grouping of the flour fractions based on the protein contents and the ash contents, the later mixture of the obtained groups in order to obtain new types of commercial varieties of flour"
- Bas (1988) – "the combination of the flour fractions in order to obtain an even variety or the combinations if the different fractions in order to obtain three or four types of flour with different technological properties. Any combination is possible, the limitation being given by the number of storing bunkers of finite products and by the total capacity of storing. "

## Experimental

The determination shave was made on a wheat mill with a capacity of milling of 200t/24h, which has performant technological equipment. In figure 1 it is shown the principal scheme of the milling process.

Analyses performed

- for the wheat from B1: the humidity, the hectoliter mass, glassiness, the ash contents, protein contents, the contents of wet gluten, the index showing the deformation of the gluten, the power of the flour by widening the sphere of dough
- for the flour fractions: the humidity, the ash contents, , the contents of wet gluten, the index showing the deformation of the gluten (STAS 90/88), the protein contents (Strong and Duarte, 1992), the power of the flour by widening the sphere of dough (Bordei, 2000), the granularity (Moraru, 1988, Gordon and

Whilm, 1994), the Falling Number (SRI SO 3093/1997), the maltose index and the proteolytical activity (Bordei, 2000).

In keeping with the information obtained and the data in the specialized literature concerning the optimal quality of the flour destined to make bread, the pastry products, the biscuits, we have realized mixtures (basic) of flour fractions.

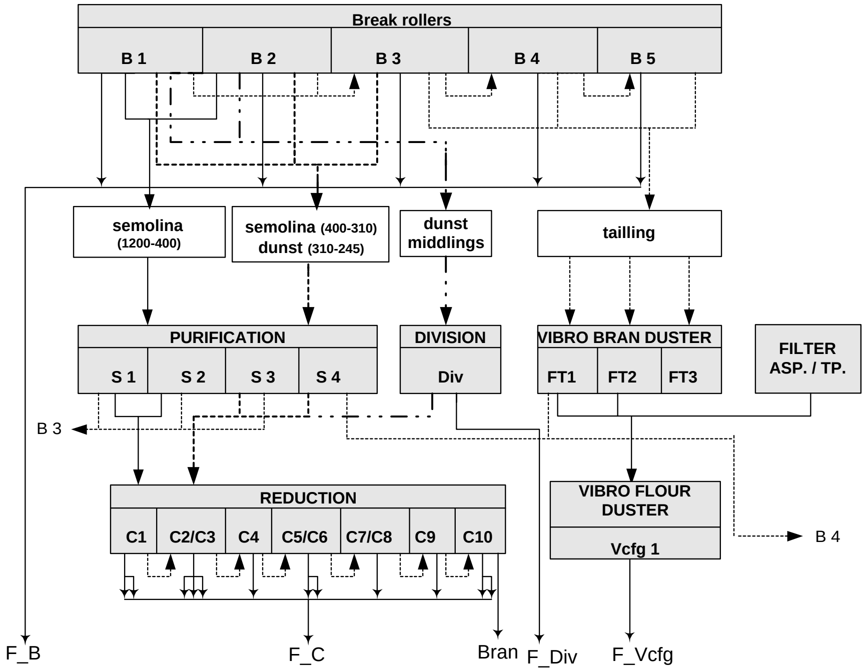


**Fig. 1**. The principal scheme of the milling process

## Results and Discussions

The physical indices determined for the wheat have been the humidity 15.8%, the hectoliter mass 77.7 kg/hl, the glassiness 40%, and the wet gluten 22.5%. The total extraction of flour is of 77.2%, out of which: flour from B – 19%, flour from Div – 2.4%, flour from C – 52%, flour from Vcfg – 3.8%

The determinations made for the flour fractions have pointed out:

- **the humidity**
  - falls gradually from B 1 at the last technological passage due to the evaporations that take place: the highest humidity has been

obtained for the flour fractions selected at the break rollers passages, followed by those ones separated at C.

- the fraction separated at the Div passage has the humidity comparable, in point of value, with the flour from B1, B2, B3, this passage processing fine dust middling resulted from B1 and B2.

**- the ash contents**

- the smallest ash contents have been obtained at fractions separated at C1 and C2/C3, these passages processing medium and big semolina separated at B1 and B2, semolina which come from the central area of the endosperm (figure 2).
- low contents of flour are equally obtained at B1 and B2, while at the other break rollers passages we separate flour fractions with ash contents growing bigger and bigger, parts of the exterior area of the endosperm participating in their formation,
- the highest ash contents have been obtained at the flour fractions separated at the break rollers and reduction passages: B4 and B5, C7/C8, C9 and C10, and from Vcfg (this equally processes rejections from the first two vibro bran duster).

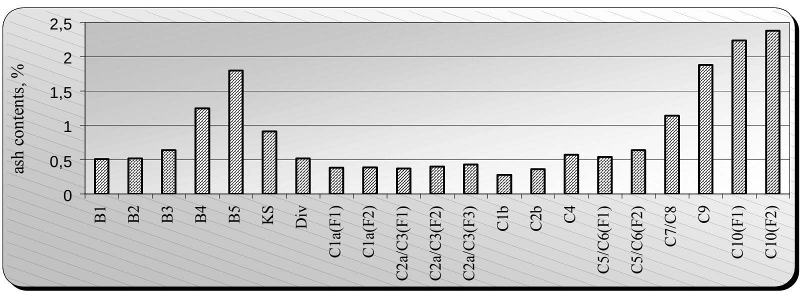


**Fig. 2**. The ash contents of the flour fractions

**- the contents of wet gluten and proteins**

- the total contents of proteins is higher at the flour fractions from B1 compared to those from C (figure 3)
- at the level of the flour fractions from B, the total contents of proteins grows gradually, which means that these substances grow progressively in the grain from the center of the endosperm to the layers, from the same reasons, high contents of proteins have been equally obtained in the flour fractions from the last M and Vcfg passages, fractions with a high contribution of layers.

- the highest wet gluten contents have been obtained at the B, Div and then M passages:
  - at B passages, the contents grows from B1 to B5
  - at the C passages, the contents grows from C1 to C4, from C5 to C10, it falls due to the fact that these fractions contain high contents of layers which have a low contents of proteins soluble in water.

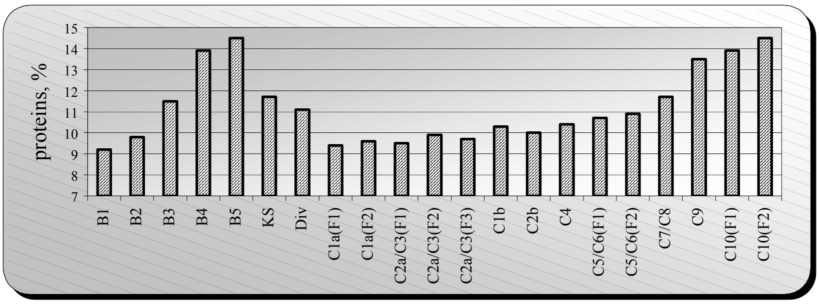


**Fig. 3.** The total contents proteins of the flour fractions

**- the proteolitical activity**

- the flour fractions from the B passages have a good proteolytical activity, in their case the gluten swollened in the diluted acetic acid to a great extent, and the acid solution has not been troubled. It can be said that the degree in which the gluten can be attacked by enzymes (realized by endopeptidase going along with formation of polypeptide, making the rheological characteristics of the dough worse) is within normal limits (figure 4).
- the highest proteolytical activities have been obtained for the fractions from the reduction passages – C1a (F2), C1b, C2a/C3(F3), C5/C6 (F1, F2), the acid solution after a period of maintaining the dispersed gluten at 30ºC has been strongly troubled; the fractions at the last reduction passages have a low proteolytical activity.
- the proteolytical enzymes are unevenly distributed in the grain , the highest quantity is concentrated in the endosperm and the aleuronic layer, the layers contain a very low quantity of proteolytical enzymes

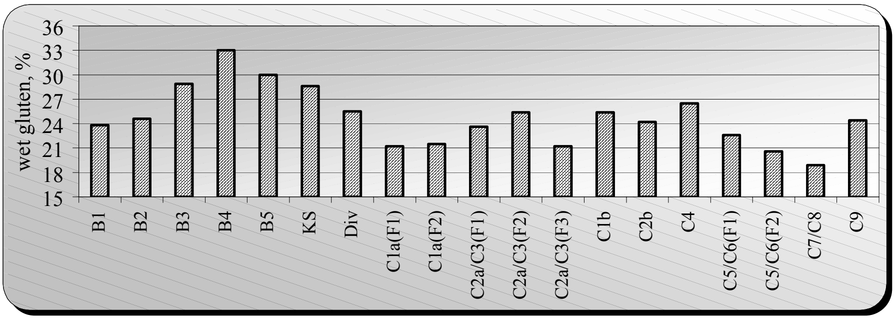


**Fig. 4.** Proteolytical activity of the flour fractions

**- the power of flour**

- the fractions from C1(F1) and C2/C3 have had the best technological behaviour while the fractions from B5, C1(F2), C2, C5/C6(F2), C7/C8, C9 have the weakest behaviour which is explained through an activity of proteolytical enzymes which is higher in the lastly mentioned fractions.

**- the granulosity**

- the flour fractions from B1, B2 and B3, from Div, C1(F1), C2/C3(F1), C4, C5/C6 are obtained as sifted through sieves with the meshwork of 140µm,
- the fractions from the last break rollers - B4 and B5, and from the last reduction passages – C7/C8, C9, C10, are obtained through sieves with smaller the meshworks - 125, 112, 100µm due to the high contents of bran particles that these fractions present,
- the highest fractions are obtained from the passages C2/C3(F2/F3), C1(F2), sifted through sieves with the meshworks of 160, 180, 200µm.

  In figure 5 is presented granulosity of the flour fractions, as sifted through sieves with the meshwork of 125µm.

**- the Falling Number and the maltose index**

- the lowest values of the Falling Number (figure 6) have been obtained at the flour fractions collected from the break rollers passages of the second category, at vibrocentrifugal and at the last break rollers passages; these results correlate the distribution of α-amylases in the wheat grain and with the area of the grain from which the respective fractions come from

- high degrees of the maltose index (figure 7) have been obtained for the flour fractions that have a high percentage of deteriorated starch.

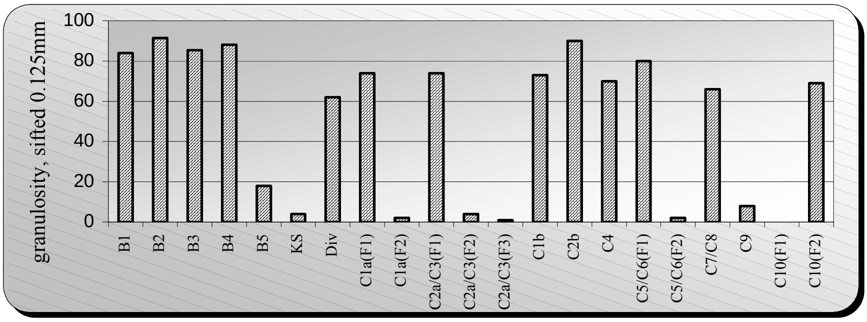


**Fig. 5.** Granulosity of the flour fractions, as sifted through sieves with the meshwork of 125µm

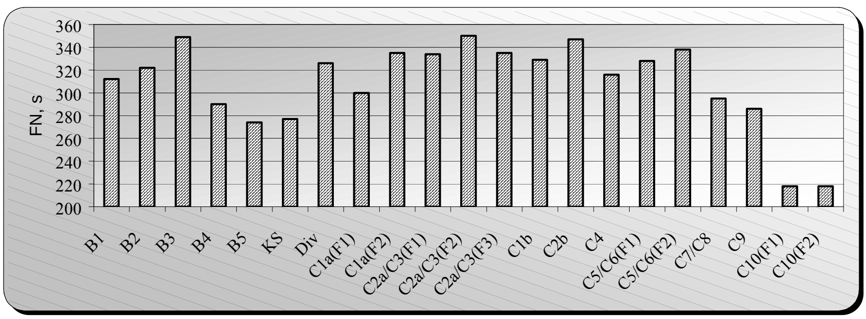


**Fig. 6.** Falling Number of the flour fractions

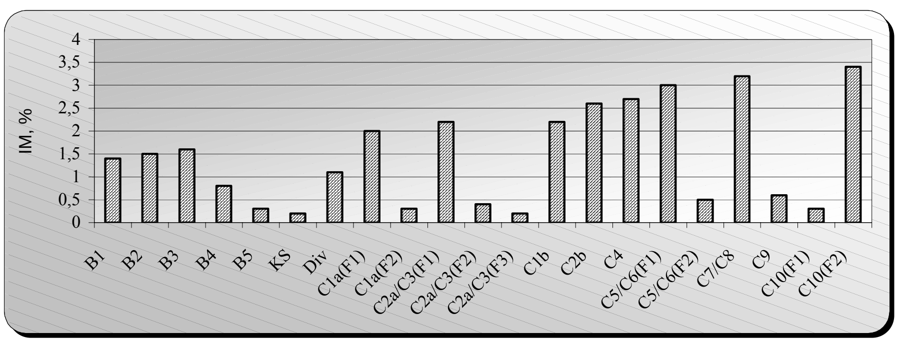


**Fig. 7**. Maltose index of the flour fractions

According to the data in the specialty literature (Bordei et.al. 2001), the optimal quality of the flour destined to making bread, pastry products and biscuits are shown in table 1.

**Table 1**. The optimal quality of the flour destined to making bread, patisserie and biscuits

| Quality indices | Bread | Patisserie | Biscuits |
|---|---|---|---|
| Proteins, % | 10-13 | 9-10 | 7-9 |
| Wet gluten, % | 27-32 | $<20$ | 20-22 |
| Power of flour | strong | poorly | poorly |
| Granulosity, % | medium | medium | short |
| Proteolitical activity, % | 2-35 | - | 80-120 |
| Falling Number, s | 250-270 | 200-300 | $>300$ |
| Maltose index, % | 1.8-2.2 | 1.5-2 | 2-2.5 |

The flour fractions obtained at the technological passages have been mixed function of the protein contents, the contents of wet gluten and the index of deformation of the gluten, the contents of ash and granularity.

We have also taken into account the extraction of each flour fraction:

- flour for bread 65-70%,
- flour for patisserie 5-10%,
- flour for biscuits 20-25%.

The proportion has been imposed to each mixture in the total flour. The mixtures thus obtained (table 2) have constituted the bases for optimal combinations of flour destined to flour, pastry, and biscuits. The quality indices of the mixtures, which are thus created, are shown in table 3.

Theses basic flour mixtures can combine in order to obtain varieties of flour with different technological properties with special destination.

The number of basic mixtures can grow bigger due to the wide range of products: bread and bakery specialties, biscuits – glutenous or sugary ones, crackers, patisserie products, products of scalded dough, chemically spongy products, others than crackers. The limitation of the number of the basic mixtures is made only by the number of storing bunkers of the finite products and the total capacity of available storing.

If the combination of the basic mixtures is not enough for correcting some quality indices, we can ameliorate mixtures through vital gluten adding, proteolytical enzymes (biscuits) etc.

**Table 2**. Mixtures made from the flour fractions obtained at technological passages

| Flour fractions | Mixture for bread, % | Mixture for patisserie, % | Mixture for biscuits, % |
|---|---|---|---|
| B1 | - | - | 5.8 |
| B2 | 5.7 | - | - |
| B3 | 3.8 | - | - |
| B4 | 2.8 | - | - |
| B5 | | - | 0.9 |
| Vcfg | 3.9 | - | - |
| Div | 2.4 | - | - |
| C1a(F1) | - | 5.7 | - |
| C1a(F2) | - | - | 2.9 |
| C2a/C3(F1) | 5.9 | - | - |
| C2a/C3(F2) | 5.9 | - | - |
| C2a/C3(F3) | 1.5 | - | - |
| C1b | - | - | 4.8 |
| C2b | 9.6 | - | - |
| C4 | 3.6 | - | - |
| C5/C6(F1) | 7.2 | - | - |
| C5/C6(F2) | - | - | 0.2 |
| C7/C8 | - | - | 2 |
| C9 | - | - | 1.1 |
| C10(F1) | - | - | 0.8 |
| C10(F2) | - | - | 0.7 |
| Total, % Ex | 52.3 | 5.7 | 19.2 |
| Total, % | 67.7 | 7.4 | 24.9 |

**Table 3**. Quality indices for flour mixtures

| Quality indices | Mixture for bread, % | Mixture for patisserie, % | Mixture for biscuits, % |
|---|---|---|---|
| Proteins, % | 10.6 | 9.4 | 10.5 |
| Wet gluten, % | 25.4 | 21.2 | 23.6 |
| Granulosity, % sifted 125µm | 58 | 74 | 65 |
| Proteolitical activity, % | 25 | 20 | 30 |
| Falling Number, s | 326 | 300 | 247 |
| Maltose index, % | 1.8 | 2 | 2.1 |
| Ash, % | 0.55 | 0.38 | 0.77 |

## Conclusions

In this article has been realise some (basic) mixtures of flour fractions that are combined in different proportions in order to make up varieties of flour with different technological properties, with special destination imposed previously. This is possible only that the technolog knows the quality indices of the flour fractions.

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