

ABSTRACT

Among various inputs in shrimp aquaculture, feed is considered as one of the major decisive factor, sharing more than 60% of the total operating cost. Few feed manufacturing companies are engaged in producing good quality feed, using only pellet press technology. Extrusion cooking technology with its various advantages has not yet been much used in this field. An indigenously developed laboratory scale single screw extruder was used in the present investigation to study the extrusion characteristics of shrimp feed mix. The shrimp feed formula was developed for juvenile tiger shrimp, *P. monodon* from the quality raw ingredients available in indigenous market. The inclusion percentage of fish meal, shrimp head meal, squid meal, wheat flour, deoiled rice bran, defatted soyabean meal and fish oil in the formula were 29.373, 10.0, 5.0, 28.252, 4.005, 15.0 and 2.27, respectively. The process variables selected for the study of extrusion cooking were screw speed (20 to 140 rev/min), L/D ratio (8 to 16), barrel temperature (60 to 100 °C) and feed mix moisture content (20 to 60%). Experiments were statistically designed, following Response Surface Methodology, to study the effect of process variables and their combined effect on the extrudate characteristics. Performance characteristics of the extruder was studied with respect to volumetric flow rate. It was found that the flow rate was significantly influenced by all the process variables selected with positive correlation. However, the theoretical flow rate model, developed previously for Newtonian flow, over-predicted the flow. Three important extrudate characteristics studied were water stability, expansion ratio and true density. The water stability could be maximised at 90.3% with the screw speed = 92 rpm, L/D ratio = 13.7, barrel temperature = 94.4°C and feed mix moisture content = 35.4%. Water stability was significantly affected by the L/D ratio and barrel temperature, whereas screw speed and feed mix moisture content exerted lesser effect. The expansion ratio of the dry extrudates varied between 0.845 and 0.982. Results showed that expansion of extrudates was strongly influenced by L/D ratio and feed mix moisture content. The true density of the extruded feeds were found higher than that of the sea water density and, hence, the production of sinking type of feed could be achieved. Results showed that true density was strongly influenced by L/D ratio, barrel temperature and moisture content. Comparative study of the

feeds performed equally well for all three product characteristics whereas, the mincer feed failed to produce a good water stable feed. The performance of extruded feed studied in an aquarium culture trial, in terms of weight gain, FCR, SGR and PER, was not significantly different from that of commercially available imported feed pellets, but was observed better than that of mincer pellets.