Indigenous Re-circulatory Aquaculture System (i-RAS) developed for fish nutrition research

*D. Linga Prabu[1], S. Ebeneezar[2], S. Chandrasekar[3], P. Sayooj[2] and P. Vijayagopal[2]

[1]Tuticorin Research Centre of ICAR-Central Marine Fisheries Research Institute, Thoothukudi
[2]ICAR-Central Marine Fisheries Research Institute, Kochi
[3]Mandapam Regional Centre of ICAR-Central Marine Fisheries Research Institute, Mandapam
**e-mail: prabufnbp@gmail.com*

Fish nutrition research is an integral part of aquaculture research. The nutrition research requires a well equipped wet laboratory to conduct research in an effective manner for acceptable research findings. Adequate quantity and quality of water is a prerequisite for research in aquaculture. Also, maintenance of water quality parameters in the optimum range is crucial for the well-being of fish kept in the experimental system. An appropriate filter assembly can maintain the quality of water within the acceptable limits and simultaneously reduce the usage of water. Therefore, an indigenous re-circulatory filtration assembly was set up using 1.25 t capacity rectangular FRP tank (2×1×0.6 m^3) for conducting fish nutrition experiments. The tank was partitioned into five compartments using 10 mm thick glass slabs fixed to the inner walls of FRP tank using silicone gel. The partition may also be done by FRP sheets of 5 mm thickness for better pressure proof during the course of operation. The first compartment was filled with multi layers of bio-sponges in varying pore sizes which helps in the filtration of undissolved and suspended particles from the outlet water. The second partition was filled with bio-balls and ceramic bio-rings which harbors beneficial bacteria for nitrification and de-nitrification process that will reduce the ammonia load in the system. The third compartment was packed with coral sand and oyster shells which complement the role of bio-balls and additionally maintains the pH of the system without much fluctuation. The fourth section was filled with wood charcoal in a net bag for easy handling and cleaning which effectively removes chlorine, volatile organic compounds, odour and improves the clarity of water through adsorption process. The fifth partition was designed for the collection of filtered water at least 500 L capacity. In this compartment, a submersible pump (115W) with an output capacity of 5000L h^{-1} was kept for pumping the filtered clean water to experimental tanks. Further improvement in filtration efficiency is possible by the installation of indigenous type protein skimmer and UV lamps in the filtration chamber which is effective in reducing the organic as well as microbial and parasitic loads in the system.

A battery of 12 numbers of 200 L capacity glass aquarium tanks or FRP tanks can be connected to one indigenous filtration assembly of 500 L filter water capacity for effective operation of re-circulating aquaculture system. Water supply to the experimental tanks was made through nozzles (2 mm) made in PVC pipe (25 mm diameter.) kept on the top of the tank. The inlet water sprinkled on the top of the experimental tanks serve the function of mixing and aeration of water in the tanks.

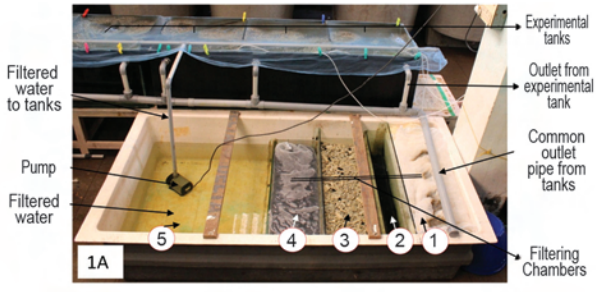

Fig. 1. Filter assembly showing different components (Numbers 1-5 indicates respective compartments) of indigenous Recirculatory Aquaculture System (i-RAS)

Circulated water leave the tanks through outlets fitted on the top corner of the tanks and will be collected in the common outlet pipe which leads to the first compartment of the filter assembly, which gets filtered through different compartments and subsequently gets collected in the fifth compartment (Figs. 1 & 2). Water circulation can be maintained round the clock at a flow-rate of 5 L min^{-1} in each tank. The first compartment of the filter filled with sponge bags and sponge mat were routinely (weekly) taken out, cleaned, dried and replaced with cleaned sponge bags. The components of rest of the compartments were cleaned and replaced on a monthly basis. It is also advisable to siphon the tanks if uneaten feed remains in the tank even after the stipulated time for normal feed consumption, which may reduce the overall load to the filtration assembly. At the time of feeding, water circulation should be stopped for effective feeding, to reduce feed leaching and also for better observation of fishes and feeding activity.

Fig. 2. Indigenous RAS in operation

The experimental tanks should be covered with 20 mm mesh size nylon braided nets to protect the fishes from predatory birds enters inside the laboratory and also to prevent the fishes from leaping out of water. During the initial stages of culture experiment until the fish reaches up to 10 g size, the outlets should be fitted with small sized mesh nets (10 mm) to prevent the escape of fish through the outlet. Under high stocking density, the water circulation should be maintained continuously. Any break in water circulation for more than 3 hours results in severe anoxic conditions in the experimental tanks, which further leads to stress that cause release of copious amount of mucous and sloughing of mucous from the skin. This occurs in most of the marine food fish species which are highly sensitive. Subsequently the fish becomes prone to any opportunistic pathogenic infections. Hence, the type of system mentioned here can be considered ideal for conducting nutrition experiments in marine fish in the weight range of 5 to 250 g.