

Professor helps turn wheat bran into plastic

By James R. Johnson—March 17, 2018

MAYVILLE, ND - Bran is the hard outer layer of a cereal grain, such as wheat.

Along with flour, 14.5% of what is milled from wheat kernels is bran. Millers sell 90% of this bran at extremely low prices or dispose of it as waste. That's 3 million out of 3.34 million bushels of bran annually.

Mayville State University Professor Khwaja Hossain and Dr. Chad Ulven at North Dakota State University say wheat bran contains a number of high-value components, including starches, fiber and protein. They've collaborated to process the byproduct into plastic polymers for industrial use. They've applied for a patent.

Their research indicates wheat bran has the potential to be an effective and economical reinforcing material because of its low density, non-abrasive nature, availability, low cost, and renewability.

Hossain explained that the wheat bran is first treated with sodium hydroxide, which increases cellulose availability, then ground into pellets that are one-quarter millionth of a meter in size. A device called a twin screw extruder melts the bran with polypropylene, a synthetic resin used in molded objects.

The melted pellets are injected into a mold and the specimens cure for 48 hours before they're tested for mechanical properties.

Hossain says the research has worked with many varieties of wheat, including winter, spring and durum, but the cultivar Mountrail has provided the suitable bran to be used in plastics. The end result was a 16.3% increase in flexural strength at a loading rate of 20% and higher.

An economical future

Hossain is a native of Bangladesh. He moved to the U.S. from Japan in 2000, spending four years at NDSU before

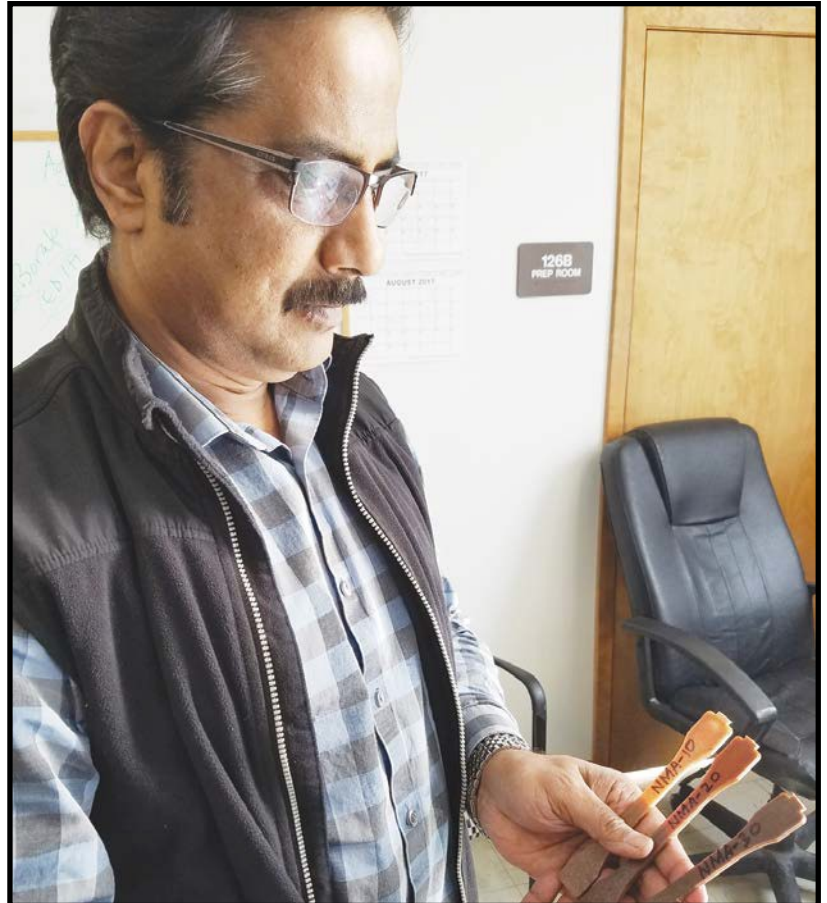


Photo by Harry Lipsiea | TRIBUNE

Mayville State Professor Khwaja Hossain holds three flexible, plastic composites made with different percentages of wheat bran.

WHEAT BRAN cont'd.

starting in January 2005 at Mayville State University.

He's tracked statistics that shows wheat production is down in North Dakota at a time when the state produces 80% of the U.S. wheat crop.

"The commodity price is so low that people don't see a profit in it," he says. "Profit is decreasing mostly because wheat does not have alternative uses."

Hossain believes wheat bran plastics "could become a profitable plastics industry."

If it's patented as an appropriate reinforcement in the polymers, it could trade between \$100 and \$200 per ton, and the pellets could be transported from rural areas.

Ulven is associate professor of mechanical engineering at NDSU. He says he's had success finding higher-value added use for flax fiber, sugar beet pulp and sunflower hulls.

"This is a good opportunity to bring a higher-value-added use of a waste stream," Ulven says of the wheat bran/plastics research. "It'll be nice to have a secondary revenue stream from wheat production."

Further alternatives

Hossain is studying other applications. He's also extracted a polymer from wheat bran called arabinoxylan. He says its nano-particles could be used for drug delivery in human systems and nutrient delivery in plants.

You may have at one time had a water filter attached to your faucet with charcoal pellets inside to help filter contaminants from the water.

Hossain says wheat bran fired at 700-to-800 degrees Celsius (about 1,300 to 1,400 degrees Fahrenheit) is decomposed through a process called pyrolysis. The end result is a fine grain that could fit into a tea bag, but on a much larger scale could filter contaminants at water treatment plants.

Two MSU undergraduate students, Alex Johnson and Cheyenne Durant, have been assisting Hossain and Ulven with their research. Ulven says the patent process could take a couple of years.

Ulven told the Tribune, "In the meantime, we'll continue to develop the technology and maybe license it to somebody, most likely a plastics compounder."