Clam Holds Secret All Along—

Disposal from Clam Processing

Seeking a solution to the problem of disposal of waste from surf clam processing, a Sea Grant researcher has discovered a versatile enzyme that holds promise for dissolving dental plaque, improving beer-brewing processes, and breaking up molds in the blood vessels of burn victims.

The scientist is Dr. Robert Shallenberger of Cornell University's New York State Agricultural Experiment Station at Geneva. New York's Sea Grant Program is supported by the Commerce Department's National Oceanic and Atmospheric Administration, and by the State of New York through the State University of New York and Cornell University.

Several years ago, Dr. Shallenberger began seeking solutions to the increasingly serious problem of what to do with the leftovers of surf clam processing. Traditionally, processors have disposed of wastes, such as shells and digestive tracts, in nearby oceans, bays, and estuaries.

Pollution control regulations now are forcing the processors to find other methods of disposal or develop commercially profitable products from the leftovers.

Dr. Shallenberger, an enzyme chemist, reasoned that the clam must have a digestive enzyme capable of breaking down carbohydrates in the marine plants that are its food.

Although carbohydrates in most terrestrial animals and plants differ from marine plant carbohydrates, some are similar and can be broken down by enzymes such as those in the clam's digestive tract.

If these digestive enzymes could be isolated, processed, and packaged at reasonable cost, Shallenberger believed, they might be useful and marketable.

In 1973, he identified the surf clam's major active enzyme as a gluconase that digests relatively resistant carbohydrates with linkages similar to those of marine plants. The enzyme, laminarinase, breaks down the natural polysaccharide, laminarin, into a highly soluble and digestible simple sugar component.

A private processing firm—the Shelter Island Oyster Company, which prepares and packs surf clams—is cooperating in Shallenberger's research. The company uses only the clam foot and formerly discarded the digestive tract, thereby wasting up to 20% of the animal's body tissue.

Today, it provides clam bellies for the project, and test samples of the enzyme are produced in the laboratory. The product is marketed by Calbiochem, a San Diego firm, in research quantities. So far, the processor has realized $1,200 on he raw materials—the first financial return it has ever received for this former waste product.

"Although the enzyme constitutes only a tiny fraction of clam wastes," Dr. Robert B. Abel, director of NOAA's Office of Sea Grant, points out, "It promises to become a significant part, scientifically and economically."

Now that the enzyme is available for research, several potential uses are being examined.

Studies at Western Michigan University indicate that the enzyme seems to have anti-leukemia activity. According to one theory, the carbohydrate-protein structure of the cancerous cell wall apparently has the carbohydrate grouping found in marine plants, and will therefore partially break down in the presence of the enzyme.

Breweries in the United States and Germany have found that the enzyme works effectively to dissolve carbohydrates clogging their filters.

Dr. Shallenberger believes that the enzyme, added to toothpaste, would dissolve the thin invisible film of plaque that forms on teeth, hardens into tartar, and becomes a major dental problem.

Another possible use, he suggests, is for dissolving the network of threadlike tubes in a mold that develops in blood vessels of severely burned persons. This mold resits the drugs used to control gangrene and can lead to death unless it is counteracted.

Dr. Shallenberger's project is continuing work on the development of less complex techniques for processing the clam wastes and attempting to produce a very pure enzyme extract for medical studies.

If commercial applications for the enzyme increase and industries come to need large amounts of it, the Sea Grant scientist may examine other marine organisms for additional sources of the enzyme.

The original problem—what to do with surf clam wastes—is still not fully solved. Shelter Island Oyster Company has been experimenting with some possible uses—in pet foods or to enhance the flavor or nutritive value of food products. Dr. Shallenberger plans to study the potential of clam wastes as fertilizer for upland beets.