Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i16.2446

# SHRIMP WASTEWATER TREATMENT PLAN

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**Abstract**
In this research, scallop and sea cucumber bivalves of the species Holothoria lecospilota were used for the biological treatment of wastewater from shrimp farms in Gwatar Bay in the spring of 2017. Sedimentation, biological and aeration ponds were built on the side of the main pond for filtration, then bivalves were collected from the natural environment and placed in the bed of said ponds. The concentration of quality parameters was investigated in four stations, including station 1 (sea sample), station 2 (inlet water), station 3 (outlet sewage) and station 4 (water before entering the sea). The results showed that the concentration of parameters in the effluent of the main pool (Station 3) was significantly higher than other stations ($P<0.05$).

The results of the correlation test showed that the amount of filtration has a significant negative correlation with the quality parameters, so that the concentration of the parameters decreases with the increase of filtration. The concentrations of nitrate, phosphate, turbidity, EC, TDS and dissolved oxygen in the main pool are 0.67, 1.52, 22.36, 39.78, 20.21 and 9.49 mg/liter, respectively, and after filtration equal to 56 It was 0.0, 0.79, 16.81, 38.68, 16.45 and 12 mg/liter, which shows that the difference between the parameters before and after filtration is significant ($P<0.05$). Also, the amount of biological filtration in different time periods has a significant difference ($P<0.05$) so that the highest and lowest filtration rates were observed on the fifth day and the first day, respectively. 20, 48, 27, 22 and 2.5% of nitrate, phosphate, turbidity, dissolved solids and electrical conductivity were removed from the wastewater in the filtration process, respectively. Therefore, based on the results, it was determined that scallop bivalves have a high ability in the biological filtration of shrimp farming effluents and can be used as a suitable indicator for the filtration of breeding farms.

**Key words:** biological treatment, shrimp farms, bivalves, sea cucumber, Goiter Bay

## Introduction
In aquaculture systems, there are sometimes limitations that have adverse effects on the quantity and quality of production. Applying different methods to solve these problems and as a result improving the quantity and quality of production may involve different costs. In this way, the aquatic breeders in the world have always tried to benefit from efficient methods. One of these methods that has

received attention in recent years is the simultaneous cultivation of several aquatic genes in an aquatic ecosystem. In addition to being cheap, the method will bring benefits such as: more suitable production in terms of quantity and quality, health and hygiene of the ecosystem, and ultimately more profit. Shrimp is considered one of the most valuable aquatic species in the world and has a large share in the seafood market. This aquatic species is mostly cultivated in earthen ponds. During a breeding period, factors such as excess food deposition in the bed, plankton death , shrimp waste and finally the microbial activity of the bed of earthen ponds causes the creation of harmful factors in an aquatic ecosystem, which causes a decrease in the quantity and quality of production and an increase in costs. On the other hand, sea cucumber is one of the aquatic animals that live in the water bed. This aquatic always swallows the sediments of the bed and uses the organic materials in it. In fact, as a natural purifier, it removes the pollution from the bed This is provided by the health of an aquatic ecosystem. In addition, sea cucumbers have many uses as a valuable aquatic product in human and livestock food, pharmaceutical and medical industries.

Aquaculture contributes to half of all worldwide fish generation, decreasing weight on normal angling, and keeping up an normal development rate of 4.5% per year in 2011–2018 (FAO, 2020, Pradeepkiran, 2019). Be that as it may, a fast development of lake regions and need of generation range arranging have driven to undesirable natural and social impacts (FAO, 2020, Nguyen, 2017, Sampantamit et al., 2020). To play down the unfavorable impacts of hurtful existing aquaculture strategies, Great Aquaculture Hones (GAqPs) have been executed through the issuance of lawful systems and subsidized aquaculture arrangements in numerous nations (European Commission, 2016, FAO, 2020, Sampantamit et al., 2020). In any case, as it were a little number of aquaculture ranchers have gotten to the GAqPs improvement arrangement. In our case ponder, beneath 1% of shrimp ranches had received the Vietnamese Great Farming Hone (VietGap) standard as of 2018, all of which were large-scale ranches (Pongthanapanich et al., 2019)( Phong,,2021).

Shrimp farming is directly related to the water quality of breeding ponds, so that if the water and soil quality of the pond is not maintained at the optimal level, the feeding of the shrimps is not done well and the shrimps become sensitive to diseases and their survival is reduced. The water used in aquaculture contains substances It is organic and mineral. Soluble mineral ions, dissolved gases, suspended substances, soluble organic compounds and microorganisms have an effect on the quality of aquaculture . Water quality changes under the influence of biological processes such as photosynthesis, respiration, metabolic waste disposal, and physical factors such as temperature and wind. Also, water quality may change following the adoption of management strategies. so that excessive feeding leads to an increase in suspended substances soluble in water. According to the report of Briggs , Vanami shrimp can withstand temperatures of 23-30 and pH of 8 degrees Celsius, salinity up to 45%. He states that the amount of oxygen solubility in water depends on factors such as temperature, salinity and water depth, and increases The temperature, salinity and depth of oxygen solubility in water decrease and the oxygen solubility in salt water is significantly lower than in fresh water. It depends on the organisms, plants and aerobic bacteria present in the system.

**litrature review**

Dahanay conducted studies on the diversity and accumulation of macrobenthos in Sri Lanka according to environmental conditions and stated that the composition of benthic organisms is closely related to the quality of water and aquatic environment, and therefore, benthic organisms are a good indicator of past and present water conditions. Cesar conducted studies in the field of macrobenthic invertebrates as food for hatched shrimp in a breeding pond in Brazil, and in this study, the importance of microinvertebrates as a source of natural food, especially in combination with supplementary food, was described. Vannamei shrimp (western white), Vannamei Litopenaeus is native to the western coast of Latin America in the Pacific Ocean from Peru in the south to the coast of Mexico in the north. The introduction of Vannamei shrimp in Asia started from China and Taiwan and then spread to the Philippines, Indonesia, Vietnam, Thailand, Malaysia and India. nearly 85% of Vanami shrimp production is related to these areas, which is considered a non-native species.

The western white shrimp, unlike other species of the Panaidae family, which have closed telicomes, has open telicomes, so it is easier to force them to mate and lay eggs in captivity, and this makes it possible that the life cycle of this shrimp in The conditions of captivity should be perfected and the selection (faster growth and resistance to diseases) and the implementation of localization programs should also be facilitated. One of the prominent characteristics and strengths of Vanami shrimp breeding is the speed of reaching a weight of 20 grams and special growth of 3 grams per week. The most important issues related to the breeding of an aquatic species are the knowledge of the relationships between biological and non-biotic parameters and their effects on the growth and survival of the species and determining the pattern of relationships between them .Samocha , Sowers and Tomasso stated that by reducing the salinity of the sea water, the growth of Vanami shrimp is better and by increasing the temperature to the optimal level (about 28 degrees Celsius), the growth rate increases, while with the increase in salinity and pH The growth rate decreases, and therefore by knowing the increasing and decreasing factors of shrimp growth, one can try to achieve higher growth in shrimp and eliminate or reduce the adverse effects of decreasing factors. In order to determine the appropriate growth pattern with high reliability and accuracy, it is better to use, The growth pattern can be used to predict production and as a result profitability, new aquaculture locations or new production strategies.

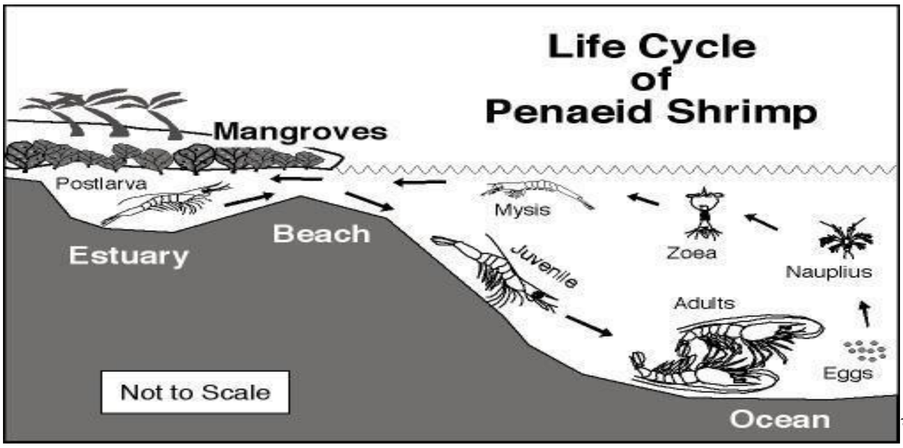


**Figure 1** The life cycle of the shrimp of the Penaeidae family in nature. [21]

Female vanami shrimps can release from 50 thousand to 1 million eggs after maturity. And the eggs are hatched after 24 hours and turn into naples. Naples feeds on the yolk sac of its body and enters the zoa stage during metamorphosis. In the zoa stage, the larvae feed on algae and after about 3 days, the larva enters the mysis stage. Mysis is more similar to adult shrimp and feeds on algae and zooplankton. In the next stage and after about 3 days, the final stage of metamorphosis from the mysis to the post-larva stage is performed. The post-larval stage in hatching halls takes about 12 to 15 days to transport to breeding farms, and often 15-day-old post-larvae are introduced to breeding ponds .

| **Table (1) common chemicals used in aquaculture** | | | |
|---|---|---|---|
| **Type of chemical** | Mariculture of salmonids | Tropical inland Aquaculture | **Tropical marine Shrimp culture** |
| **Therapeutants Antibacteria ls** | Five types of antibiotics | potassium permanganate(antibiotics rarcly uscd) | **Eight types of antibiotics** |
| **Parasitic treatment، Fungicides** | Diclorvos، trichlofon، fenbcndazol، Malachite green(hatchries) | Malachite green، formalin، permanganate، Dipterex | **Formalin، methylene blue** |
| **Algicides (antifoulants)** | Copper oxide، silicon wax | - | **Copper sulPHate** |
| **Piscicides, molluscicides** | Not used | - | **Tea seed cake، rotenone، nicotine، endrin، organotins** |

| | | | |
|---|---|---|---|
| **DisinfECtants** | Formalin, Sodium hypochlorite, Sodium hydroxide, choramine | Formalin | **Sodium hypochlorite‹ benzlkonium chloride** |
| **Water and soil treatment chemicals** | PH regulators (lime, (hatchries) | Lime, potassium permanganate | **Lime‹ EDTA, zeolite, calcium carbide, potassium permanganate** |
| **Anaesthetics** | Benzocaine, metacaine, chlorbutanol, carbon dioxide | - | **-** |

**Table (2) Antibiotics used in the food of breeding species in selected countries**

| | Canada | Japan | PHillipines | Norway | **United States** |
|---|---|---|---|---|---|
| **SpECies** | Aquaculture in general‹ but mostly salmonids[1] | Primarily yellowtail[2] | Penaeid shrimp | Salmonids | **Salmonids 3** |
| **Referen ce** | **E.A.Black‹ pers. Comm.** | **Schnick 1991‹AAD B/ NACA199 1‹ Okamoto 1992** | **Primavera‹et al 1993** | **Norwegian Medicinal Depot‹ unpublished Data** | **Schnick 1991** |

In this research, an embankment was established on the edge of the aquaculture breeding pond to receive the wastewater produced by the complex, and finally, a purification system was implemented in it. In this way, three pools were selected for three purification stages and their completion and preparation stages were completed. By using SPSS statistical software and using

ANOVA analysis of variance at a significant level ($\alpha=0.05$), the effect of the type of treatment on the length and weight growth rate of shrimps in each of the investigation times (July, August, September, 5th and 27 Mehr) was evaluated and the significance of the effect of the type of treatment was checked at each time. Also, the significant effect of evaluation period on length and weight growth was also investigated. Also, the characteristics of the water used (pH, dissolved oxygen, electrical conductivity, nitrate, turbidity, and phosphate) of the water entering the main pool, the effluent of the main pool, sedimentation pool water, biological treatment pool water, and aeration pool water were statistically evaluated. In the statistical evaluation, the statistical difference of the investigated parameters during a period of 5 months (from April to September) and also the statistical difference of the parameters in different pools were evaluated. Finally, the values measured in each month were compared with the standard value through a sample pair t test.

## Research Methodology

In order to investigate and clarify the state of water pollution in shrimp farms and its possible effects on the environment, there is a need for a complete and accurate record of the environmental information of the region in order to be able to understand the scope of changes in each factor as well as the degree of self-purification of the environment receiving the pollution load. estimated Currently, due to the lack of comprehensive and accurate previous information, the obtained results can be discussed based on two methods. The first method is a direct comparison of the results with the limit values available in different sources for each factor, and the second method is an approximate comparison of the data obtained together with the results of previous surveys and studies in the research area, which the main emphasis in this method is to compare the data with The results of the previous phases of the project and past investigations in the region and also their comparison with the data collected before the period of wastewater entering the environment. 6-1 - Introduction of the main pollutant parameters in shrimp breeding centers Based on the results of studies and measurements, the main future parameters in shrimp breeding centers can be listed. 1- Electrical conductivity 2- Turbidity 3- PH 4- Nitrate 5- Phosphate 6- Dissolved oxygen

According to the results in all investigated times except August, the location of sampling had a significant effect on the electrical conductivity of water samples (P<0.05). According to the value of F, the greatest effect of location on water pH was in May and the least in August. According to the results of analysis of variance, it can be concluded that the sampling time has a significant effect on the electrical conductivity of the water samples in all locations except the water entering the pool and the sedimentation pool (P<0.05). According to the value of F, the greatest effect of sampling time was on the electrical conductivity of water samples at the outlet of the biological treatment pool. According to the results in all investigated times, the location of sampling had a significant effect on the pH of water samples (P<0.05). According to the value of F, the greatest effect of location on water pH was in September and the least in May. Comparing the pH of the samples of the biological treatment pool outlet and the outlet of the end of the aeration pool with the standard limit showed that there is a significant difference in the pH of all water samples with the standard limit. According to the results, the location of sampling had a significant effect on the dissolved oxygen of the water samples in all the investigated times (P<0.05). According to the value of F, the greatest effect of location on water dissolved oxygen was in September and the least in August. According to the results of analysis of variance, it can be concluded that sampling time had a significant effect on dissolved oxygen in water samples in all locations (P<0.05). According to the value of F, the greatest effect of sampling time on dissolved oxygen of water samples was at the outlet of the end of the aeration pool and the least effect was at the outlet of the main pool. According to the results, the location of sampling has had a significant effect on the turbidity of water samples in all times except for the month of Shahrivar (P<0.05). According to the value of F, the location has the greatest effect on water turbidity in July. The results of evaluating the turbidity of water samples at each location during the storage period were statistically evaluated in order to investigate the effect of sampling time on the turbidity of water samples.

**Results**

According to the analysis of variance results, it can be concluded that sampling time had a significant effect on the turbidity of water samples in all locations (P<0.05). According to the value of F, the greatest effect of sampling time on the turbidity of water samples was at the outlet of the biological treatment pool and the least effect was at the sedimentation pool. According to the results, the location of sampling had a significant effect on the amount of phosphate in water samples (P<0.05). According to the value of F, the highest and lowest impact of the location on the amount of water phosphate was in May and September, respectively. The results of the evaluation of the amount of phosphate in water samples at each location during the storage period were statistically evaluated in order to investigate the effect of sampling time on the amount of phosphate in water samples. According to the results, the location of sampling has had a significant effect on the amount of nitrate in the water samples in all investigated times (P<0.05). According to the value of F, the greatest effect of the location on the amount of water nitrate was in September and the least in May. According to the results of analysis of variance, it can be concluded that the time of sampling in all locations had a significant effect on the amount of nitrate in water samples (P<0.05). According to the value of F, the greatest effect of sampling time on the amount of nitrate in water samples was in the effluent of the main pool and the least effect was in the water entering the pool. According to the results of analysis of variance, it can be concluded that sampling time in all locations had a significant effect on the amount of phosphate in water samples (P<0.05). According to the value of F, the greatest effect of sampling time on the amount of phosphate in water samples was in the sedimentation pool and the least effect was in the outlet at the end of the aeration pool. According to the standard amount of phosphate, which was equal to 3 ppm, 2-6Comparison of different treatments during 70 days Co-breeding of shrimp with sea cucumber was done in fiberglass ponds. The reason for this was better control and more research stages and determining the factor or factors influencing the weight and length growth of shrimps. The reason for choosing sea cucumber for co-cultivation between shrimp and sea cucumber was due to the nutritional behavior of this aquatic, because this aquatic is a detritus eater and during its life, it feeds from the sediments of the bed, which always contains large amounts of organic matter. These sediments in the shrimp farming system in earthen ponds cause adverse factors in the aquatic ecosystem, which ultimately affect the quantity and quality of the product. Similar studies in India, after failures in the shrimp farming industry in the early nineties, made the breeders hope to solve these failures and think about more production with higher quality and ultimately more profit.

Also, in 2001, Rayner stated in his project report, which was titled as a study on the breeding of sea cucumber Holothuria scabra and its cultivation methods, that due to the sediment-eating habit of this aquatic animal and as a result, the removal of nutritious sediments that contain large amounts of organic matter in them, Improving the aquatic ecosystem of shrimp farms (8) - Longitudinal growth According to the last column of the analysis of variance table, if the P values are less than the significance level ($\alpha = 0.05$), the independent parameter under investigation (here the type of treatment) has a significant effect on the dependent parameter (here the average longitudinal growth). had. The results of analysis of variance showed that the type of treatment had a significant effect on the average longitudinal growth of shrimps in all the investigated months ($P<0.05$). According to the value of F in the analysis of variance table, the highest and lowest effect of the treatment type on the average longitudinal growth of shrimps was on October 27 and July, respectively. It should be noted that the higher the value of F, the greater the impact of the independent parameter on the dependent parameter. The results of analysis of variance showed that the duration of storage in each treatment had a significant effect on the average longitudinal growth of shrimps ($P<0.05$). According to the value of F in the analysis of variance table, the greatest and least impact of storage time on the average longitudinal growth of shrimps was in T3 and T1 treatments, respectively. Comparison of the average longitudinal growth of shrimps in different treatments during the investigated period was compared with each other using Duncan's supplementary test.

According to the small letters on the graph related to July in different treatments, it can be concluded that there is no significant difference in the average longitudinal growth of shrimps in T1 and T2 treatments. While there is a significant difference in this feature in T1 and T3 treatments ($P<0.05$). Examining the average longitudinal growth of shrimps in August shows that there is no significant difference in this characteristic in T2 and T3 treatments. While this value of this feature in the control treatment (T1) is significantly different from other treatments ($P<0.05$). The highest value of the average longitudinal growth of shrimps in August belongs to the T3 treatment samples and the lowest value to the control treatment sample (T1). Examining the average longitudinal growth of shrimps in September, 5 October and 27 October shows that the highest value of this characteristic belongs to the T3 treatment sample and the lowest value belongs to the T1 treatment sample and there is a significant difference in the average longitudinal growth of shrimps in different treatments in time ($P<0.05$) are observed. -Weight gain The results of analysis of variance showed that the type of treatment had a significant effect on the average weight growth of shrimps in all investigated months ($P<0.05$). According to the value of F in the analysis of variance table, the highest and lowest effect of the treatment type on the average weight growth of shrimps was on October 27 and July, respectively. The results of analysis of variance showed that the duration of storage in each treatment had a significant effect on the average weight growth of shrimps ($P<0.05$). According to the value of F in the analysis of variance table, the highest and lowest effect of storage time on the average weight growth of shrimps was in T3 and T1 treatments, respectively. Comparison of average weight growth of shrimps in different treatments during the investigated period was compared with each other using Duncan's supplementary test. According to the results, it can be concluded that there is no significant difference in the average weight growth of shrimps in T1 and T2 treatments. While there is a significant difference in this feature in T1 and T3 treatments ($P<0.05$). Examining the average weight growth of shrimps in August and September shows that there is a significant difference in this characteristic in all treatments ($P<0.05$). So that the highest value of the average weight growth of shrimps in the month of August belongs to the T2 treatment samples and the lowest to the control treatment sample (T1). Examining the average weight growth of shrimps on October 5 and 27 shows that the highest value of this characteristic belongs to the T3 treatment sample and the lowest value to the T1 treatment sample, and there is a significant difference in the average weight growth of shrimps in different treatments at the mentioned times. becomes (P>0.05). Also, the results show that a significant difference was observed in the average weight growth of shrimps during their storage period in all treatments. So that the highest average weight growth of shrimps corresponds to October 27 and the lowest average length growth of shrimps belongs to July.

**Conclusione**

According to the studies carried out and the investigation of the current status of wastewater management of shrimp farms in Sistan and Baluchistan province, as well as the importance of the marine environment of the region, which is facing serious risks and has witnessed unfortunate events and incidents in these ecosystems, and also in line with Achieving sustainable development, which is also emphasized in the fifth development plan of the government, the construction of wastewater treatment systems for shrimp farming complexes can be considered as one of the wastewater management solutions and is recommended. Also, according to the results of the analyzes and the identification of the type and amount of pollutants and their nature, the best wastewater treatment system that has a lower cost and is easier to manage is the ETS system, which is detailed in this report. In general, there are two ways to perform the complete treatment of wastewater for the goitre complex, which are: 1. The construction of a purification system at the end of each twenty-hectare complex, which will require a total of about two hectares of land, the advantage of which is management by each breeder and the use of the benefits of its subsequent production, that is, the collection and sale of aquatic animals raised in the purification system and etc. pointed out that it can actually be profitable for the grower and at the same time the main task of the work, which is wastewater treatment, must be fully observed. Also, if the purification process is carried out, the amount of pollutant entering the drains will be reduced to a minimum and at the same time allowable state, and silting along the exit route will be reduced to a minimum and the need for dredging will be reduced and the benthic organisms will be significantly controlled. Therefore, it is suggested that this type of treatment center be designed for 20-hectare complexes, where the required land for each complex will be 2 hectares (10% of the farm area). In fact, these types of treatment systems can be created in parallel and in series. Another advantage of this system is its easy management, which almost does not require a special expert full-time, and considering that less specialized forces tend to be in the region full-time, therefore, local and existing forces, through the necessary training courses, They will be able to manage the system.

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