Chemistry

New process helps rice retain vitamins

Ever wonder why enriched rice carries a label warning consumers not to wash the grains? It's to keep people from rinsing away 75 to 90 percent of the vitamins, explains Esmond W. Joseph, a food scientist at CPC International/Best Foods in Union, N.J. But Joseph says a new enrichment process, which he helped develop while at Louisiana State University in Baton Rouge, can embed vitamins into white rice so effectively that they withstand not only thorough washing but also the high temperatures required for canning. Moreover, the process strengthens the rice so that it doesn't mush during cooking or canning, Joseph and his co-workers report in the July-August JOURNAL OF FOOD SCIENCE.

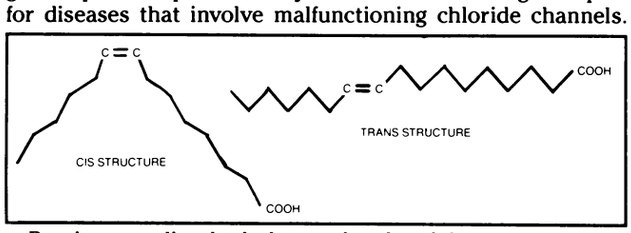
Though most Americans prefer white rice, they pay a nutritional price for selecting it: Milling techniques that whiten brown rice also remove much of its vitamin content. Enrichment processes can replace the lost nutrients, but "none of the methods presently used to enrich rice is rinse- and cook-proof," the Louisiana team notes.

Their process involves soaking rice for 30 minutes in water acidified to a pH of about 2.4. Then they add a mix of vitamins and acetaldehyde, a reagent that introduces new chemical crosslinks into the starch to reinforce the grains' internal structure. As the crosslinking process swells the rice, each grain draws the added vitamins deep into its starchy matrix.

During cooking and canning experiments, the researchers found that unenriched white rice lost an average 17.7 percent of its niacin, 11 percent of its pyridoxine, 53.8 percent of its thiamine and 13 percent of its riboflavin. In white rice enriched through the acetaldehyde process, levels of these vitamins dropped by an average of 2 to 25 percent. Thus, the rice survived cooking and canning temperatures with about two to four times the vitamin content of the raw untreated rice.

Fatty hints to faulty chloride channels

Several diseases, including cystic fibrosis and certain diarrheas, owe their devastating symptoms to faulty chloride channels: These cell-membrane structures help regulate the flow of chloride ions and water into and out of the epithelial tissues lining organs such as the trachea and gut. In the August PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.87, No.15), researchers report the first data showing that some unsaturated fatty acids can shut down chloride channels. These fatty acids, they say, may serve as potent natural gatekeepers and point the way to more effective drug therapies for diseases that involve malfunctioning chloride channels.



Previous studies had shown that breakdown products of unsaturated fatty acids could open closed chloride channels. No one expected, however, that the "parent" fatty acids could also regulate channels "in the opposite direction, in closing them," says Sandra E. Guggino of the Johns Hopkins University in Baltimore. Her team found that only the structurally kinked, "cis-type" unsaturated fatty acids shut channel openings, whereas their straighter, "trans-type" counterparts exerted no control over channel closing. Long-chain *saturated* fatty acids also showed no effect.

Guggino says this suggests that chloride-channel blockage in diseases such as cystic fibrosis might result from a genetic mismanagement of the cis-type fatty acids near the channels.

Materials Science

One coat of paint yields two tones

Getting trim stripes or a fancy two-tone effect on a car customarily requires separate coats of different paints and a masking technique to maintain sharp edges between the paints. That takes time, skill, and expensive labor. But two electrical engineers say they have now invented a way to get two tones from one coat of metallic paint.

James R. Melcher of the Massachusetts Institute of Technology in Cambridge and Stuart Inkpen of Instrumar, an electronic-sensor company in St. John's, Newfoundland, developed the technique while studying why the same batch of paint can yield different tones depending on how it's applied.

Metallic paints have tiny flakes of aluminum, silver or other metals suspended in a liquid that includes polymeric binders, which hold the pigments and flakes in place, and solvents, which allow spraying or brushing. In spray-painting processes, the metal particles normally arrange horizontally on a surface, producing a uniform tone. But by subjecting specific areas of the wet paint to a small "corona current," Melcher and Inkpen have found that they can get the particles to align perpendicular to the surface. More pigment shows through and a darker tone results.

The researchers generate the corona current — a stream of ionized air — by placing a high-voltage electrode near a conducting surface such as a recently painted metal panel.

Polymers that shrink from light

Muscles contract when their natural polymers respond to nerve impulses. Materials scientists strive to develop synthetic polymers that similarly respond to stimuli such as light by changing their shape, permeability or other properties.

Earlier this year, Toyoichi Tanaka of the Massachusetts Institute of Technology synthesized polymers that respond to ultraviolet light. Now, he and Atsushi Suzuki of Yokohama (Japan) National University have made a polymer that shrinks when subjected to light of visible wavelengths and reswells in the dark. In the July 26 NATURE, they suggest that the responsiveness to visible rather than ultraviolet light makes this polymer a more versatile candidate for applications such as artificial muscles and mechanical actuators for robots.

The responsive polymer gel consists mainly of linked N-isopropylacrylamide molecules. By adding links of copper chlorophyllin, a light-sensitive molecule, the researchers created a polymer that harvests light energy and distributes it within the polymer as heat. The heat induces a size-reducing phase change in the polymer, akin to water vapor condensing into a liquid, Tanaka says. In their paper, the researchers report a size reduction of about two-thirds, but Tanaka says he expects future formulations to shrink several hundred-fold in response to visible light.

A smart glass that manipulates light

By carefully fusing multiple layers of glass, each of which bends light slightly more or less than adjacent layers, scientists at Isotec Ltd. in Tucson, Ariz., have made specialty glasses that guide light beams along specific, even winding, courses the way wires guide electricity. These "gradient refractive index" (GRIN) materials could serve in emerging technologies such as optical computers and photonic circuitry, suggests Richard Blankenbecler, a physicist at the Stanford Linear Accelerator Center, who also is a consultant for Isotec. Photonic devices resemble electronic devices, but work by manipulating photons and light beams instead of electrons and currents. Company spokesman Paul Dempewolf says the Isotec process costs less, takes less time and produces a wider range of light-piping glasses than existing techniques for making GRIN materials.