Improving Roads with Ethanol Co-products

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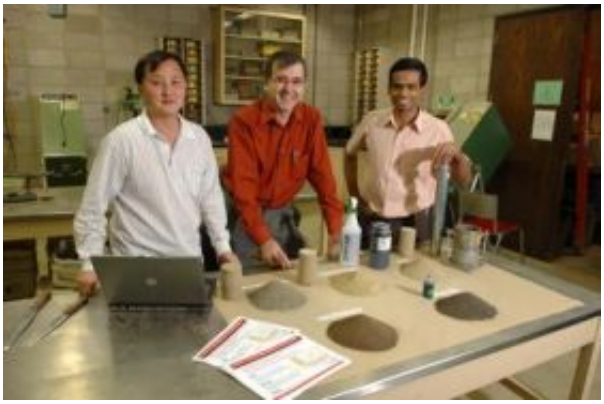

An Iowa State University research team is studying how lignin, the glue that holds plant fibers together and a co-product of cellulosic ethanol production, could improve soil strength under roads. The team -- left to right, Sunghwan Kim, a post-doctoral research associate; Halil Ceylan, an assistant professor of civil, construction and environmental engineering; and Kasthurirangan Gopalakrishnan, a research scientist -- will test lignin's ability to strengthen soils in Iowa State's soils engineering laboratory. Credit: Bob Elbert/Iowa State University

Iowa's soil is great for growing corn. But it's not so great for building roads. Soil around the Midwest is mostly soft clay and till deposited by glaciers, said Halil Ceylan, an Iowa State assistant professor of civil, construction and environmental engineering. It's hardly the bedrock engineers would like for a good, solid roadbed.

And so the soil under Iowa's roads often has to be mixed with chemicals

that bind and stabilize soil particles. That improves soil strength. And that makes for better roads.

While stabilizing soils for road construction is standard practice around the Midwest, there are limits to its effectiveness. Ceylan said costs can be high and current practices only work with certain soil types and site conditions. So civil engineers are always looking for better, cheaper and more efficient ways to get the job done.

That has Ceylan and Kasthurirangan Gopalakrishnan, a research scientist in civil, construction and environmental engineering, experimenting to see whether lignin, a co-product of producing ethanol from plant fibers, could be a good soil stabilizing agent.

Their research is partially supported by a $93,775 grant from the Grow Iowa Values Fund, a state program that promotes economic development. The Iowa Highway Research Board, Grain Processing Corp. of Muscatine and Iowa State's Office of Biorenewables Programs are also supporting the project.

Using lignin to stabilize soil make sense. Lignin is the glue that holds plant fibers together. It's the tough stuff that allows corn plants to stand up to a summer thunderstorm. But there's not a lot of value in it when it's removed from corn stalks, switchgrass or other biomass feeding the production of cellulosic ethanol.

As researcher Andy Aden of the National Renewable Energy Laboratory in Colorado recently told National Geographic magazine, "The old joke is you can make anything from lignin but money."

Ceylan said previous Iowa State studies of lignin from the paper-making industry found it to be a cementing agent that could be of value for soil stabilization. But nobody has determined if that's also the case for lignin

from ethanol production.

Ceylan thinks it will be.

“It is expected that the lignin derived from lignocellulosic biorefineries will see similar success, if not better,” he wrote in his proposal for a Grow Iowa Values Fund grant.

To find out, Ceylan and his research team will head to the soils engineering lab in Iowa State’s Town Engineering Building where they’ll prepare soil samples containing various percentages of lignin. The mixtures will be tested and evaluated for strength, stability and other properties.

The researchers hope they come up with a new technology that’s good for road builders, good for drivers, good for the environment and good for the cellulosic ethanol industry.

The research could also be a big help to the people who build and maintain Iowa’s roads, especially as ethanol plants increase truck traffic through rural areas.

“When I talk to county engineers they’re very concerned about increased traffic,” Ceylan said. “Roads are designed according to traffic forecasts and suddenly there is a lot more truck traffic. This can be a cause of distress to the highway system. But, maybe we can also get the benefit of soil and road stabilization from these plants.”

Source: Iowa State University