Wheat requires an adequate milling process to obtain flour, the principal raw material for bread and many other baked products. The wheat kernel is characterized by a particular layer, with a deep crease along the length of its longitudinal axis (Figure 1). To this end, a special process of wheat grinding was used. The milling process was carried out in the endosperm by breaking the kernel and removing the tegumental layers (with numerous operations in various steps) which pass from the inside towards the outside of the kernel.

Another process which removes bran layers is debranning. Largely used in the rice industry.

In this case, the removal is progressive, proceeding from the outer layers towards the inner regions, allowing the recovery of subproducts that are differently processed as a later stage.

In the case of wheat kernels, the complete removal of bran by the debranning process is unusual as parts of the tegument remain inside the crease, whatever the debranning level.

In order to obtain flour, the debranned kernels have to be milled by conventional milling. Recently, however, positive results have been obtained by debranning durum wheat (Triticum durum L.) kernels, estimating the semolina yield of debranned kernels used in a higher than after conventional milling and that there is an increase in the quality of semolina pasta making (Pagani et al., 2002).

The effects of different debranning conditions on the properties of common wheat (Triticum aestivum L.) kernels were investigated with particular attention given to the amount of broken kernels and to the starch content in debranning by-products. Both these aspects, in fact, can affect the flour yield and quality.

Moreover, the effect of the debranning on the microbial contamination in the finished products was evaluated. The removal of the outer layers of the kernels before milling can also improve their hygienic characteristics.

The present work is a part of research project financed by the Regione Lombardia “Promozione dell’eccellenza nei meta-studi industriali della Lombardia”. Milano2 Project

The effects produced by different debranning conditions on the grain surface were evaluated by SEM (Figure 5). The action of MA covered by coarse abrasive elements was not homogeneous in either the hard or the soft wheat kernels, apart from the debranning conditions applied and the debranning level. The bran layers were mainly present on some surface areas while in other regions the starch granules of endosperm were clearly recognizable as a consequence of an excessive abrasive action. Moreover, many “cuits” were observed on wheat surface, and these were deeper in the case of hard kernels.

A pilot-plant debranning machine equipped with innovative abrasive elements lined with synthetic diamond powder® was used. Different variables were taken into consideration during the process, as summarized in Table 1.

The new MB debranning element allowed a strong abrasive action (Figure 8). In particular, after 1 step with the new system, the external layers of hard wheat grains were raised but still attached to the kernel, mainly in the crease. Even after 3 debranning steps, the debranning action was good but not complete; many raised layers could be observed. Nevertheless, all the incisions originated by MA were no longer present in the MB debranned kernels.

A further experimental step on a pilot-scale was carried out using a brushing machine after debranning. The presence of raised layers could originate small broken particles and, therefore, decrease the flour quality. The brushing operation allowed to obtain a smoother surface of the kernels (Figure 9).

Among the different debranning trials performed in this study, the best results were related to a Debranning Level (DL%) equal to 8-10%, obtained when the following conditions were applied: pre-hydration of the kernels with 3%w/w of tempering water, few minutes of resting time in relation to the debranning level and the debranning length of the debranning process. The use of finer synthetic diamond powder® (MB) increased the positive effects of this pre-treatment, allowing the decrease of the penetration of the debranning action into the endosperm, the reduction of starch content in the by-products and the decrease of the number of broken kernels during process. Finally, this pre-treatment reduced the microbial contamination and could facilitate the subsequent steps of the milling process, as the grinds would already be lacking in bran.

Conclusion

The debranning of Common Wheat (Triticum aestivum L.): An Innovative Tool for Improving Grain Characteristics

References


Figure 3. SEM images of hard wheat after 1 step or 3 steps of debranning by MB abrasive elements (the white arrow shows the “cuts” caused by MB on the kernel surface)