

Chemistry

Elizabeth Pennisi reports from New York City at the Fourth Chemical Congress of North America

Coring improves frozen corn on the cob

Considered one of the ephemeral delights of summer because its sweet taste fades so fast, corn on the cob also ranks as one of the great challenges to food scientists seeking to preserve its fresh flavor. Now Chang Y. Lee of Cornell University and his colleagues have demonstrated that drilling a 1-centimeter-diameter hole almost completely down the center of the cob makes frozen corn less soggy and more tasty.

Food companies have sold frozen corn on the cob for 60 years, preparing it by first cooking the corn for 10 to 14 minutes, says Lee. This blanching kills enzymes in both kernels and cob that otherwise gradually destroy corn's flavor molecules. The corn needs such long cooking because heat transfers slowly to the cob's core. As a result, kernels reach temperatures up to 20°C higher than the cob. If overcooked, kernels get soggy and less appealing to the palate, Lee says.

Once cored, cob and corn cook more quickly and more evenly. Both reach 80°C within six minutes. Lee's group prepared and froze corn in this and the traditional way. Every three months for a year, they measured the enzyme content of individual kernels and cobs from the two groups. They then put a hole through the corn prepared the old way to make it indistinguishable from the other corn for blind taste tests by 16 volunteers.

Blanching destroyed 95 percent of the disflavoring enzymes in kernels and 68 percent of the enzymes in the cob of cored corn, almost double those destroyed by the traditional approach. And the cored corn did consistently better in the taste tests, Lee reports. In addition, the shorter blanching time means lower energy costs for food companies, he says.

Firms sweet on no- or low-cal sugar

One day bakers may make their own low-calorie double fudge brownies and diabetics may be able to satisfy a sweet tooth without deviating from their strict diets. Nutrasweet Co. in Mount Prospect, Ill., and the German company Südzucker AG in Grünstadt have developed new bulking agents, which serve as sugar substitutes. These substitutes lack the intense sweetness of artificial sweeteners such as saccharin or aspartame but look and react so much like sucrose — table sugar — that they can replace sugar in baked goods and frozen desserts, says Hubert Schiweck, a chemist with Südzucker.

He says his company's product, Isomalt, carries half the calories of sucrose. Nutrasweet's products — called sugar amides — pass through the digestive system unaltered and thus add no calories, says Nutrasweet chemist Manssur Yalpani.

Thus, when used with artificial sweetener, these bulking agents can reduce by one-half to one-third the caloric content of many desserts without changing their sweetness or character or requiring changes in how companies or home bakers produce their sweets, Yalpani adds. Both products still need approval from the U.S. Food and Drug Administration.

In addition, Coors BioTech, Inc., in Westminster, Colo., has announced it will use Japanese technology for producing a class of sugars called fructooligosaccharides in the United States. In Japan, about 50 foods, including infant formulas, contain this natural additive, which has less than half the calories of sucrose and helps keep the digestive tract healthy, says Coors chemist Robert M. Speights.

These sugars pass intact through the stomach and small intestine to the large intestine, where beneficial bacteria can metabolize them as an energy source, says Speights. The bacteria — related to those found in yogurt — thrive and make the intestine less susceptible to infection by *Salmonella* and possibly to carcinogenic chemicals, he adds. The sugars can work as low-calorie substitutes, but for now Coors plans to market them solely as a healthful food additive.

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Computers

Finding needles in database haystacks

Computers have become the repositories of vast amounts of information, ranging from electronic messages and bulletins to newspaper articles, research papers, textbook materials, documents and dictionaries. Whereas storing large masses of information is relatively easy, retrieving particular items from such enormous stocks can prove both time consuming and frustrating. Text retrieval is especially difficult when a database contains material covering an unlimited range of subjects expressed in widely varying vocabularies. Because some words may mean different things in different contexts — plasma, for example — conventional search and retrieval methods, which rely on indexes consisting of sets of key words or phrases, are unreliable and difficult to apply.

Computer scientists Gerard Salton and Chris Buckley of Cornell University have now developed an alternative approach for extracting relevant information from a large, diverse database. Their scheme, described in the Aug. 30 *SCIENCE*, relies on automated techniques for evaluating the degree of similarity between different pieces of text. The method involves breaking down each piece of text into such units as sections, paragraphs and sentences, then assigning to each unit a set of terms used to represent its content.

Suppose that a user of a digitally stored encyclopedia wants to find all material related to astronomical instruments. The user selects a single article, perhaps on telescopes, as her starting point. She then asks the computer to look for all other articles containing material similar to that in the telescope article. The computer proceeds by evaluating the degree of similarity, expressed according to a set of special formulas, between the telescope article and the material in the rest of the database. On the basis of those calculations, the computer then selects other articles that appear relevant to the topic. Instead of starting with a text excerpt or article already in the database, a user can also write out a request for information, expressed in English-language sentences that provide a good description of the required material.

The scheme's efficiency and convenience depends on how effectively it identifies related text passages. Preliminary tests have proved encouraging, the researchers say. "No other text search and retrieval approach currently contemplated appears to offer equal promise for unrestricted text environments and arbitrary subject matter," they conclude.

Detecting the loss of encoded data

An increasing number of computer users are applying encryption techniques to conceal electronically transmitted information from all but authorized recipients. Indeed, encryption is already routinely used for the electronic transfer of funds from one bank to another. However, the operation of such a scheme requires careful synchronization of the encryption and decryption processes. If an encrypted message arrives at its destination a few information bits longer or shorter than when it started, the message ends up completely garbled.

Researchers at the Sandia National Laboratories in Albuquerque, N.M., have now developed improved electronic equipment designed to detect the loss of information because of improper synchronization during decoding. Conventional loss-detection methods require the injection of specific, recognizable patterns of bits into a message, which serve as a kind of identifying mark to provide assurance that no information has been added or lost in transit. The hardware developed by Lyndon G. Pierson and his co-workers improves on that approach by looking for the absence of certain information patterns rather than the presence of specific patterns. The new hardware detects faults about 50 times faster than conventional devices.

155