Could Panda Poop Be the Secret to More Efficient Biofuel?

Unique microbes in a panda's gut efficiently break down bamboo—mass producing these microbes could help scientists make sustainable biofuels

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September 10, 2013 Smithsonian

Rising gas prices and a dangerously low world panda population–what if someone told you that we soon could have one solution to both these problems? If it seems too good to be true, think again; scientists at Mississippi State University are conducting research on the feasibility of using pandas to help solve our biofuel woes, a step that could lead to a bump in conservation efforts and a drop in fuel expense. The secret to the solution? It's all in the panda's poop.

When it comes to biofuels, the market is dominated by one word: ethanol, a biofuel made from corn. Though ethanol is the most widely used biofuel, it

isn't necessarily touted as a perfect replacement for fossil fuels–in fact, the benefit of ethanol is been hotly debated since its creation.

The debate goes a little something like this: in order to fill the tank of an SUV with ethanol fuel, you need to use enough corn to feed a single person for an entire year. A 2012 paper published by the New England Complex Systems Institute cites ethanol as a reason for the increasing price of crops since 2005. And even environmental groups steer clear of ethanol, citing the massive amounts of fossil fuel needed to render corn a useable biofuel product and the propensity of companies to buy land in developing countries to grow the lucrative biofuel rather than food for local consumption.

Ashli Brown, a researcher at Mississippi State University, thinks she's found the answer to this alternative fuel conundrum. By taking corn byproducts–the husks, the stems and cobs–ethanol could be created without dipping into the edible parts of corn, reducing the chance of a food shortage and price spike. The issue is that to break down these materials, which are extremely high in lignocellulose, or dry plant matter, a special pretreatment process is required. The process is extremely costly and not very time-efficient, using high temperatures, high pressures and acid to break down the dry plant matter before it can become ethanol. To circumvent this problem, Brown and other researchers have been looking for a natural solution–bacteria, which could help with the breakdown of the lignocellulose material.

Biofuel companies have been seeking a natural method to break down plant material for a while; so far, termites have been a favorite for chewing through the woody material. But it turns out there might be a better–and cuter–animal that can help produce biofuel. The intestines of pandas are remarkably short, a physical attribute which means their intestines have come to contain bacteria with unusually potent enzymes for breaking down their woody diet of bamboo in a short amount of time.

"The time from eating to defecation is comparatively short in the panda, so their microbes have to be very efficient to get nutritional value out of the bamboo," Brown, the researcher heading the work, said. "And efficiency is

key when it comes to biofuel production—that's why we focused on the microbes in the giant panda."

The study began more than two years ago, when Brown and a team of researchers began looking at panda feces. In 2011, they identified these super-digesting microbes are present in panda feces, but they had yet to specify the type and amount of microbes present until now. Using the poop from two giant pandas–Ya Ya and Le Le in the Memphis Zoo–Brown and her team performed DNA sequencing on microbes in their samples**,** identifying more than 40 microbes in the panda feces that could be useful to the breakdown and creation of biofuels.

To grow these microbes on an industrial scale, Brown believes that scientists could put the genes that produce those enzymes into yeasts**-**-these yeasts could then be mass-produced and harvested for biofuel production. The process would go something like this: Large pits of corn husks, corn cobs, wood chips, and other forms of discarded fibrous material are covered with the genetically altered yeasts. As the microbes digest woody substances, they quickly turn it into sugar, which would then be allowed to ferment. Over time and after filtering out solids and any excess water, you would have ethanol, distilled from woody waste products.

Pandas aren't the only animal that subsists on a grassy diet, but their physiology makes them a unique candidate for breaking down plant byproducts in a hyper-efficient way. Pandas have the same digestive track as any other bear; unlike cows or other herbivores, pandas don't have an extra stomach where hard lignocellulostic material is pretreated before being digested. Instead, they have the intestinal system of a carnivore, and yet manage to extract enough nutrients from their herbaceous diet to survive.

"Because their retention time is very short—they're constantly eating and they're constantly pooping—in order to get the material for nutrition, they have to be really quick at breaking it down and extracting the sugars," Brown explained. "Many microbes produce celluloses that breakdown lignocellulostic biomass, but it's about how efficiently or how effectively they do it." When it comes to a panda, Brown notes, their microbes are some of

the most efficient scientists have seen at breaking down the woody material of a plant.

And Brown thinks that using pandas for their poop could lead to more than a greener economy: it could also lead to increased conservation for the animals, who have seen their numbers in the wild drop to a dangerous 1,600 (though there has been recent luck with breeding pandas in captivity, like the new baby panda at the National Zoo). “These studies also help us learn more about this endangered animal’s digestive system and the microbes that live in it, which is important because most of the diseases pandas get affect their guts,” said Brown.

Brown notes that if the panda becomes valuable to the market for more reasons than its incredibly adorable demeanor, it might spark greater steps toward conservation–a move that could be mutually beneficial to pandas and humans alike.”It’s amazing that here we have an endangered species that’s almost gone from the planet, yet there’s still so much we have yet to learn from it. That underscores the importance of saving endangered and threatened animals,” she said. “It makes us think—perhaps these endangered animals have beneficial outputs that we haven’t even thought about.”