



RESEARCH Kernels

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- New Analytical Technique for Determining the Size of Proteins in Flour.** Previous studies have indicated that the proteins in wheat flour play a major role in determining the bread baking quality of hard wheats. This is thought to be due to their ability to form large polymers that hold the starch and air sacs in the baked bread. As a result, accurate measurement of the size of these protein polymers in flour may be an important tool for predicting bread baking quality. We used a new technique called multiangle laser light scattering or MALLS to provide accurate molecular size information for flour proteins. This technique can be applied to very small amounts of material. Future work will focus on developing this technique as a simple, accurate tool for predicting bread baking quality for breeders, millers, and bakers.

(George Lookhart, telephone: 785-776-2736, email: george@gmprc.ksu.edu.)

- Immune Response Protein Purified from the Indianmeal Moth.** In almost all living organisms, proteins play a major role in defending the organism from attack by bacteria and fungi. A key protein in the immune defense system of the Indianmeal moth, an important insect pest of grain and grain products, has been successfully purified from the larvae of this pest. Studies of its properties show that it binds to the carbohydrate found in the cell walls of microorganisms that invade this insect pest. In an as yet undetermined mechanism, this binding process initiates the insect's immune response, including production of antimicrobial peptides that attack the invading microorganism. Studies of how insect pests such as the Indianmeal moth protect themselves against attack by invading microorganisms may provide vital information needed to develop new technologies for controlling these pests in the future. This study, a cooperative effort with the Kansas State University Department of Biochemistry, is the first significant effort to clarify the immune defense system in this major insect pest.

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- **Objective Measurement of Dark Hard Vitreous Kernels in Hard Red Spring Wheat.** The content of dark hard vitreous (DHV) kernels in Hard Red Spring wheat is an important grading factor that is associated with protein content, kernel hardness, milling properties, and cooking quality. The current visual method of determining the number of DHV kernels is time consuming and tedious. Spectra from DHV and non-DHV kernels were collected using an NIR diode-array spectrometer. Results showed that those kernels which were bleached by environmental conditions in the field were the most difficult to analyze correctly and classification accuracies ranged from 91.1% to 97.1%. This is compared to accuracies of 97.5% to 100.0% obtained on samples without bleached kernels. Therefore, NIR can serve as a rapid analytical technique for DHV kernels in Hard Red Spring wheat.

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- **New Insecticide to Control Pantry Pests.** A volatile formulation of the insect growth regulator hydroprene (Pointsource), which is not toxic to humans, was evaluated for control of the red flour beetle and confused flour beetle. Both beetle species were susceptible to Pointsource; exposed larvae often failed to molt to the adult stage, and adults that did emerge were usually deformed and quickly died. This commercial product could be used to control insects in small confined spaces in urban settings, including retail stores and homes.

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- **High Speed Detection and Removal of Wheat Defects.** The Engineering Research Unit has partnered with Satake USA, Inc., to investigate the potential of high speed optical sorters for detecting and removing specific wheat kernel defects. This technology has the capacity to inspect and sort single kernels at rates up to 20,000 lbs/hr. Initial tests show the system can detect and remove red wheat from white wheat stock, and can detect and remove some insect infested kernels. Detection and removal of additional defects in wheat and corn will be studied.

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- **The Fate of DNA During the Baking Process.** The labeling of genetically modified foods is dependent on the development of methods that are capable of sensitive and accurate detection. Detection of transgenic events can be based on the detection of novel proteins produced by the

genetically modified organism or the detection of the modified DNA itself. DNA-based analysis is the method of choice due to the fact that DNA is very stable and very sensitive and accurate analytical techniques are available. We have used DNA analysis to determine the effects of various steps in the bread baking process on wheat DNA. DNA samples were extracted from Hard Red Winter wheat kernels, milling fractions, flour, fully mixed dough, 1st punch, 2nd punch, moulding, pan stages, during the bake (at 5, 10, and 15 minutes), and after the bake (at 1, 3, and 5 days). DNA purified from whole kernels demonstrated the expected long, high molecular weight strands containing over 12,000 base pairs. DNA extracted from the flour was partially broken into smaller pieces ranging in size from less than 300 base pairs to the original >12,000 base pairs. The majority of the large DNA pieces were contained in the bran fractions. During the first ten minutes of the baking process, DNA fragmentation accelerates. DNA purified from bread contained a maximum size of 400 base pairs. These results show that, as wheat is processed into flour and baked, the DNA molecules are broken into smaller and smaller pieces. However, the DNA-based analytical method used is sensitive enough to detect low levels of genetic materials in finished bakery products and should be able to detect the presence of transgenic genes. It is interesting to note that low levels of yeast DNA also were detected in the final bread products. The next experiments will involve adding different levels of flour from transgenic soybeans to the wheat flour used to produce bakery products. Testing the soy-wheat flour mixture as it moves through the dough development and baking processes should confirm the ability of DNA-based testing to detect transgenic genes in the final products.

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