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Intensification of medicine on shrimp culture

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Abstract

Shrimp farming is an aquaculture business for the cultivation of marine shrimps or prawns for human consumption and is considered a major economic and food production sector as it is an increasingly important source of protein available for human consumption. The intensification of shrimp farming had led to the development of many diseases, which resulted in the excessive use of antimicrobial agents, which is finally responsible for any adverse effects. Currently, probiotics are chosen as the best alternatives to these antimicrobial agents and they act as natural immune enhancers, which provoke disease resistance in a shrimp farm. The exploitation of these probiotics in the treatment and prevention of viral diseases in shrimp aquaculture is a novel and efficient method.

Keywords: Shrimp, disease, aquaculture

1. Introduction

With the expansion of shrimp culture in India, there has been an increasing trend in using medicine and chemical in shrimp health treatment. Shrimp farming is playing a great role in the present Indian economy. It has a big contribution to the economy of a developing country like India but is always subjected to some adverse environmental consequences. Shrimp culture has been more widely than any other because of its high export value and to satisfy the ever-increasing demand of consumers. In shrimp health management and disease treatment, farmers use different compounds as growth promoters, disinfectants, and probiotics and to improve water quality and Dissolved Oxygen. Chemicals used in aquaculture included sodium chloride, potassium permanganate, copper compounds, malachite green, and methylene blue. Commonly used chemicals in West Bengal aquaculture were lime, rotenone, various form of inorganic and organic fertilizer, salt, dipterex, antimicrobials, potassium permanganate, and copper sulfate. For the success of shrimp culture, chemicals and aqua-medicines must be used responsibly. Shrimp disease is an alarming factor for which production of aquaculture is hampered. Aqua-medicine is indeed an essential ingredient for successful shrimp culture. The use of aqua-medicines in aquaculture systems for various purposes is widely recognized. In Purba Medinipur district, about 40 pharmaceutical companies are now producing about 400 different aqua-medicines. Excessive use of such a huge number of aqua medicine and chemicals creates environmental degradation. Most farmers doesn't know the proper dosages and method of their application. Thus the present status of the use of aqua-medicine in the shrimp culture sector especially in aquatic animal health management. For the health management of fish and shrimp, several types of probiotics are used by farmers. The common ingredients of probiotics are *Bacillus subtilis*, *Bacillus megaterium*, *Bacillus polymyxa*, *Lactobacillus* sp, and *Nitrosomonas* sp etc. Some common chemicals used for health management include sodium chloride, formalin, malachite green, methyl blue, Potassium Permanganate, and hydrogen peroxide. Potassium permanganate is the most widely used chemical for treating external protozoa and external bacterial infection. For treating fungal infection, external parasites on shrimp and shrimp eggs as flush, prolonged or indefinite treatment or fungal control sodium chloride and formalin is an old treatment used by the farmers. Recently farmers use probiotics such as Early PS, Bacto Treat, Gut pro-tech, Thionil-sp, Bacto Gest, and Avant Back etc. Chemicals are often used in aquaculture to control shrimp disease and improve water quality. FAO, 2002 shrimp farming has boomed in tropical and subtropical regions since the early 1980s and Southeast Asia is the leading region. Thailand is the world's largest producer of cultured shrimps, yielding 235 000– 275 000 tons annually since 1993 (FAO, 2002)^[4].

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Interviews were conducted with 76 shrimp farmers in three major shrimp producing regions, the eastern Gulf coast, the southern gulf coast, and the Andaman coast area. Farmers in the study area used on average 13 different chemical and biological products. The most commonly used products were soil and water treatment products, pesticides and disinfectants, and antibiotics used by the farmers could have negative on the culture shrimps, cause a risk to food safety, and occupational health, or have negative effects on adjacent ecosystem. Manufacturers and retailers of the products often neglected to provide farmers with necessary information regarding active ingredients and relevant instructions for safe and efficient use. Shamsuzzman and Biswas (2012) [14] stated that on the southwest coast of Bangladesh, commonly found traditional chemicals in health management were lime, salt, potassium permanganate, formalin, bleaching powder, and malachite green. Shamsuzzman and Biswas (2012) [14] showed that the Pacific white shrimp (*Litopenaeus vannamei*) is an economically important species with high market value. Availability of Specific Pathogen Free (SPF) and Specific Pathogen Resistant (SPR) seeds and the suitability of the species for high-density culture have led to the quantum leap in the percentage contribution of the species in the world shrimp production. Alam (2014) [1] carried out a six months study to understand the present status of the use of aqua-medicine and chemicals in aquatic animal health management in the Shakira district of Bangladesh.

2. Study area

In our study work, we selected a shrimp farm (Ashalata Aqua Farm) at Dhaipukuria of Bhagwanpur-II block in Purba Medinipur district, West Bengal. The present study was initiated during June 2019 to September 2019. It has 5 ponds under this farm and has a total area of 17000 sq. meters. Shrimp culture in this farm is carried out in dug-out ponds scientifically and the types of culture include improved traditional, stagnant pond culture with management,

modified extensive, and semi-intensive.

3. Selection of species

Many factors must be considered when a farmer is deciding which species of shrimp he should culture. Due to their large size and high price, *Litopenaeus vannamei*, and *Penaeus monodon* are generally considered for farming. It has also been seen that both these species are suitable for farming in West Bengal's environment. Apart from these candidate species other commercially important species such as *Penaeus indicus*, *Metapenaeus monoceros*, *Penaeus semisulcatus*, and *Penaeus merguiensis* are also potential species that can be grown in India. Although the Government of India has not yet given sanctions to culture it in the country, many Asian countries have already started to culture this species.

4. Use of chemicals and medicines in shrimp culture

Different types of chemicals and medicine are used in shrimp culture. Chemicals help to increase Dissolved Oxygen, soil quality, and also pond preparation in shrimp culture. Medicines also help with gas removal, growth promoters, disinfectants, and disease treatment. Recently some commercial farms in both regions used experimentally probiotics as food additives for water maintenance.

4.1. Types of medicines

4.1.1. Probiotics used in shrimp farms

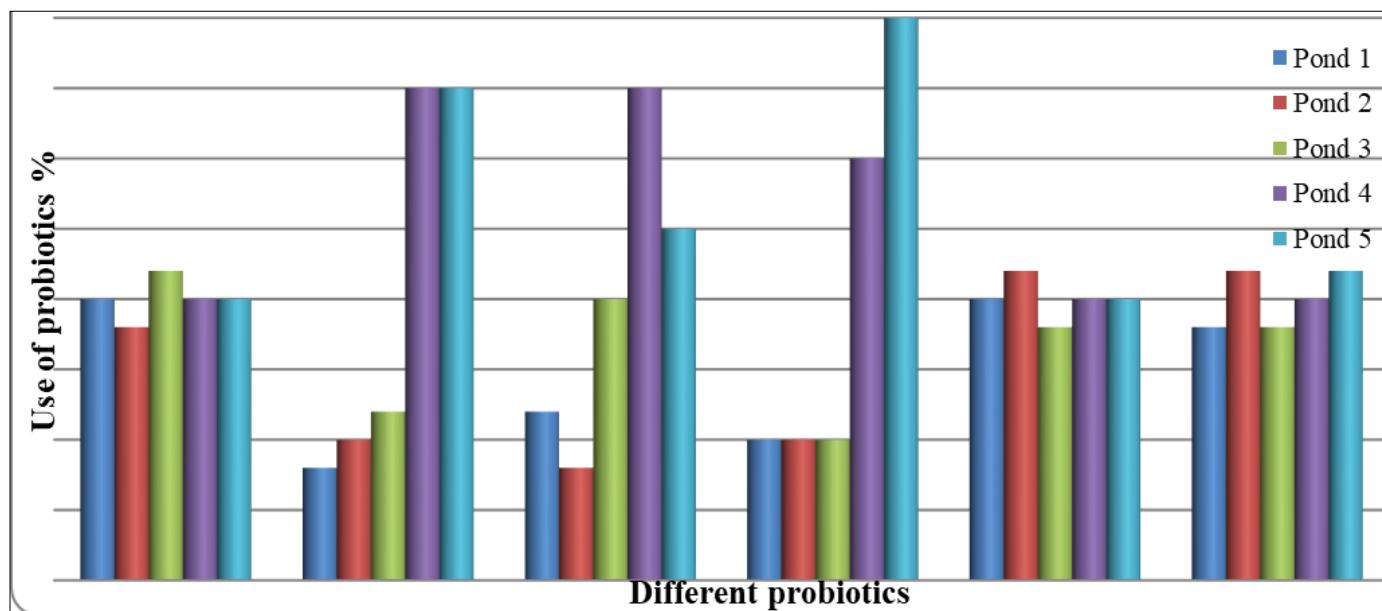
Shrimp farmer was found to use probiotic products from different aqua-medicine companies such as PVS Pvt Ltd, Virbac Pvt Ltd, Aquatech Aquahealth, Kemin aqua Pvt Ltd, Poseidon Biotech, and Micro-basia Pvt Ltd. There has been increasing interest in the use of Probiotics in aquaculture with the demand to make it environment friendly. Farmer uses a range of probiotic products to control vibriosis and luminescent bacteria, improve water quality, and control pH. The probiotics contained different beneficial bacteria including *Bacillus subtilis*, and *Bacillus pumilus*.

Table 1: Probiotics use in shrimp farms in our study area (Dhaipukuria)

Trade name	Active ingredients	Dose	Purpose of use	Source	Price/kg
Yucca Sol.	<i>Bacillus</i> sp	5-10 ml/m ²	1. Provide natural food and improved feeding growth. 2. Absorbed toxic gasses like ammonia.	PVS Ltd.	2800.00
V ₅	<i>Rhodobacter</i> sp, and <i>Rhodococcus</i> sp	300 ml/1000 m ²	1. Maintain algal bloom. 2. Maintain water quality and balance.	Virbac Pvt Ltd	1480.00
Tech Care	Amino acid and digestive enzymes	5-10 mg/kg feed	1. Improve immune response, molting shell formatting, weight gain, and FCR.	Aquatech	2550.00
Toxi Tech	<i>Bacillus</i> sp	1.5-2 kg/Hac	1. Absorb toxic gasses and improve pond bottom soil.	Aquatech	2490.00

Table 2: Pond-wise distribution of Probiotics

Pond number	Name of probiotics in our study area (%)					
	Yucca Sol	Last Act	Backstreet	Gut Pro Tech	Early PS	Thionil-Sp
1	20	08	12	10	20	18
2	18	10	08	10	22	22
3	22	12	20	10	18	18
4	20	35	35	30	20	20
5	20	35	25	40	20	22

**Fig 1:** Analysis of the different types of probiotics use in a different pond**4.1.2. Aqua-medicine used to increase Dissolved Oxygen**

To increase Dissolved Oxygen Recharge, Sea fresh, Oxy-tech, and Micro O₂ were used. The list of such aqua-medicine with

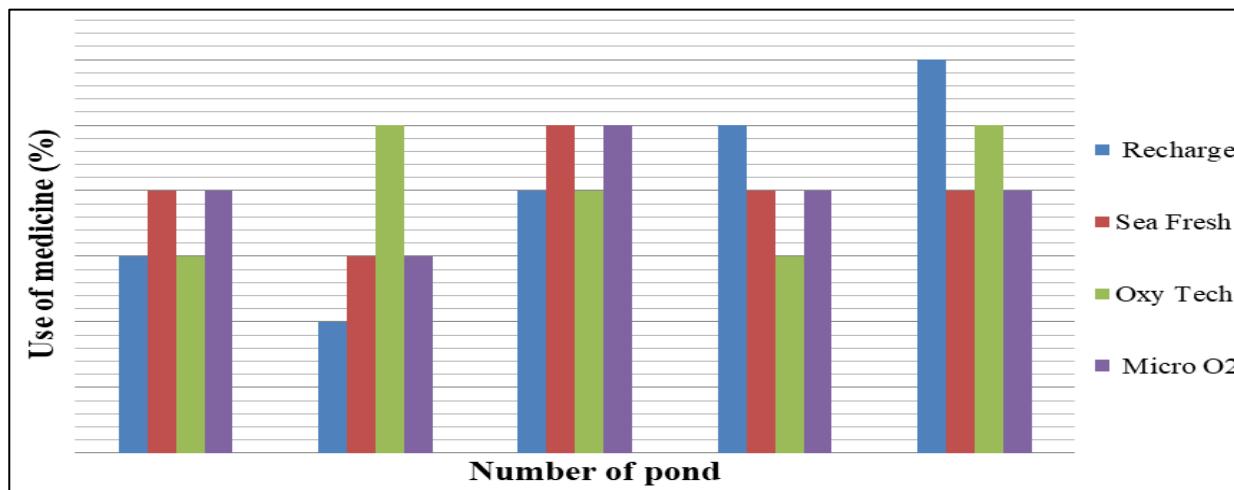
their active ingredients, prescribed dosage, sources, and approximate price is shown in Table-3. This medicine was used to increase Dissolved Oxygen in aquaculture ponds.

Table 3: Aqua-medicine used to increase Dissolved Oxygen.

Trade name	Active	Dose	Purpose of use	Source	Price/kg
Recharge	H ₂ O ₂ / CaO ₂	1.5 kg/1000 m ²	To increase DO in water.	Growel	160.0
Sea Fresh	Specialized sodium derivatives	3 kg/1000 m ²	To increase DO in water.	CPF	1325.00
Oxy Tech	Specialized sodium derivatives	3 kg/1000 m ²	To increase DO in water.	Aquatech Aquahealth	863.00

Table 4: Pond-wise distribution of O₂ promoters use in Shrimp culture

Pond number	O ₂ promoters use (%)			
	Pond number	Pond number	Pond number	Pond number
1	15	20	15	20
2	10	15	25	15
3	20	25	20	25
4	25	20	15	20
5	30	20	25	20

**Fig 2:** Graphical analysis of the different types of O₂ promoters in a different pond**4.1.3. Growth promoters used in shrimp farms**

Several aqua-medicines were found to be used as growth promoters as well as to increase fish production. Him-C, Calgophos, MV-24, C-Feed, P-Liv, and Pro Marine were

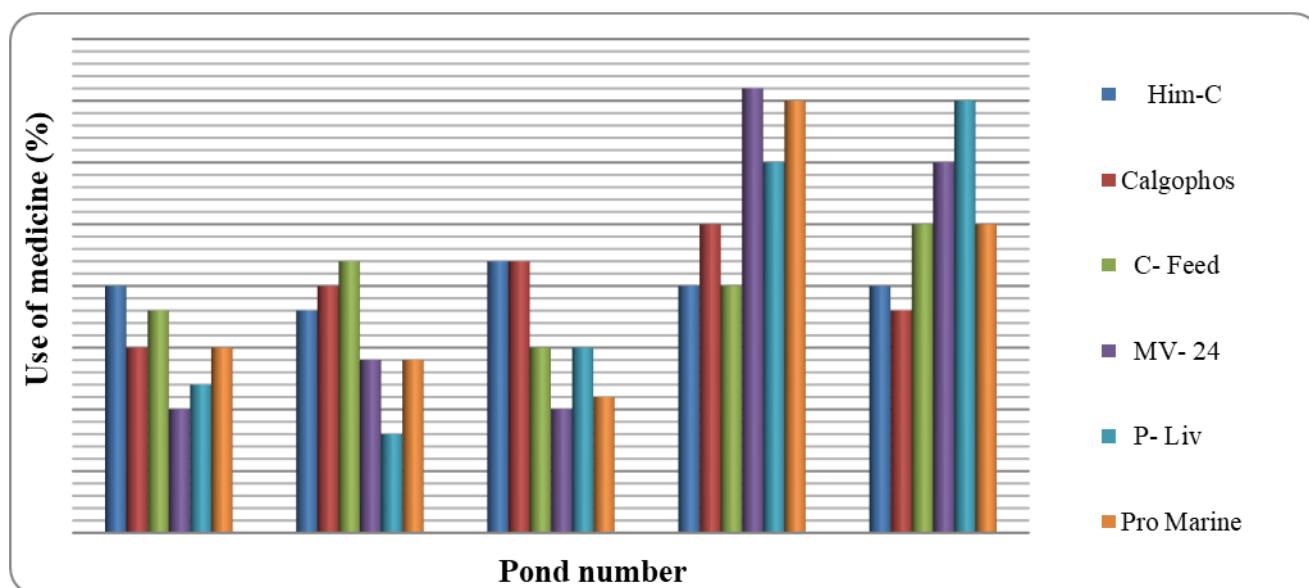
used. The list of such aqua-medicines with their active ingredients, prescribed dose, sources, and approximate price is shown in Table-5.

Table 5: Growth promoters used in our study area (Dhaipukuria)

Trade name	Active ingredients	Dose	Purpose of use	Source	Price / Kg
Him-C	Vitamin-C	10 gm/kg Feed	1. Control stress formation of exoskeleton. 2. Improve survival rate and FCR.	Himalaya	700.00
Calgo-phos	Ca, Mg, Na, Zn, Cu, K, Di-acid, and Phosphate	5-10 ml/kg Feed	1. Optimizes exuviating process. 2. Rigidity, and brightness of outer layer.	Virbac	450.00
MV- 24	Vit(A, D ₃ , E, K ₃ , C, B ₁ , B ₂ , B ₃ , B ₅ , B ₆ , B ₇ , B ₈ , B ₉ , B ₁₂), and mineral	2-5 gm/kg feed	1. Reduce stress and mortality. 2. Help to optimize meat colorant quality.	Virbac	2660.0
P- Liv	B ₁₂ , K, Methionine, and Lysine	10-20 ml/kg	1. Prevent liver/hepato-pancreas disorder. 2. Improve body weight with FCR.	PVS Ltd	450.00
Pro-Marine	Vitamin and mineral	5 gm/kg feed	1. To reduce unwanted microorganisms. 2. To reduce bacterial growth.	Virbac	1500.0

Table 6: Pond-wise distribution of growth promoter's use in our study area

Pond number	Use of growth promoters (%)					
	Him-C	Colophons	C- Feed	MV- 24	P- Liv	Pro Marine
1	20	15	18	10	12	15
2	18	20	22	14	08	14
3	22	22	15	10	15	11
4	20	25	20	36	30	35
5	20	18	25	30	35	25

**Fig 3:** Graphical analysis of the different types of growth promoters use in a different pond

4.1.4. Medicine used as a disinfectant in shrimp farms

Farmers used aqua-medicines as a disinfectant to keep their ponds free from pollution or pathogen. I-WFS, Omega Protein, Get out, Hepano Mix, Attract, Erawan-G, and

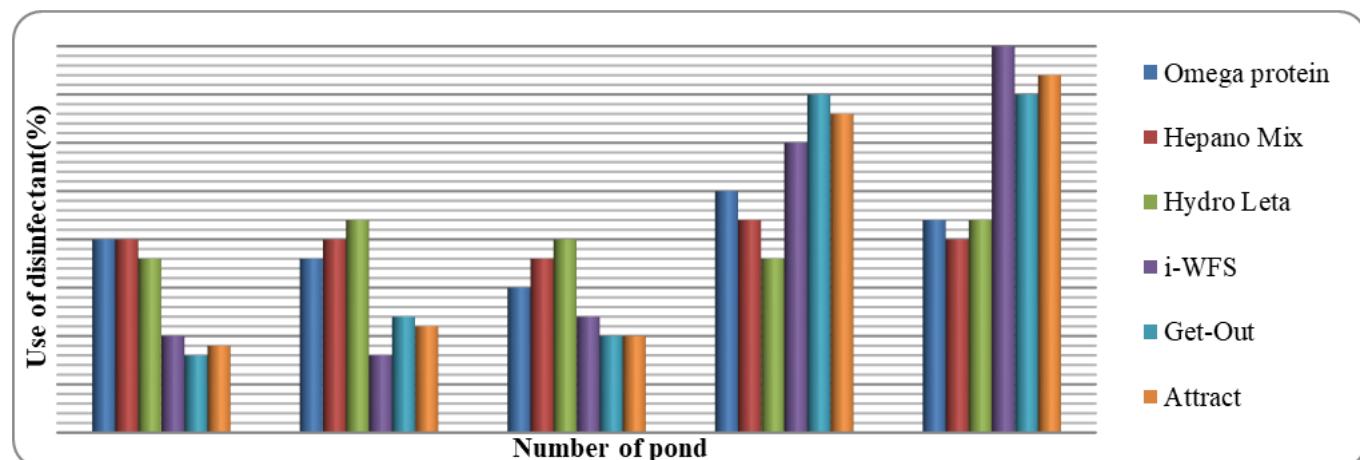
Hydroleta were used as a disinfectant. Their active ingredients, prescribed dosage, sources, and approximate price are shown in Table-7.

Table 7: Medicine used as a disinfectant in shrimp farms

Trade name	Active ingredients	Dose	Purpose of use	Source	Price
Omega Protein	Omega 3 fatty acid, amino acid P, Mg, Mn, Cu, and Zn	20-30 gm/kg	1. Improve feed utilization efficiency, growth immune response, and resistance in shrimp.	ASCENDS	1278.00
Hepano Mix	Amino acid, and vitamins	10 gm/1 kg feed	1. Strength hepato-pancreas function. 2. Improve immune function.	Virbac	3200.00
Attract	Natural multivitamin	5-10 gm/kg	1. Attractant. 2. Growth promoter.	PVS Laboratories	780.00
Hydro-Leta	Algal 1-3Bgluean, and coated vit-C	5-10 gm/ feed	1. Improve immunity. 2. Reduce stress.	Kemin Industries	1999.00

Table 8: Pond-wise distribution of disinfectant in our study area

Pond number	Disinfectant use (%)						
	Omega-Protein	Hepano-Mix	Hydro-Leta	I-WFS	Get-out	Attract	Erawan- G
1	20	20	18	10	08	09	11
2	18	20	22	08	12	11	10
3	15	18	20	12	10	10	09
4	25	22	18	30	35	33	30
5	22	20	22	40	35	37	40

**Fig 4:** Graphical analysis of the different types of disinfectant used in a different pond

4.1.5. Medicine used for water and soil quality management in shrimp farms

Many aqua-medicine companies were found in our study area (Dhaipukuria) such as Aquatech Aquahealth, Virbac, CPF, and Growel.

Various types of aqua medicines were produced by those companies which were used in aquaculture activities for water and soil quality management (Table- 9).

Table 9: Medicine use for water and soil quality management in shrimp farms

Trade name	Active ingredients	Dose	Purpose of use	Source	Price / Kg
Hydromin	Ca, K, P, Mg, Mn, Cu, and Co,	2-3 kg/1000 m ²	1. Weight gain, molting soft cell problem, plankton growth, and increase hardness.	Aquatech Aquahealth	165.00
Watrmin	Ca, Mg, K, P, and Na	2-3 kg/1000 m ²	1. Maintenance of healthy growth and productivity of prawn.	Virbac	998.00
Toximar	Natural hydrated sodium calcium alumina silicate	3-4 kg/1000 m ²	1. Neutralize toxins.	Virbac	1380.0
Sodamix	Ca ²⁺ , Mg ²⁺ , Na, K ⁺ , Cl, and SO ₄ ²⁻	4-5 kg/1000 m ²	1. Increase mineral level in the water. 2. Increase alkalinity and hardness.	CPF	560.00

4.2. Chemicals used in shrimp farms

Potash, lime, formalin, methylene blue, benzalkonium chloride, salt, and malachite green, were found to be used for

disease treatment. The list of such chemicals with their active ingredients, dose, and purpose of use, sources, and approximate price is shown in Table -10.

Table 10: Chemicals used in the study area (Dhaipukuria)

Trade name	Active ingredients	Dose	Purpose of use	Source	Price / Kg
Potash	KMnO ₄	2-3ppm	Water treatment.	Chemical seller	195.00
Lime	CaO, Ca(OH) ₂	1kg/Dec	Pond preparation.	Chemical seller	15.00
Bleaching	Chlorine	60ppm	Water treatment.	Chemical seller	60.00
Salt	NaCl	1kg/Dec	Pond preparation.	Chemical seller	08.00

5. Different types of problems during shrimp farming and their solution

During shrimp farming in the Purba Medinipur district, farmers faces different types of problem. To overcome the

problem during shrimp culture farmer should have a proper idea of aquaculture medicine management.

Table 11: Problem & Solution of shrimp culture

Sl. No.	Problem	Solution
1	Molting Problem	Liming + Minerals
2	Gas Problem	Ex-Am, Geosol and H ₂ O ₂
3	Gill choked	Seafresh, and KMnO ₄ ,
4	White Muscle Syndrome	Calmag, K-max, and Sodamix
5	Size variation	Double feeding
6	Mg shortage	Calmag, and K-max
7	Pond bottom problem	Sludge remove+H ₂ O ₂ , Ex-Am, Geosol
8	Mineral shortage	MagKcal, Enhance, and Rider
9	Down pH	LSP+MgSO ₄ + NaHCO ₃
10	High pH	NaHCO ₃ +Dolo
11	Gut problem	Biogut + Avant pro

The use of medicine in aquaculture systems for various purposes is widely recognized and the benefits of medicine usage in aquaculture are many. The aquaculture activities in Purba Medinipur district is also influenced by many medicines. The present study was carried out to know the current status of the use of medicine in the shrimp farmer Dhaipukuria of Bhagwanpur - II block in Purba Medinipur district, West Bengal, and analysis of the production cost. The present study identified a range of aqua-medicines and chemicals marketed by different companies for using various activities of aquaculture. The present study noticed several new products with various trade names in the market which included Hydeomin, Watrmin, Toximar, Soda mix, Jinong Humic Acid, Sokrena-WS, and Gasonix+Y etc. The local animal feed and chemical shops are the main sources of these compounds. It was found that most farmers used chemicals during pond preparation, for improving water quality and disease treatment. Generally, disease treatment in aquaculture can be of great value when the medicine is used properly but when improperly use medicine then the fish can cause large losses of shrimp. To properly use

Medicine in the water or feed, it is important to accurately determine the dosage and the best application method. In the present study, about 13 branded probiotics were found available in the market to use mainly in the shrimp culture to control vibriosis, and luminescent bacteria, improve water, and soil quality, and control pH.

6. Conclusion

In shrimp, culture success depends on feed, seed, environment, and management. In our study area among five ponds, observed fluctuations in turbidity, DO, pH, BOD, COD, alkalinity, hardness, and ammonia etc. Due to the fluctuation of environmental parameter, shrimps are not taken appropriate quantity of food. Excess feed, damage water parameter for this low survivability, and shrimps are very weak. For this shrimps attract various diseases, reducing the growth rate. For this at present different medicine used to help shrimp being a normal life span.

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