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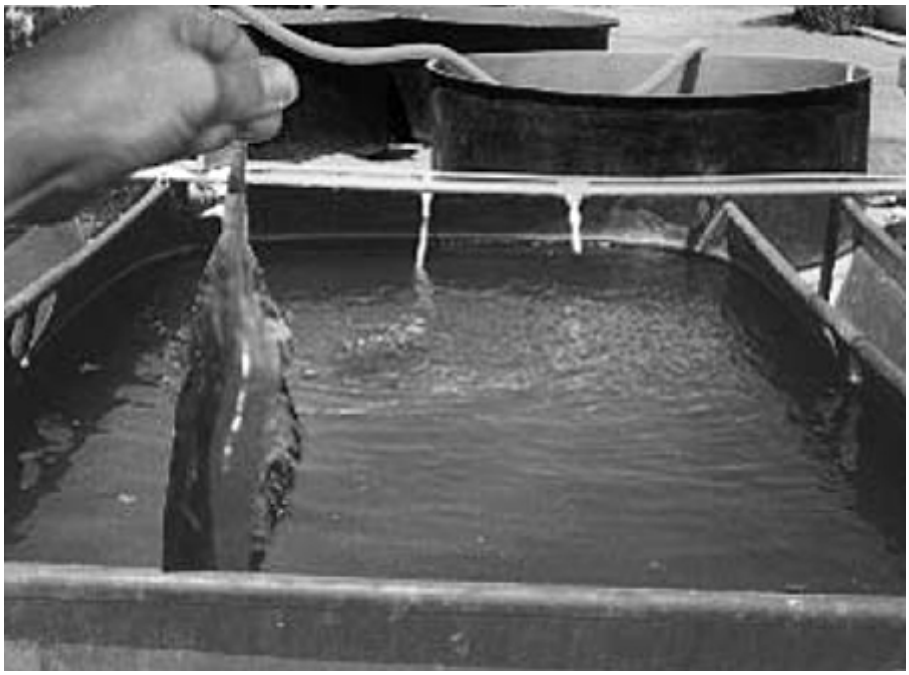
Yucca extract reduces ammonia concentrations in Mexico shrimp trial

Responsible Seafood Advocate logo
1 June 2003 Luis R. Martinez-Cordova, Ph.D. Alfredo Campaña-Torres, M.S.

Significant effect at of 3.0 grams per kilogram



Experimental shrimp received feed with varying levels of *Yucca* extract.

In shrimp aquaculture, the degradation of organic matter produces several metabolites, especially nitrogenous ones like ammonia and nitrite. Ammonia is also the main excretion product of crustaceans. At relatively low concentrations, ammonia – especially its nonionized form NH3 – is toxic for many aquaculture organisms including shrimp and can damage their organs. Low oxygen levels increase the negative effects of this metabolite.

Several strategies can be used to avoid or minimize high concentrations of ammonia in aquaculture ponds and/or effluents. These include the adequate management of water exchange and aeration, reduction of nitrogen inputs

from feed, removal of pond sludge, biological treatments such as polyculture, and the use of mangrove forests as nitrogen sinks.

Most recently, products added to the water column or feed have been used to trap or transform ammonia into innocuous metabolites. In a study, the authors evaluated the effects of one of these products, BioAquaTM, an extract of *Yucca schidigera*, on water quality and the production parameters of Pacific white shrimp (*Litopenaeus vannamei).*

Experimental setup

Twelve 4.2-cubic-meter plastic pools were each stocked with 100 juvenile *L. vannamei* averaging 1 gram in weight. A reference diet was formulated and prepared at the food technology laboratory of the University of Sonora. Four treatments consisting of different levels of inclusion of the *yucca* extract in the reference diet were evaluated by triplicate in the pools. The levels of inclusion were 0 grams per kilogram (control), 1.0 grams per kilogram (treatment 1), 2.0 grams per kilogram (treatment 2), and 3.0 grams per kilogram (treatment 3).

Feed was supplied twice a day in plastic feeding trays, and rations were adjusted according to apparent consumption. Water quality parameters were recorded in each pool during the entire experiment. Temperature and dissolved oxygen were measured twice daily at 6:00 a.m. and 1:00 p.m., while salinity and pH were recorded once daily. Organic matter and nutrients (orthophosphate, nitrite, nitrate, and ammonia) were recorded weekly. Shrimp growth was also monitored weekly. Survival, feed-conversion ratio, and final biomass were calculated at the end of the trial.

Martinez-Cordorva, Production parameters of *Litopenaeus vannamei* fed diets, Table 1

Parameter	Control	Treatment 1	Treatment 2	Treatment 3
Final weight (g)	13.06 ± 1.00^{ab}	12.45 ± 0.76^{a}	14.89 ± 0.53^{b}	11.72 ± 1.41^{a}
Weight gain (g)	11.60 ± 1.28^{a}	11.13 ± 0.46^{a}	13.50 ± 0.26^{b}	10.58 ± 1.18^{a}
Survival (%)	62.19 ± 17.62^{a}	71.20 ± 21.13^{ab}	67.72 ± 5.66^{ab}	95.72 ± 9.90^{b}
Consumed feed (kg)	$1,907 \pm 130.8^{ab}$	$1,965 \pm 90.4^{ab}$	$2,078 \pm 26^{b}$	$1,738 \pm 170^{a}$
Final biomass (kg)	819.0 ± 282.3^{a}	877.4 ± 228.7^{a}	$1,000.5 \pm 49.7^{a}$	$1,117.3 \pm 15.3^{a}$
FCR	2.32 ± 0.54^{b}	2.23 ± 0.56^{b}	2.07 ± 0.14^{ab}	1.55 ± 0.14^{a}

Table 1. Production parameters of *Litopenaeus vannamei* fed diets containing different levels of *Yucca extract*.

Results

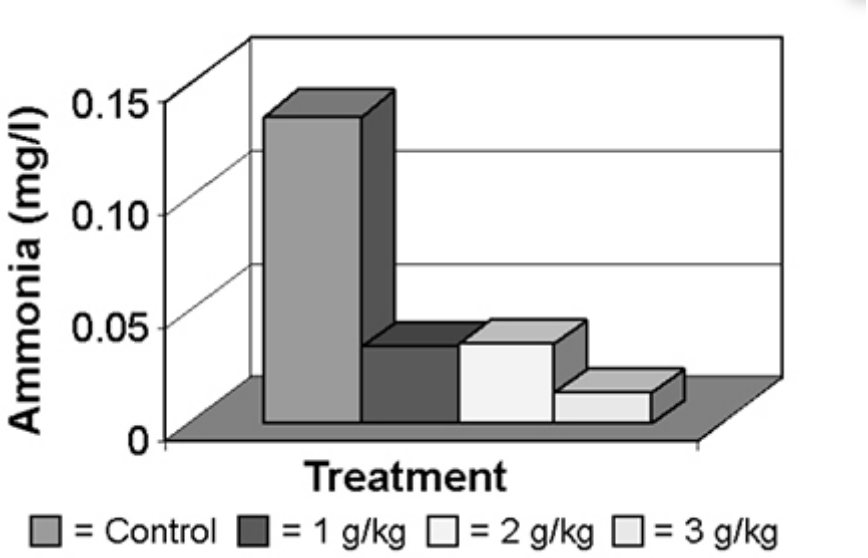


Fig. 1: Mean ammonia concentrations in the experimental treatments during the trial.

Ammonia concentration was significantly and consistently lower in the treatments that included the *yucca* extract, compared to the control. Treatment 3 recorded the lowest levels (Fig. 1). This confirmed the findings of other researchers who have worked with fish, crustaceans, and mammals using other products to minimize ammonia concentrations.

Some of the production parameters showed significant differences among treatments (Table 1). Weight gain was greater in treatment 2. However, survival and feed conversion were better in treatments 3 and 4. The low growth in treatment 3 was related to the high survival obtained in that treatment, mainly due to animal overcrowding.

Conclusion

The *yucca* extract effectively reduced ammonia concentration in the water column when given in feed to experimental shrimp. The most significant effect occurred with a concentration of 3.0 grams per kilogram of feed, but even the positive effect of 1 gram per kilogram the effect was evident. An analysis is still needed to determine what concentrations could produce the best economic results.

(Editor's Note: This article was originally published in the June 2003 print edition of the Global Aquaculture Advocate.*)*

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