Biofuel Potential in Panda Poop

Panda feces contains bacteria with potent effects in breaking down plant material in the way needed to tap biomass as a major new source of "biofuels" produced not from corn and other food sources, but from grass, wood chips and crop wastes, scientists reported in Denver at the 242nd National Meeting & Exposition of the American Chemical Society (ACS).

Optimizing the breakdown of raw plant materials used to make biofuels is a major hurdle facing the viability of the biofuel industry. "We hope our research will help expand the use of biofuels in the future and help cut dependency on foreign oil. We also hope it will reinforce the importance of wildlife conservation." said study co-author Ashli Brown, Ph.D.

Brown pointed out that bacteria from the giant panda are particularly promising for breaking down the super-tough plant material known as lignocellulose in switch grass, corn stalks and wood chips. That advance could speed the development of so-called cellulosic biofuels made from these tough plant materials in a way that doesn't rely on precious food crops such as corn, soybeans and sugar now used for making biofuels, she noted.

Scientists have long known that giant pandas — like termites and cattle — have bacteria in their digestive systems to break down the cellulose in plants into nutrients. Bamboo constitutes about 99 percent of the giant panda's diet in the wild. An adult may eat 20-40 pounds of bamboo daily — leaves stems, shoots and all. Until the energy crunch fostered interest in biofuels, however, scientists never thought to parse out exactly what microbes in the giant panda gastrointestinal system were involved in digestion.

Brown and colleagues, including graduate student Candace Williams, collected and analyzed the fresh feces of a pair of male and female pandas at the Memphis Zoo for over a year. They identified several types of digestive bacteria in the panda feces, including some that are similar to those found in termites, which are renowned for their ability to digest wood.

"Our studies suggest that bacteria species in the panda intestine may be more efficient at breaking down plant materials than termite bacteria and may do so in a way that is better for biofuel manufacturing purposes," said Brown, who is with Mississippi State University.

Based on other studies, Brown estimated that under certain conditions these panda gut bacteria can convert about 95 percent of plant biomass into simple sugars. The bacteria contain enzymes — highly active substances that speed up chemical reactions — so powerful that they can eliminate the need for high heat, harsh acids and high pressures currently used in biofuel production processes, she said. Those processes also tend to be time- and energy-intensive, as well as expensive. Panda bacteria could therefore provide a faster, cleaner and less costly way to make biofuels.

Brown is currently trying to identify every intestinal bacterium in the giant panda in order to isolate the most powerful digestive enzymes for biofuel production and other purposes. She noted that scientists could use well-established genetic engineering technology to put the genes that produce those enzymes into yeasts. The yeasts then would produce the enzymes and could be grown on a commercial scale to provide large amounts of enzymes for a biofuel industry.

"The discovery also teaches a lesson about the importance of biodiversity and preserving endangered animals," Brown said, noting that less than 2,500 giant pandas remain in the wild and about 200 are in captivity. "Animals and plants are a major source of medicines and other products that people depend on. When we lose them to extinction, we may lose potential sources of these products."