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[1.] Balázs P. SZABÓ, [2.] Ernő GYIMES, [3.] Antal VÉHA

THE EFFECT OF DEBRANNING TIME FOR KERNEL HARDNESS OF DIFFERENT WHEAT VARIETIES

[1-3.] Department of Food Engineering, Faculty of Engineering, University of Szeged,
Moszkvai krt. 5-7, Szeged, HUNGARY

Abstract: We did a debranning research using two different wheat kernels; called GK Fény (with soft kernel hardness), and GK Békés (with hard kernel hardness) in different water content. We used the varieties of Szegedi Gabonakutató Nonprofit Kft. (Cereal Research Non-Profit LTD., Szeged) as samples. The aim of our work was to demonstrate and compare the changes in parameter of wheat kernels such as Hardness Index as the function of debraning times. To the debranning we used PeriTec technology. We modelled the PeriTec technology with a laboratory size, batch-operating, horizontal debranning machine by SATAKE. Debranned grain samples were used to identify the Hardness Index (HI) by SKCS-4100 instrument (Perten Inc.). Our result: longer debranning times caused a decrease in kernel hardness. We found strong correlation between these parameters. The Hardess Index of GK Békés (tempered - 15 % water content) decreased 76 to 73 and the Hardness Index of GK Fény (tempered - 15 % water content) decreased 32 to 19. The Hardess Index of GK Békés (air dry - untempered) decreased 71 to 68 and the Hardness Index of GK Fény (air dry - untempered) decreased 31 to 22.
Keywords: wheat debranning, kernel hardness, PeriTec technology

1. INTRODUCTION

In the last decade the wheat commercial trading is more important. The kernel hardness is a very important parameter in connection with the aim of the price and the consumption. Wheat hardness has an effect on the milling process, it influences the properties, qualities and end use of flours. The kernel hardness is a significant characteristic. The kernel hardness is a property which is genetically determined (controll by friabilin protein). In recent years the debranning of kernels before milling has moved to the forefront. Ranieri (2011) based on a process of peeling, which is traditionally milled grain products (rice, barley, oats) are used during production. Funds that intense influences (peeling, grinding) on the grain surface of the shell is detachable parts, the outer layers of the kernel can be removed. Rizzello et al. (2012) examines the textural and sensory features of bread from debranned durum wheat. The bran of wheat kernel branch makes up 14-16%, which is the outer skin layers, including the aleurone layer. The latter is usually removed together with the other layers during milling technology, although botanically the aleurone layer is the outer layer of the endosperm (Mousie et al. 2004). Bottega et al. (2009) highlight the fact that the wheat peeling allows the removal of the outer skin layers and keeping the aleurone layer in a controlled manner.

The essence of the PeriTec technology - originally developed by SATAKE, a Japanese company, to clean rice - is that it gradually removes the bran layers of the grain by mechanical means before further processing. We modelled the PeriTec technology with a laboratory size, batch-operating, horizontal debranning machine by SATAKE. Applying different treatment times we varied the rate of debranning. We studied the kernel hardness parameter changing in connection with debranning time.

2. MATERIALS and METHODS

2.1. Materials

We carried out our experiments using a wheat from Gabonakutató Ltd, Szeged; called GK Fény (with soft kernel hardness), and GK Békés (with hard kernel hardness) in different water-conditions. GK Békés and GK Fény samples were air-dried (GK Békés – 10.5 %, GK Fény – 11%) and 15% moisture content, they were carried out in the conditioned state experiments. The conditioning was calculated based on the initial moisture content and weight of the amount of wheat, with tap water at 20 °C.

2.2. Methods

After conditioning the samples to a moisture content of 15%, they were subjected to different levels of rubbing applying 10, 20 and 40 s operation times.

The main part of the equipment is a cylindrical working space delimited by a perforated plate. In this working area there is a horizontal-spindle, corundum-covered grinding wheel rotating (Figure 1). The operation of the machine is batch-type; 200g of wheat can be treated at a time. We inject the samples into the treatment area through the inlet. The rate of polishing can be altered by changing the treatment time applied. After the debranning operation we open the latch put/located at the bottom of the working space and the kernels fall into the central container, while the removed parts of the hull get into the two lateral chambers.

Figure 1. Disc sander of SATAKE laboratory machines

Figure 2. The perforated plate of SATAKE laboratory machines after the debranning

We used a Perten SKCS 4100-type instrument to measure kernel hardness. Kernel length, width and thickness were determined with a digital calliper using 100 kernels per sample. We measured the rate of broken kernels using a 50g sample manually sorted and separated.

Figure 3. The Perten SKCS 4100 machine with computer (Perten Inc.)

3. RESULTS and DISCUSSION

The kernel hardness changed by the tempered and untempered wheat. The different debranning time caused the weak of the structure on the hard wheat variety (GK Békés). The debranning time was increase and the hardness index was decrease. The soft wheat (GK Fény), as prolonged grinding was performed several shell portion removed from the grain surfaces, the kernel hardness decreased. The tables showed the kernel hardness parameter (Table 1).

Table 1. The investigated Hardness Index parameter of GK Békés after the debranning (HI – Hardness Index)

	GK Békés, untempered (air dry – 10,5%)				GK Békés, tempered (m.c. 15%)			
Debranning time	0 sec	10 sec	20 sec	40 sec	0 sec	10 sec	20 sec	40 sec
HI/1	71,27	68,37	66,79	66,35	77,56	70,25	69,62	73,28
HI/2	71,66	67,48	68,49	69,38	75,52	72,86	70,44	75,15
HI/3	72,10	69,27	67,50	70,93	75,52	73,10	69,69	72,88
HI Average	**71,68**	**68,37**	**67,59**	**68,89**	**76,20**	**72,07**	**69,92**	**73,77**

Longer debranning times caused a decrease in kernel hardness (did not change significantly, however, the rate of broken grains in the lot increased significantly as a result of the strong mechanical impact applied during the operation).

The different debranning time weakened the structure of the hard kernel hardness wheat sample (GK Békés). The increasing debranning time resulted the hardness decreasing. We measured hardness decreasing after 10 and 20 seconds debranning time. Some growth was seen, when there was 40 seconds is the debranning time by air dry and the 15 % conditioned state. When examining the reasons for this trend, we presumption the following. The wheat coat is softer and more flexible; the endosperm is harder and more brittle. After the shorter debranning time, coat remains on the surface of the kernel. After 40 seconds debranning time, the endosperm part remains only, and it is harder and brittle than the coat.

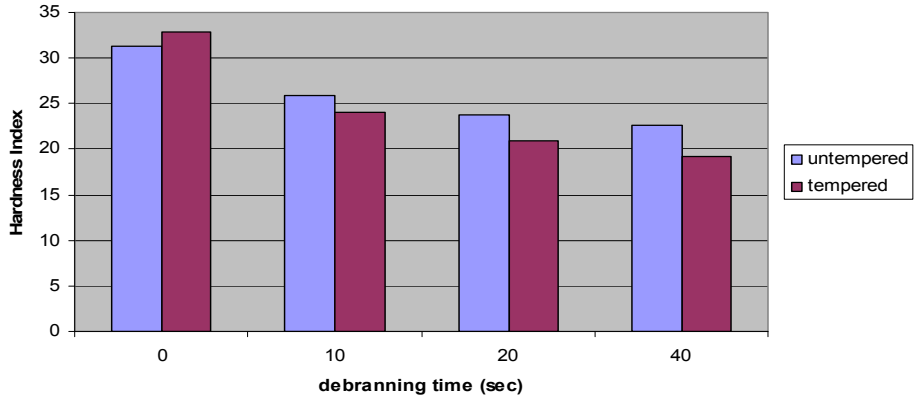

Figure 4. Effect of debranning time to Hardness Index (GK Fény, air-dry, moisture content 15 %)

The debranning time period was not longer than 40 seconds, because we modelled the industrial practice. Longer debranning time causes more waste (large amount of endosperm) and more broken grains.

The debranning time is increased by the shell content of endosperm has also been discarded parts. The increasing debranning time, the sample had a greater amount of mechanical stress, which resulted in a growing proportion of broken grains. The hard kernel structure (GK Békés) has greater broken kernel ration (tempered and untempered) than the soft kernel structure (GK Fény), for any period of debranning.

The Hardness Index of GK Békés (tempered - 15 % water content) decreased 76 to 73 and the Hardness Index of GK Fény (tempered - 15 % water content) decreased 32 to 19. The Hardness Index of GK Békés (air dry - untempered) decreased 71 to 68 and the Hardness Index of GK Fény (air dry - untempered) decreased 31 to 22.

If we wish to formulate the proposal based on industry practice for measurements in laboratory conditions, we can make the following statement: 20 seconds debranning time by the hard kernel hardness wheat, because less endosperm loss and higher energy demand due to the hardness increase. 40 seconds debranning time by the soft kernel hardness wheat, because more coat remove without increase grinding energy and endosperm loss.

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