第四届

“全国石斑鱼类繁育与养殖产业化”论坛

论文与摘要汇编

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目　录

Design of a multi-functional equipment for recirculating mariculture

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1. Introduction

Adoption of recirculating aquaculture science and technology enable the farmers of high-value marine species such as grouper, to provide product throughout the year, make full use of aquaculture facilities, shorten the farming cycle, reduce wastewater and sewage, and mitigate the dependence on the natural climatic and environmental factors.

Traditionally recirculating aquaculture system consisted of a combination of water treatment equipments which were operated uniquely for mechanical filtration, or foam separation, or biological treatment, etc. Meanwhile, those combinations of equipments often resulted in decreased water treatment efficiency. Overall the shortcomings of the old fashioned recirculating technology includes: (1) the various water treatment equipment with single function resulted in requirement of large space for the bulky system; (2) different technical standards of various water treatment equipment resulted in increased difficulty for installation and maintenance of water treatment system; (3) the number of water treatment equipment entailed the high investment and cost of energy consumption. A cost-effective facility has been designed for family breeding programs of marine organisms (Weijie et al., 2011). We have designed a multi-functional equipment for recirculating mariculture for high value shrimp and fish species (Xiaoyong et al., 2012).

2. Equipment design

The design of the multi-function equipment for recirculating mariculture is shown in Fig.1. The operation of the multi-function equipment could be listed as the following:

Aeration process: The water in the culturing pond was pumped through a centralized bottom discharge pipe, flowed into the potential aeration device, in which the flow rate of the water

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increased and resulted in negative pressure behind the air intake tube and formed water-vapor mixture. Thus the dissolved oxygen increased without energy consumption.

Filtration and automatic discharge process: The water from the bottom of the culturing pond contains large numbers of granule. The majority of faeces granule and feed residue were filtered by filtration screens and then flowed along the slope of the funnel into the sewage system automatically. The height of water level in the overflow pipe kept the water level of sewage system remaining to a relatively high degree that large particles in the water aggregated and deposited at the bottom. When the particles accumulated to a certain height, the control valve automatically opened and discharged.

Biological treatment process: The water that has been filtered by filtration screens flow through holes of the biological treatment chamber meanwhile the hydraulic residence time increase. Nitrifying bacteria attached to the biological filler utilize ammonia-nitrogen as an energy source for growth, and nitrobacter bacteria, which also presented in biological filters, utilize nitrite-nitrogen and produce nitrate as a by-product. Usually aquatic species can tolerate extremely high level of nitrate-nitrogen.

Foam separation processes: In the treatment system foam forms during aeration process for the first time, and its number increases through filtration mesh, then cut into fine bubbles by biochemical filler. Suspended solids and protein in the water were absorbed by fine bubbles, discharged through collecting pipe.

Back-washing process: when the filter screens (2) clogged, pressure sensor (10) sends signals to the controller (9) and Back-washing process start automatically.

Sterilization process: The ozone generated by the ozone generator was mixed in the water to be treated during the water flow process in the equipment. Ozone is an effective antagonist to the viability of an enormous range of pathogenic organisms.

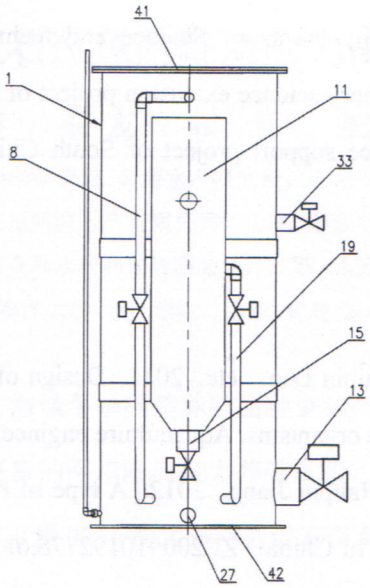

Fig.1. Schematic lateral diagram of the equipment: (1) outside tank; (8) separate flow pipe; (11) sewage-drain device; (13) exhalent tube; (15) sewage-drain tube; (19) overflow pipe; (27) emptying tube; (33) diversion pipe; (41) crown plate; (42) bottom board.

3. Advantages and application potentials

Compared with the traditional recirculating equipment the multi-functional water treatment equipment has the following advantages:

I. This equipment serves several water treatment functions with only one device of relatively small volume, including foam separation, aeration, mechanical filtration, etc.

II. This equipment consumes relatively less energy, reducing the cost for operation and maintenance.

III. Aeration process was realized without power consumption.

IV. Foams formed and cut into tiny bubbles, which promoted water treatment efficiency without additional energy consumption.

V. The high level of treatment efficiency was insured by automatic back-washing system.

The present equipment has direct application potential in recirculating mariculture especially for high value species such as grouper. It successfully balances the preciseness and cost of shrimp and fish culture in the up-tide pond, as well as the small scale of family breeding programs.

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References

Weijie zhang, Chong Zhao, Shibin Luo, etc. 2011. Design of a cost-effective facility for family breeding programs of marine organisms. Aquaculture engineering 45, 146-147.

Xiaoyong Xie, Chunhou Li, Hanpin Jiang. 2012. A type of multi-functional recirculating water treatment equipment. Patent of China: ZL200910192778.6.