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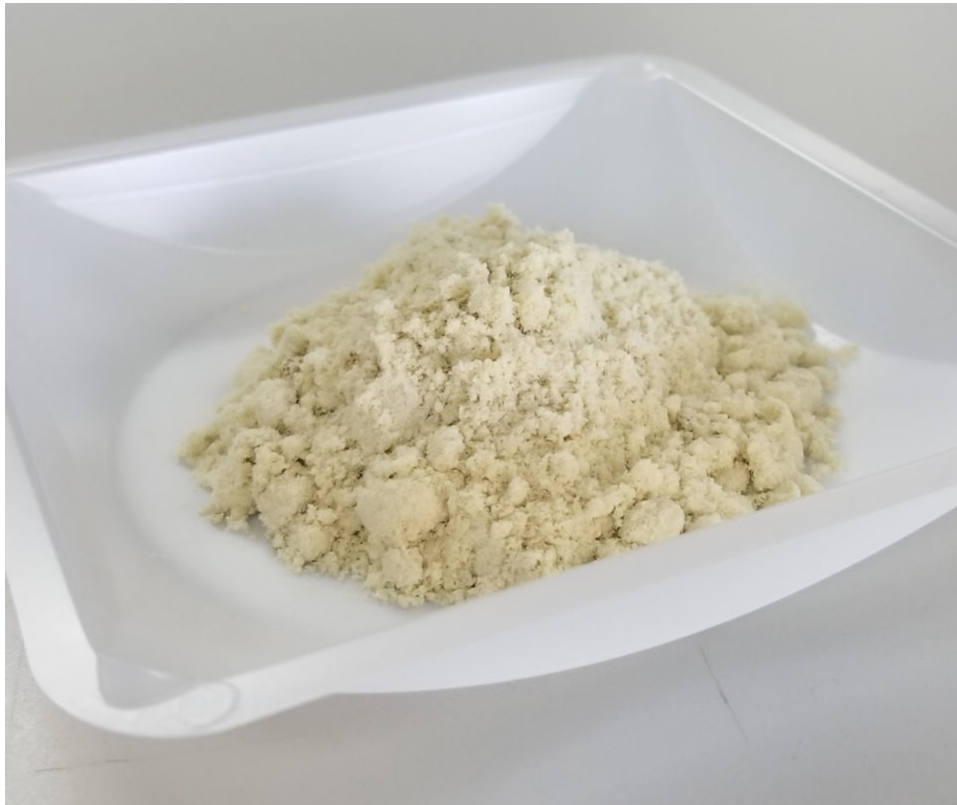
 Aquafeeds

U.S. biotech firm targets shrimp with SCP ingredient

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By Lisa Jackson

ProTyton, a single-cell protein feed ingredient, demonstrates potential to boost survival, growth and disease resistance



ProTyton, developed by White Dog Labs, is an anaerobically produced single-cell protein aquafeed ingredient.

Courtesy photo.

Researchers in Canada have just successfully completed a shrimp challenge. Not an eating contest or a limited-time offer at Red Lobster, but a potentially big step forward for aquaculture nutrition.

Scientists at **The Center for Aquaculture Technologies in Canada** (<http://aquatechcenter.com/>) (CATC) independently tested the potential benefit of ProTyton – an anaerobically produced single cell protein feed ingredient – for cultivated shrimp. After 18 months of trials, early findings suggest that this new ingredient could be a cost-effective and sustainable product with possible perks for a global industry worth up to \$15 billion a year.

"This ingredient not only provides nutrients that matter, but also seems to contribute to the health and immunity of the species we have investigated so far," said Dr. André Dumas, director of fish nutrition at CATC. "Indications are that ProTyton can be an excellent ingredient for enhancing shrimp survival, growth and health."

As Dumas elaborated, the early results are extremely encouraging: In preliminary four-week shrimp feeding trials, ProTyton inclusion at 10 percent and 15 percent (with a single replicate per treatment) doubled survival rates (to more than 80 percent compared to a commercial reference diet), and increased weight gain by more than 50 percent. The product proved to be highly digestible and performed well in multiple aquaculture diets.

Moreover, an additional study demonstrated that inclusion of ProTyton into a CATC reference diet reduces mortality of Pacific white shrimp (*Litopenaeus vannamei*) compared to a commercial diet when challenged by *Vibrio parahaemolyticus* – the etiological agent of the destructive disease Acute Hepatopancreatic Necrosis Disease (AHPND), commonly referred to as EMS, or Early Mortality Syndrome.

"It was a very positive, encouraging response we saw," said Dumas.



White Dog Labs is based in New Castle, Del., USA. Courtesy photo.

Before this newfangled technology went under the microscope at CATC, ProTyton was developed and scaled up by **White Dog Labs** (<https://www.whitedoglabs.com/>) (WDL), a biotechnology company headquartered in New Castle, Del., USA. ProTyton is currently being produced using a 5,000-gallon fermenter at WDL's Delaware pilot facility, and since it's an anaerobically based technology, WDL's CEO predicts that it could help address "cost and scalability" issues within the shrimp farming industry.

"Other single-cell protein technologies [being advanced] in commercial markets are largely aerobic-based technologies," said Bryan Tracy, WDL's CEO. "Historically, those types of processes that use oxygen have to be practiced at smaller scale and have to make higher-value products, because it's overall a more expensive process."

"There have been, historically, a number of proposed technologies to make single-cell protein products for animal feeds," he added. "A really large question has always been: Are those technologies scalable to produce the quantities that this industry demands?"

Naturally, WDL needed to be armed with evidence before moving forward. Eighteen months earlier, WDL partnered with CATC to independently evaluate the ingredient, starting with testing ProTyton incorporation in salmon feed.

"Preliminary results indicate[d] that we can reduce the overall cost of the diet while maintaining high amino acid digestibility values," said Dumas. "We accomplished this by replacing half of the 20 percent fishmeal in the control diet with a smaller amount of ProTyton to balance the crude protein and essential amino acids levels. We then decided to test ProTyton's health benefits with post larval shrimp, due to the high variability in the survival rate of shrimp in this phase of their growth."

In the second phase of trials, CATC retreated back into the lab and examined ProTyton's effect on shrimp survival.

"We did a control diet of typical post-larval feed for shrimp and got around 47 percent survival," said Dumas. "With the ProTyton, at 10 and 15 percent inclusion, we went up to more than 85 percent survival."

With such an "encouraging" response, CATC went one step further and assessed ProTyton's impact on shrimp immunity. Calling it the "AHPND challenge," they acclimated shrimp to various diets over three weeks.

"We did a preliminary study where we challenged the shrimp on different diets," said Dr. Mark Braceland, director of fish health at CATC. "We took the shrimp that were fed the non-enriched diet with 0 percent ProTyton and then some different inclusion levels of ProTyton, and compared to a commercial control that is currently fed in the marketplace to the [Pacific white] shrimp."

The shrimp were then challenged with *Vibrio parahaemolyticus*, a bacterium that Braceland estimates costs the industry more than \$1 billion globally each year. Tested diets included a commercial diet that was optimized for shrimp disease resistance, a CATC reference diet and four test diets with up to 20 percent inclusion of ProTyton in the CATC diet. After monitoring survival over the course of a week, the preliminary results turned up favorable.

"When shrimp were fed ProTyton-containing feeds, it perform[ed] as well or better than commercial feeds, and consistently better than a non-enriched feed," said Braceland.

Mortality rates were 33 percent and 55 percent for the commercial and the CATC diets respectively, while the ProTyton test diets performed equal or better than the commercial diet. Three of the four ProTyton diets performed better than the commercial diet, and in two cases reduced mortality to one-third of rates accomplished with the commercial diet. Now, CATC plans to reconfirm and scale up ProTyton analysis, particularly in a model that is similar to field outbreaks.

Different forms of ProTyton for various feed applications. Courtesy photo.

"We believe these health benefits are due to the anaerobic nature of ProTyton," explained Tracy. "It is known that anaerobic SCP can also contain immunostimulating secondary metabolites and nucleotides. Moreover, our ProTyton SCP also contains low levels of butyrate, a short-chain fatty acid commonly used as a terrestrial feed additive to support gut health and reduce antibiotic use."

Looking at the findings, it's a win that could eventually help tackle some challenges faced by the global shrimp farming industry: Aside from battling various viral, bacterial and fungal diseases, there's the increasing need to find additional, innovative ingredients required to manufacture and support a **growing demand for aquafeeds** (https://www.aquaculturealliance.org/advocate/current-production-challenges-and-the-future-of-shrimp-farming/?_hstc=236403678.31b63208543cb8a3d13f7242b16e0d25.1684319592507.1684319592507.1684319592507.1&_hssc=236403678.1.1684319592508&_hs) While ProTyton isn't magic, the product has potential to broaden the industry's options.

"The opportunity we're going after is a new feed that brings performance and health benefits, while also being able to be combined with other existing ingredients, like plant-based ingredients," said Tracy. "I think the winning combination is things like ProTyton combined with soy protein concentrate or corn gluten meal – things that allow for a robust, reliably sourced, cost-effective group of ingredients."

As Tracy further explained, part of the good news story is that ProTyton could cut costs and boost access to a sustainable ingredient that may reduce the industry's dependency on wild-caught, foraged fish.

"Our internal price range allows us to sell at a price point that's very competitive to fishmeal," said Tracy. "That comes about by the sheer nature of the fact that we do animal reproduction in capital, cost-efficient facilities. We aim for similar performance to fishmeal. We bring an ingredient that can scale to millions of tons per year production scale – rapidly – and that would be able to provide a lot of price stability for this ingredient."

Before throwing a victory party, there are still hurdles to jump over before ProTyton can hit the mainstream market. WDL is focused on building its first commercial production facility, set to open in the final quarter of 2019, as well as completing customer qualifications. Presently, several major aquafeed companies in Norway and Japan are evaluating ProTyton.

"We have data sets that we share with feed formulators," said Tracy. "But they have to do their own trials in their own tanks to really get comfortable with the ingredient. So we're at that stage of the feed formulator qualifying and officially duplicating our results."

Likewise, although "current outcomes certainly exceed expectations," WDL and CATC plan to further validate early findings with a larger-scale trial, as well as expand the scope of research to include other species.

"This essentially justified to us to continue to advance to larger-scale population-type studies, more advanced digestibility and nutrition studies," said Tracy. "We need to follow up with more rigorous studies on the shrimp. We're qualifying with feed customers in Japan, and [their] markets are more interested in yellowfin tuna (*Thunnus albacares*), sea bream (*Pagrus major*), and eel (*Anguilliformes*). We need to start doing preliminary studies in those other species."

Despite the long road ahead that will undoubtedly involve more tinkering in the lab, WDL and CATC agree that ProTyton could offer "a real opportunity" in the innovative aquaculture world.

"Twenty years ago, the library of ingredients we could access was relatively low," said Dumas. "The more ingredients in the library of aquaculture feed companies, the better the security, access to healthy nutrition, and fostering the growth of the industry."

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