BATON ROUGE — For a long time, the tail has wagged the head of the fierce-looking crawfish in its economic and culinary importance to Louisiana. But a LSU discovery could change all that.

LSU scientists say they have cloned an enzyme that can digest a plastic-like substance found in the exterior skeleton of shellfish and turn it into a valuable high-tech industrial compound.

The development puts dollar signs not only in the mounds and mounds of crawfish heads and tails that Louisianans throw away each year, but also in the shrimp and crab shell wastes which each year amount to some 25,000,000 pounds in the Bayou State alone.

LSU scientists made the breakthrough with the cloning of the enzyme known as “chitinase,” says LSU biochemistry department chairman Roger Laine. The enzyme digests its natural crustacean target, a substance known as “chitin,” and breaks it down into a nitrogen-rich sugar compound. The compound, which has special uses in high-tech industrial processes, currently sells for $10 a pound, according to the LSU researcher.

“We jumped up and down and broke out the champagne when we saw the results,” Laine said of the breakthrough which came after two years of research. LSU quickly put the papers through for a patent on the process.

Its possible uses go far beyond chemical industrial applications, Laine said. “You can grow yeast on the sugar to produce single-cell proteins for use as a food supplement for poultry and in aquaculture.”

The sugar produced is more complex that common glucose. It has “bound nitrogen,” which makes it an excellent nutritive agent. “In order to grow any organism, you need a source of nitrogen to generate protein.”

“The gene also acts as an anti-fungal agent,” he said. That opens up possibilities for researchers to probe its use to increase plant resistance to fungal infections.

Project member Dr. Jesse Jaynes, an LSU plant geneticist who recently announced inroads in putting protein into the potato, is already pursuing the plant anti-fungal research, Laine said.

The shell waste used in the LSU research came from a Henderson plant which had already extracted an expensive food colorant from crawfish shells. The extraction process for the colorant, which is high in vitamin A, was developed by LSU food scientist Sam Meyer in 1984.

Funding for the cloning research came for LSU’s Sea Grant Program ($85,000) and the Louisiana Biotechnology Program ($35,000).

The gene was cloned from an ocean scavenging “vibrio” bacteria that has long been known to degrade the chitin of dead crabs, shrimp, and lobsters in nature, the researcher said.

The next step in the LSU research is to engineer methods to “super-produce” the chitinase enzyme for eventual commercial uses. With adequate funding, a commercially feasible pilot plant could be developed within two years, Laine predicted.

The cloned enzyme is very tough and highly resistant to harsh environments, making it ideal for use in industrial application. The enzyme has all the traits of its original form in the vibrio bacteria. It thrives in high-salt, high-acid or high alkali, and high-temperature conditions.”

The sugar, known as “N-acetyl glucosamine,” could be used as a precursor or a starter in the chemical industry, Laine said. Certain high-tech chemical industries require that elements be structured within a specific molecular space so that certain processes can be initiated to produce a desired end product. Such industries are involved in the production of drugs, pesticides and other biological agents.

Industry has not widely used the sugar compound because it is so expensive. However, the LSU breakthrough could make its industrial use economically feasible. Given an abundant supply of the chitin-digesting enzyme, the market price for the sugar compound would be considerably lower, Laine noted.

“Next to cellulose in plants, chitin forms one of Earth’s most abundant supplies of renewable resources from living matter. The seas are teeming with organisms that have chitin as exterior skeleton.”

Chitin comprises 25 percent of all crawfish, shrimp, and crab, Laine said. Some 100,000,000 pounds of these seafood species are produced in Louisiana alone. Eighty percent of the crawfish, for example, is thrown away. Disposal of such waste is expensive and a continuing environmental problem.

Most of the LSU laboratory work was carried out by Dr. Chin Y Ou, a molecular biologist and his associate, Dr. J. Y. Lo, both in Dr. Laine’s research group.