UF Researchers develop Plant-Based Technology that Helps Biofuels, may fight Cancer

GAINESVILLE, Fla. — For the first time, University of Florida researchers have developed plant-based technology that could reduce America's dependence on foreign oil and may also help treat cancer.

Known as lignin nanotubes, these cylindrical containers are smaller than viruses and tiny enough to travel through the body, carrying cancer patients' medicine. They can be created in biorefineries from lignin, a plant substance that is a byproduct of bioethanol production.

Bioethanol is a renewable alternative to fossil fuel created by fermenting sugar — such as that from sugarcane and sweet sorghum juices, stalks and stems.

"We're looking at biomedical applications whereby these nanotubes are injected in the body," said Wilfred Vermerris, an associate professor in UF's agronomy department and Genetics Institute who was part of the team that developed the nanotubes. The team's work is described in a March issue of the journal Nanotechnology.

Carbon-based nanotubes, which are the kind used today, cost around $500 a gram, and nanotechnology drug delivery has been projected to be a $220 billion market by 2015.

Nanotubes offer an advantage over radiation or traditional chemotherapy because they have a protective shell that keeps the drugs they contain from affecting healthy parts of the body, such as hair or intestinal lining, said Vermerris, a member of UF's Institute of Food and Agricultural Sciences.

As with current carbon nanotubes, cancer-fighting drugs can be enclosed in the plant-based nanotubes and sent to target specific tumors, he said.

But, the researcher said, unlike currently used carbon nanotubes, lignin nanotubes are flexible and lack sharp edges. That means they're expected to have fewer, if any, of the toxicity issues associated with current varieties.

"It is also much easier to chemically modify the lignin nanotubes so that they can locate their intended targets like homing devices," he said.

Vermerris envisions nanotubes as a way to reduce the cost of biofuel production.

"By selling the nanotubes for biomedical applications, an additional revenue stream is

generated for the biorefinery that can offset some of the processing costs," he said. "That essentially reduces the price of the fuels and makes them more competitive with petroleum-based fuel."

Luisa Amelia Dempere, an associate engineer and director of the Major Analytical Instrumentation Center in UF's College of Engineering, guided the analysis and characterization of the lignin nanotubes as part of the research team.

She called the development of the lignin nanotubes "quite significant" and noted their ability to break down in the environment as another advantage over current nanotubes.

"They are taking something from the waste stream, like lignin is for a lot of industries, and making it into something that can be useful and then can degrade back into the environment," Dempere said. "This is probably a material that can be called green and sustainable because it comes from nature and goes back to nature."

UF has applied for a patent on the technology.

Vermerris said his research is now testing the technology in living cells in the lab as a first step toward tests in humans in the near future.

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