PERFORMANCE OF THE PACIFIC WHITE SHRIMP *Litopenaeus vannamei* IN BIOFLOC-DOMINATED ZERO-EXCHANGE RACEWAYS USING A NON-VENTURI AIR INJECTION SYSTEM FOR AERATION, MIXING, AND FOAM FRACTIONATION

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Losses due to viral disease outbreaks and the potential negative impact from nutrient-rich water on receiving streams are two major challenges for the development of sustainable, biosecure, and cost-effective shrimp farming practices. Use of greenhouse-enclosed, super-intensive, biofloc-dominated, zero-exchange systems may alleviate these problems. Operating biofloc systems at high production levels (>6 kg/m^3) requires substantial energy to satisfy the high oxygen demand of the shrimp and the microbial communities. In 2010, in an effort to reduce production costs (e.g., lower oxygen and electricity usage) an 87-day study was conducted at Texas AgriLife to test an alternative non-Venturi injector. Two raceways (RWs) were each filled with 80 m^3 and stocked with 270 shrimp/m^3. The study showed that at the harvest biomass of 6.4 kg/m^3 the injectors were able to maintain adequate DO levels without oxygen supplementation, concluding with 90% survival, 1.4 g/wk growth and final mean harvest weight of 26.2 g. In addition, the injectors were able to provide adequate mixing throughout the water column thus eliminating the need for an air blower, air diffusers, and airlifts.
In the current study two 100 m^3 EPDM (Firestone Specialty Products, Indianapolis, IN) lined RWs were each filled with a mixture of seawater (55 m^3), municipal chlorinated freshwater (10 m^3), and biofloc-rich water (35 m^3) from a previous nursery study. RWs were stocked (390 shrimp/m^3) with juvenile (1.90 g) Taura resistant *L. vannamei* from Shrimp Improvement System, Islamorada, FL. To provide aeration, mixing, and circulation, a total of 14 non-Venturi injectors were positioned parallel to the direction of flow along the bottom of each RW wall. In addition, one nozzle was used to power a home-made foam fractionator to enable the removal of particulate and dissolved organic matter, originally targeting TSS and SS levels in the ranges of 200-300 mg/L and 10-14 ml/L, respectively. The target TSS levels were increased (Day-30) to 400-500 mg/L in hopes of lowering the FCRs. Shrimp were fed a 35% CP diet (Hyper-Intensive-35, Zeigler Bros. Gardners, PA). Chlorinated freshwater was added weekly to maintain salinity, and RWs were maintained with no water exchange. Alkalinity was adjusted to 150-200 mg/L (as $CaCO_3$) using sodium bicarbonate and agricultural lime. Each RW was equipped with a DO monitoring system (YSI 5200, YSI Inc., Yellow Springs, OH). Water temperature, salinity, DO, and pH were monitored twice/d. TAN, NO_2-N, NO_3-N, alkalinity, SS, turbidity, TSS, VSS, and $cBOD_5$ were monitored at least once a week. Based on sampling data collected on Day-60 TAN and NO_2-N remained very low (<0.5 mg/L), shrimp averaged 16.7 g in weight, grew 1.57 g/wk, with a biomass of 6.35 kg/m^3 and an estimated FCR of 1.6:1. Thus far each RW has achieved an estimated total biomass of 635 kg (6.35 kg/m^3) supported until this point by one 2 HP pump without supplemental oxygen. A second 2 HP pump was available to provide additional aeration if DO levels drop below 4.3 mg/L for an extended period. RWs will be harvested when mean weights reach 25 g. This presentation will summarize the results obtained in this study.