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## The use of antibiotics and disinfectants in the brackish water shrimp (*Penaeus monodon*) farms of Purba Medinipur and South 24 Parganas districts of West Bengal

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### Abstract

A survey had been conducted of the brackish water shrimp (*Penaeus monodon*) farms along with hatcheries of Purba Medinipur and south 24 Parganas district in West Bengal to gain information regarding the details of antibiotics as well as disinfectants used for controlling the prawn diseases and pathogens. Through the survey, it was found that there are 4 antibiotics and 4 disinfectants that are used for prawn disease and pathogen control which are utilized by the farmers during the 1 year study period. The chemicals those get used in the very culture systems like the disinfectants and the antibiotics for tanks, culture water, and other utensils, along with those others have serious health issues for both the cultured prawns as well as human beings. In this study, it is also indicated that herbal medicines as well as probiotics can be used in prawn farms.

**Keywords:** antibiotics, disinfectants, brackish water shrimp farm, *Penaeus monodon*

### Introduction

The different traditions of the state of West Bengal include polyculture in the fish of brackish water. This happens mainly in the deltaic range of the South 24 parganas and the purba medinipur districts. There is a growing demand in the domestic markets of different domain of the state and also in the foreign markets. The prawn culture in freshwater has been proved to be of great economic importance and has transformed into a booming business in West Bengal. *Penaeus monodon* or the “giant tiger prawn” which is locally called “Bagda Chingri” is a significant part of West Bengal's economy. It helps by earning a decent amount of foreign exchange, in the improvement of the socioeconomic status of the people belonging to the backward community, in the generation of employment along with in raising the food production that is based on protein. This is done alongside pisciculture, and the culture of other organisms and paddy. However, the farmers face huge problems as well. The biggest one is the problem occurred by bacterial, viral or parasitic diseases. Treatment for the viral diseases is not given by the farmers. These diseases attack the whole shoal as those are not curable. The different bacterial diseases are cured with the help of antibiotics to avoid outbreak of the diseases that can prove to be fatal. The soil and water quality are also maintained with the help of the disinfectants.

This study deals with the different chemicals and the antibiotics that are utilized in freshwater prawn farms together with hatcheries of the districts of North as well as South 24 Parganas of the state of West Bengal for controlling the outbreak of diseases.

The industry of prawn farming is criticized from the viewpoint of the environment. The chemical usage in those farms and the impact that it potentially has on the human health as well as the environment has become a great concern for the environmentalists.

### Materials and Methods

A survey had been conducted in the timespan of July 2020 to June 2021. The survey had been placed in the various farms of fish-prawn which had been based on brackish water wetlands, popularly acquainted as “berries” in the district of North as well as South 24 Parganas in West Bengal, India.

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There are around 80 different farms which include the wetland culture system that has been surveyed and the information regarding the chemical usage along with the usage of antibiotics, probiotics, drugs and herbal medicines are collected through personal interview from the different members of the “cooperative societies” or the farmers who are culturing prawns by predefined questionnaire.

## Result

According to the research, there are numbers of different drugs that are used vigorously in the different farms of the different districts for the reduction of the attack to the various pathogens and enable the improvement of the survival rate along with the elevation of the intensity of feeding which

helps in the enhancement of the growth rate. The various antibiotics that are generally used are chloramphenicol, erythromycin, oxytetracycline, nitrofurans, that are used for controlling the different bacterial pathogens successfully. Mostly the farms use chloramphenicol (45%) followed by oxytetracycline (25%) and erythromycin (28%).

Apart from the different antibiotics, the farms have been using disinfectants like malachite green, formalin, methylene blue (MB), and potassium permanganate. The disinfectants that are used for disinfection of the water as well for the parasitic diseases caused by petrichous protozoan ciliates, and some bacterial pathogens. It was found that in no fish farms of the two distinct districts herbal medicines or probiotics are used for the treatment of those prawns or the seeds of the prawns.

**Table 1:** Antibiotics and disinfectants used in the prawn farms of north and south 24 Parganas districts of West Bengal during the study period (July 2020 to June 2021)

Antibiotics/disinfectants	Farms visited	(%)	Dosage (ppm)	Diseases	Pathogens
Chloramphenicol	40		10	Filamentous bacteria	<i>Leucothrixmucor</i>
				Luminous bacteria	<i>Vibrio harvey</i>
Oxytetracycline	25		10	Vibrio infections	<i>Vibrio parahaemolyticus</i>
				Bacterial shell diseases	<i>Vibrio anguillarum</i>
					<i>Vibrio spp., Aeromonas spp.</i>
Erythromycin	28.75		2–4	Luminous bacteria	<i>Vibrio harvey</i>
					<i>Vibrio splendidus</i>
Nitrofurans	15		1–2	Black gill disease	
Formalin	80		10-25	Protozoan ciliates	<i>Zoothamnium spp., Epistylis spp.,</i>
					<i>Vorticella spp., Acineta spp.,</i>
Malachite green	33.75		0.075	Luminous bacteria	<i>Vibrio harvey</i>
				Shell diseases	<i>Vibrio splendidus</i>
					Protozoan ciliates
Formalin +malachite green	27.5		0.01+0.01	Bacterial diseases,	<i>Pseudomonas spp.</i>
				protozoan diseases	<i>Zoothamnium spp., Epistylis spp.,</i>
Potassium permanganate	17.5		3–5	Luminous bacteria,	<i>Vorticella spp., Acineta spp.,</i>
				Shell diseases	
Methylene blue	35		8–10	Protozoan ciliates	<i>Zoothamnium spp., Epistylis spp.,</i>
					<i>Vorticella spp., Acineta spp.,</i>
Herbal medicines and probiotics	0		—	—	—

## Discussion

The different hatcheries and shrimp-farms are effective before they have been infected. Generally the farmers use prophylactic treatment measures based on eye observations of clinical signs. Food and Drug Administration (FDA) legalized 5 drugs/chemicals in US aquaculture, for example, formalin, oxytetracycline, ormetoprim, sulfamerazine, tricaine methanesulfonate. FDA legalized the following drugs to use as animal drugs: Finquel (MS-222), Tricaine-S (MS-222), Formalin-F, Paracide-F, Parasite-S, Romet 30, Sulfamerazine in Fish Grade, Terramycin-200, Chorulon, 35% PEROX-AID, Aquaflor, Aquaflor-CA1, TERRAMYCIN-343, Oxytetracycline HCl Soluble Powder-343, OxyMarine, TETROXY Aquatic, as well as Terramycin-200 for Fish. (FDA, 2008).

If perceived theoretically, it can be seen that the chemical other than the antibiotics which are attached to the different shrimp ponds, along with the byproducts, that have been applied substances which have a “bioaccumulation potential, could be found as residues in the shrimps”. However, it can be seen that proper attention is not paid to the different risks of residues apart from the usage of antibiotics in the farmed shrimps. No data has been found from investigations, Gräslund and Bengtsson.

The antibiotics chloramphenicol (mostly used in the farms) as well as nitrofurans are banned worldwide in the food production industry as they have serious side effects. Chloramphenicol may cause fatal aplastic anemia as well as nitrofurans are classified as carcinogens.

The usage of antibiotics in the prawn farms have been controlled to reduce the risks posed by them in the very development of resistant bacteria. If the bacteria has gained resistance, it becomes completely impossible for the farmers to do away with that bacteria with the help of antibiotics which caused the resistance. (Graslund, 2001) [18].

It has been described by Aftab Uddin *et al.* that the technique of using antibiotics to control the population of bacteria for the maintenance of a healthy environment has gained popularity. A huge range of antibiotics have been used to treat the bacterial diseases and to control the population of the bacteria in the prawn farms and hatcheries. The use of antibiotics to treat the bacteria comes from the different antibiotic-resistant bacteria. This resistance is transferred to the “pathogenic bacteria” which has guided to the reduction of efficacy of the treatment using antibiotics for the disease that has been caused by the pathogens those are resistant in nature, Frappaolo *et al.*

The antibiotics, if utilized in the prawn farms lead to the creation of health hazards if exposed to the human skin of the respiratory system. This problem has also been observed in the cases of fish farm in the two districts of West Bengal where the workers are found to have suffered respiration problems and skin irritation because of these chemicals.

Malachite green is a respiratory problem, as described by Dieberg and Kiattisimkul. It is not soluble in water and thus it binds itself to the sediments. It accumulates in biota but mostly in simple organisms. It has been stated by Bergheim and Asgard, that malachite green, can be spotted in all organs in great quantities, together with the kidney. Residues of 2400 µg/g have been noticed in fish, and they are persistent.

In water, potassium permanganate is transformed into nontoxic manganese dioxide, which precipitates out. However, it is noxious for phytoplankton, reported by Reardon and Harrell and Gräslund and Bengtsson.

In the body, MB at below concentrations, live in equilibrium along with making a structure of an irrevocable system of oxidation-reduction, this is the base of the function of MB like an electron acceptor or donor along with free radical scavengers. MB possesses the potentiality of affecting a vast variation of physiologic reactions. It is effective on the red blood cells which can reduce the 'heme' from the methemoglobin to the hemoglobin. Contradictorily, at higher doses, the equilibrium gets ruined along with a surplus of methemoglobin gets generated as stated by Curry. The production of hydrogen peroxide like a byproduct can guide to oxidation of red-cell membranes, hemoglobin's denaturation, hemolytic anemia, along with the formation of Heinz body. Current research has stressed on vasoactive properties of MB. By the very action of nitric oxide (NO) synthase, NO has been produced by the vascular endothelium, like bradykinin and acetylcholine, as responded by the agents. Soluble guanylate cyclase is activated by NO, which elevates the very levels of cyclic guanosine monophosphate (cGMP), unfolding calcium-sensitive potassium channels along with making membrane hyperpolarization, smooth relaxation of muscles, along with vasodilatation.

At very low concentrations, formalin is very toxic for aquatic life, with 96 h LC<sub>50</sub> of 1–1000 µL/L. There are some fish which are sensitive to this, so before using it a bioassay is endorsed as stated by Noga. For macrophytes (aquarium plants) and phytoplankton, inhibitions of growth along with mortality are reported. Its algal substance can again reduce oxygen. In low pH water along with high temperature, toxicity is very much important. Formalin can form a white precipitate of the paraformaldehyde when it is stored at room-temperature, and this is very much toxic than a pure formalin (Douet *et al.*).

The drainage of the disinfectants in local water bodies has guided to pollution. The issues can be mitigated through the proper implementation of the laws for controlling the hazardous drugs. Various procedures are utilized by the farms to avoid the introduction of the diseases in the prawns by regular management of water quality, probiotics and other herbal medicines those do not have much side effects. The shrimps need to get treated with approved chemicals if the farms have been infected by pathogens.

### Conclusion

Shrimp aquaculture is one of the booming food producing sectors in the world. Chemical and antibiotics have been frequently used in the shrimp culture system to control

various disease. However, the excessive and indiscriminate use of antibiotic has resulted in the development of antibiotic-resistant microbes, which may have potential risks for consumer health globally. Probiotics and herbal medicine can be better to cover up the loss economically as well as sustainably.

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