

NEW TECHNOLOGY BOOSTS FIBER IN FOODS

PEGGY GREB (K9309-1)



Charles Onwulata, a food technologist, prepares ingredients for high-pressure homogenization, a process that can increase fiber content in fluid foods.

Americans fall short when it comes to eating enough fiber each day. So what are scientists doing to help? They have come up with a new technology that allows them to add more fiber to foods without changing their texture, says food technologist Charles I. Onwulata, who's in the ARS Eastern Regional Research Center's (ERRC) Dairy Products Research Unit, in Wyndmoor, Pennsylvania. "Until now, adding fiber to foods was difficult because it changed the qualities—particularly the texture and mouth feel—of the food," Onwulata says.

Onwulata has filed for a patent on the new technology, "invisible fiber," a process that uses milk protein to envelop the fiber and keep it from soaking up water. "The protein barrier makes the fiber 'invisible' to water. The fiber doesn't pull moisture out of the rest of the food product," he notes. "But the invisible fiber envelope will dissolve during digestion, allowing the fiber to perform its normal function in the gut. This new, encapsulated fiber can be incorporated into food products without changing texture or moisture. Many foods can be modified with the invisible fiber."

Traditionally, food manufacturers have increased fiber in foods in small amounts to avoid negative effects such as changes in texture, color, and mouth feel. In foods with high fiber content, the fiber absorbs water from its surroundings, giving the food a dry texture. Reducing the water-holding capacity of the fiber improves food quality and allows more fiber to be added without changing its texture, Onwulata says.

Onwulata and colleagues conducted baking studies to test the moisture level, protein content, color, and hardness of foods made with invisible fiber and compared them to recipes with regular fiber. Fiber affects these properties, and these properties determine consumer acceptability.

The scientists-turned-chefs baked cookies and muffins power-packed with invisible fiber. The invisible fiber improved the goodies' qualities.

ARS researchers are also working with industry to increase fiber in fluid foods. They had a cooperative research and development agreement with Verion, Inc., of Exton, Pennsylvania, to adapt a "dynamic pulse-pressure treatment" process for the food industry. The technology, which is patented by Verion, uses hydrostatic pressure—the force applied through water—to change the moisture, density, and melting properties of foods. The treatment was originally used for making pharmaceuticals.

"Scientists have known for a hundred years that high pressure can be used to process foods," says Onwulata. "Old methods take anywhere from 20 to 30 minutes to pressure-process foods. With dynamic pulse-pressure treatment, pressure-processed fluid foods like milk or slurries (pastelike fluid that can pass through a nozzle) can be processed in 1 second—faster than with anything else that's on the market," he says.



PEGGY GREB (K9310-1)

Chemist Renee Wildermuth bakes muffins and cookies containing “invisible fiber.”

Foods react differently to pressure processing, since they have varying densities and abilities to dissolve in water. In studies at ERRC’s dairy pilot plant, a small-scale processing facility, scientists tested several food ingredients, including whey proteins, corn starch, wheat bran fiber, and cellulose fiber.

They found that pressure treatment modified the molecular structure of the starches. Pressure-treated fiber had about a 40 percent reduction in its water-holding capacity. Microscopic images revealed that pressure treatment packed the fibers into small balls that were impervious to moisture.

“Once these technologies are fully developed and commercialized, the food industry will greatly benefit from them,” Onwulata says. Many companies are interested in increasing the amount of fiber in their foods as a benefit to consumers. The recommended fiber intake is 20 to 35 grams per day. But on average, Americans get only about 15 grams per day. Studies suggest that fiber decreases heart disease, some cancers, high blood pressure, and diabetes.

Nutritionists still agree that eating a variety of grains, fruits, vegetables, and legumes is the best way to get fiber. Meanwhile, ARS researchers will continue to look at ways to boost fiber in other foods.—By **Tara Weaver-Missick, ARS.**

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Foods With Fiber

Dietary fiber comes from plant cell walls. There are two main types of dietary fiber, and we need a combination of both. Soluble fiber (gums, mucilages, pectins) forms a gel and is found in fruits, dry beans and peas, vegetables, and some cereals. Insoluble fiber (cellulose, hemicellulose, lignin) passes through your digestive tract basically intact and is primarily found in whole-grain products, like wheat bread. Insoluble fiber helps get rid of food your body can’t use. It also gives you that full feeling. Soluble fiber lowers blood cholesterol and helps regulate blood sugar. Here are just a few sources of fiber:

Food	Serving Size	Total Fiber (grams)
Apple, raw, with skin	1 medium	3.7
Baby lima beans, cooked	1/2 cup	5.4
Baked potato with skin	1 potato	4.8
Banana	1 medium	2.8
Black beans, cooked	1 cup	15.0
Broccoli, cooked	1 spear	1.1
Carrots, raw	1 carrot	2.2
Green peas, cooked	1 cup	8.8
Lentils, cooked	1 cup	15.6
Oat bran bagel	1 4-inch bagel	3.2
Orange	1 small	2.3
Peach	1 medium	2.0
Peanut butter, smooth	2 tablespoons	1.9
Popcorn, air-popped	1 cup	1.2
Shredded cabbage, cooked	1/2 cup	1.7
Spinach, cooked	1 cup	4.3
Whole-wheat bread	1 slice	1.9
Whole-wheat English muffin	1 muffin	4.4

Source: U.S. Department of Agriculture, Agricultural Research Service. 1999. USDA Nutrient Database for Standard Reference, Release 13. Nutrient Data Laboratory Home Page, <http://www.nal.usda.gov/fnic/foodcomp>.

PEGGY GREB (K9311-1)



Muffins and cookies made with invisible fiber.