Exploring a New Industry

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Science is essential to helping develop the Philippine market. Research and development can help us leverage our natural resources to create products, which will generate jobs, bring in money, and make the country less reliant on imports.

Researchers from the National Institute of Molecular Biology and Biotechnology, University of the Philippines Diliman and the University of the Philippines Los Baños have been doing research that could help the Philippines gain a foothold into a new industry: producing enzymes. Currently, the Philippines spends roughly $15 million on importing enzymes for use in different industries. Creating a local enzyme production industry will help save the cost of importing these important substances and create more opportunities for Filipino workers and scientists.

Enzymes are a class of molecules that are produced living organisms, which help make chemical reactions faster or more intense. In humans, enzymes used for everything from expressing our genes, helping create new cells, our immune response, and many more incredibly important processes, in every part of our bodies.

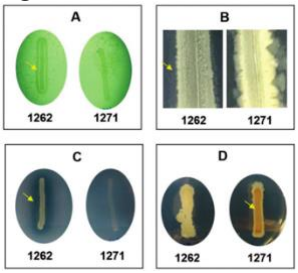
Plants, animals, and microorganisms all produce different kinds of these enzymes, and enzymes can be extracted from these organisms. Because these enzymes are responsible for catalyzing a many different chemical reactions, they have many industrial applications. Enzymes are used in many types of work, like scientific work where they are used for experiments; manufacturing, where they are used to create and treat products; and even food production.

This research, published in the *Philippine Journal of Science*, studied a particular species of bacteria called *Bacillus pumilus*. This species is commonly cultivated for the industrial extraction of their enzymes because they are heat resistant, making them able to thrive in industrial environments.

The researchers were studying local strains of this species, to see if they produced similar enzymes to strains found in other countries. The enzymes they were hoping to find were: serine alkaline protease, which is one of the most commonly used enzymes and used for the production of leather, food products, and pharmaceuticals; lipase, used in pharmaceuticals and food; pectate lyase, which is added to beverages; and laccase, an additive to food and drinks like wine and beer.

The study focused on four local strains of *B. pumilus*: one from Taal in Batangas, one from Camarines Norte, and two from a hot spring in Laguna. The scientists extracted the DNA of these strains, looking for genes that would code for serine alkaline protease, lipase, pectate lyase, and laccase.

One of the methods that the scientists used to detect these genes was the polymerase chain reaction, or PCR. PCR is a procedure that artificially creates conditions that allow extracted strands of DNA to replicate over and over again.



The qualitative tests the researchers used to determine the presence of enzymes. These compare strain 1271 (which produced laccase) and strain 1262 (which produced the other three enzymes).

allowing it to be studied and manipulated more easily. PCR can also be targeted, to only multiply a certain segment of DNA. In this case, the scientists programmed it to multiply genes that were similar to the ones that code for the target enzymes in other strains of *B. pumilus*.

After the DNA was run through PCR, the multiplied genes were sequenced, to see if any of them matched existing protease, lipase, pectate lyase, or laccase genes.

Using genetic databases and software to compare DNA sequences, the scientists were able to find genes for all four enzymes in all four bacterial strains. However, not all genes present in an organism are expressed. After establishing that the genes for these enzymes were indeed present, the researchers had to test which of these strains actually produced which enzymes.

To do this, the scientists cultivated the bacteria in different petri dishes. Each dish was filled with a substance which would allow the bacteria to grow, as well as different sets of chemicals, which were designed to react to the presence of different enzymes. By observing the chemical reactions in each dish as the bacteria grew, the researchers were able to figure out which strains actually produced the enzymes.

After all the testing, the team discovered that alkaline serine protease, lipase, and pectate lyase were produced by all but one of the four strains of *B. pumilus*. The strain that did not produce those enzymes, however, did produce laccase, which was not produced by any of the other strains.

Through PCR, a small amount of DNA extracted from an organism can be multiplied exponentially,

These results are extremely promising, leaving the door open for further research into how small genetic variations found in the genes for these enzymes could affect their function, how effective the enzymes will be compared to the industry standards, and how to locally cultivate them for industrial use.

Research into these areas are necessary first steps into establishing a local enzyme production industry, and helping make the Philippines more competitive in global science, research and development, and industry.

REFERENCE

Malit JJL, Hedreya CT. Detection and sequence analysis of enzyme genes of four thermo-toleran *Bacillus pumilus* strains from the Philippines. Philipp J Sci 2018; 147(2):239-248.

Luis Wilfrido Atienza graduated from the Ateneo de Manila University, with a BS in Biology, and a minor in poetry. He currently works as a copywriter for a sustainable agency, and spends some of his free time writing about science.