

Biorefining of corn brings gelatin production into the 21st century

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Scientists are reporting an advance toward turning corn plants into natural factories for producing gelatin to replace animal-sourced gelatin widely used by the pharmaceutical industry for manufacturing capsules and tablets. The advance, described today at the 234th national meeting of the American Chemical Society, may lead to a safe, inexpensive source of this protein for manufacturers who now rely on material obtained as a by-product of meat production.

Today, production of gelatin, a jelly-like substance, relies on the same fundamental methodology employed since commercial production began in the 17th century: Gelatin is derived from the break-down of collagen, which is a component of skin, tendon, bone, cartilage and connective tissue of animals. While there are no naturally occurring plant sources of gelatin, scientists have successfully modified plants, such as corn, to have a gene that results in the production of “recombinant” gelatin.

About 55,000 tons of animal-sourced gelatin are used every year to produce capsules and tablets for medicinal purposes. Plant-derived recombinant gelatin would address concerns about the possible presence of infectious agents in animal by-products and the lack of traceability of the source of the raw materials currently used to make gelatin. However, finding ways to recover and purify recombinant gelatin from plants has remained a challenge because only very low levels accumulate at the early stages of the development process.

Now, scientists at Iowa State University in Ames and FibroGen, Inc., in

South San Francisco say they have developed a purification process to recover these small quantities of recombinant gelatin present in the early generations of transgenic corn. The method uses a four-step recovery system to separate the recombinant protein from other corn proteins with sufficient purity that its structure and composition can be verified, says Charles Glatz, Ph.D., a chemical engineer at Iowa State University who directed the work.

“Protein production from transgenic plants is a challenging process, with potential pitfalls all along the way,” Glatz says. “It is important to develop methods in the early stages of the development program to purify gelatin to demonstrate that it can be produced properly.”

The studies establish transgenic corn as a viable way to produce gelatin and potentially other products, Glatz says. In time, researchers may also be able to develop a variety of “designer” gelatins, with specific molecular weights and properties tailored to suit various needs of products containing gelatin.

“Corn is an ideal production unit, because it can handle high volumes at a low cost,” he says. In addition the recombinant gelatin is free from the safety concerns of using meat byproducts.

The purification process relies on chromatographic and filtration techniques, building upon methods developed by FibroGen to recover recombinant gelatin produced in yeast.

Glatz says ultrafiltration allowed the group to take advantage of the size difference between the recombinant protein and other corn proteins.

“This step greatly reduced the process volume for later chromatographic steps, and was crucial to achieving a high purification factor.”

The group is now working to refine the method and boost the overall recombinant protein yields in corn, he says. Though the procedure requires more testing, Glatz says the technique could someday be used to produce high-grade gelatin in a safe and inexpensive manner.

Overall costs could be further reduced by combining the production of gelatin in corn with the extraction of non-protein parts of the grain — such as oils and starches — that are now grown and harvested for biodiesel and ethanol production, he adds.

“Corn wouldn’t be planted for its gelatin alone, but those products could help off-set the cost of biorefineries that use corn to produce other products,” he says.

Cheng Zhang, a doctoral student at Iowa State University, presented details of the new purification process at the American Chemical Society meeting.

Source: American Chemical Society

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