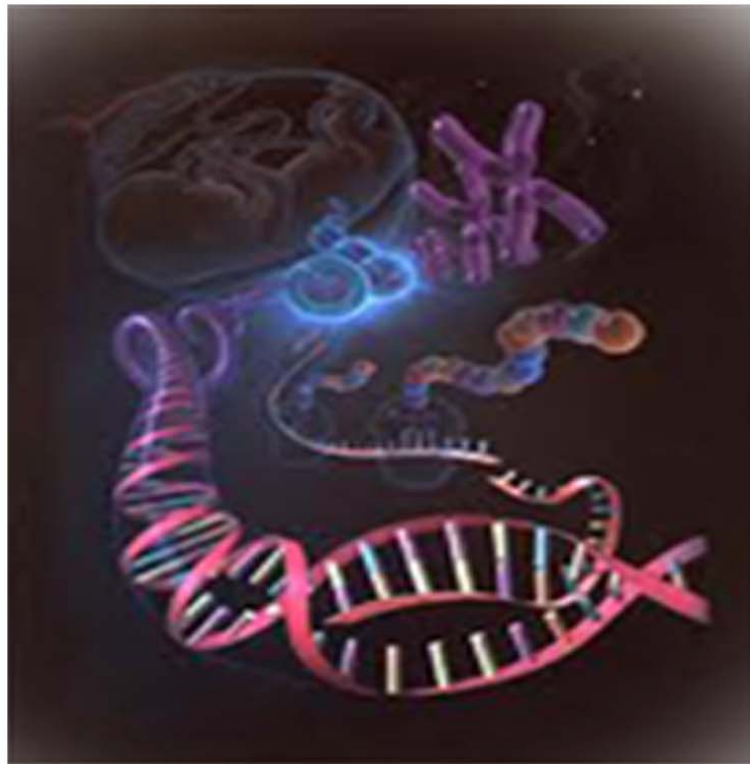




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Research Paper

# DRUGS AND CHEMICALS USED IN AQUACULTURE ACTIVITIES FOR FISH HEALTH MANAGEMENT IN THE COASTAL REGION OF BANGLADESH

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An experiment was conducted to assess the application mode of different commercial aqua drugs and chemicals in aquaculture activities in the coastal region of Bangladesh. Data were collected through stratified random sampling techniques using key PRA tools like questionnaire interview, personal interview, market survey, and Focus Group Discussion (FGD) with fish and shellfish hatchery owners, nursery and culture farmers and retailers of aqua medicine and representatives of pharmaceutical companies. Six categories of aqua drugs and chemicals were found to be used by fish farmers and hatchery owners for water quality management, disinfectants, disease treatment, antibiotics and growth promoter. Most commonly used chemicals in this area including Geotox, Zeolite, Zeocare, Lime, Mega zeo, Bio Aqua, Aquanone and Zeo prime for the pond preparation and water quality management. Bleaching, Aquakleen, BKC, EDTA, Efinol, Formalin are used for the treatment of disease. Bio-ox, Best oxygen, Oxygen plus, Oxyflow, Oxylife, Oxymax, Oxymore and Oxyplus are the available chemicals for increasing oxygen concentration in the pond. Renamycin, Bactitab, Chlorsteclin, Cotrim-Vet, Orgacycline-15%, Oxsentin 20% and Sulfatrim were widely used antibiotics in this area. The study shows that lack of knowledge regarding use of chemicals, appropriate dose, method of application and indiscriminate use of chemicals are the major problem for fish health management in the coastal region of Bangladesh.

**Keywords:** Antibiotics, Aquaculture, Chemicals, Disinfectants, Fish Health Management

## INTRODUCTION

In Bangladesh the production of Aquaculture is increasing day by day through diversification (Mahmud *et al.*, 2012 and Ahmed *et al.*, 2012).

Major aquaculture relies heavily on the input of formulated feeds and the application of agrochemicals, antibiotics and other aqua drugs.

The chemicals and aqua drugs are important

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components for the successful aquaculture which have been used in various methods for centuries (Subasinghe *et al.*, 1996). Aquaculture drugs and chemicals plays a pivotal role not only in fish health management but also pond construction, soil and water management, enhancement of natural aquatic productivity, feed formulation, manipulation of reproduction, growth promotion and processing and value addition of the final product (GESAMP, 1997; Subasinghe *et al.*, 1996). A variety of drugs and chemicals are used in aquaculture for fish health management apart from antibiotics. Most commonly used chemicals are sodium chloride, formalin, malachite green, methylene blue, potassium permanganate, hydrogen per oxide and glutaraldehyde (Plumb, 1992). Chemical needs are minimal in extensive and semi-intensive culture methods, often being limited to addition of fertilizer (e.g., manure), soil or water treatments (e.g., lime), and perhaps a pesticide (e.g., use of teaseed as a piscicide). These minimal chemical needs would be typical in finfish culture systems utilizing low stocking densities of herbivorous or omnivorous fish, including carp and tilapia species.

Different types of disease could be found in farmed aquatic animals in Bangladesh (Karim *et al.*, 1998; BFRI, 1999 and Faruk *et al.*, 2004). Hence farmers are using a range of chemicals and antibiotics to control the fish disease and other cultured aquatic animals. Besides different pharmaceuticals companies and chemical sellers are influencing fish and shell fish farmers to buy their products. Most of the farmers use these chemicals indiscriminately without knowing their necessity, effectiveness, proper dose and method of application.

Farmers are commonly used aquaculture drugs in Bangladesh include lime, rotenone,

various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion and melathion for the treatment of diseased fish and shellfish (Phillips, 1996; Hasan and Ahmed, 2002; Brown and Brooks, 2002; DoF, 2002 and Faruk *et al.*, 2005).

Now concern is growing over the use and potential misuse of some of these chemicals. The amount of information on chemical use in coastal aquaculture and its significance for human health assurance, environmental protection and sustainable development of the sector, has been increasing throughout the last decade (Plumb, 1995). With the expansion of aquaculture in the coastal region, the use of chemicals, antibiotics and aqua drugs are increasing tremendously. But no appropriate research works have been carried out on the use of drugs in aquaculture for fish health management in the coastal region. Therefore, the present work was carried out to assess the list of drugs and chemicals used in aquaculture, purpose, methods and dosage of application in the coastal region.

## MATERIALS AND METHODS

### Study Area

Data was collected from different private hatcheries, nurseries, fish farms and aqua drug shop in the coastal region mainly focused on Patuakhali district where aquaculture clusters are located for a period of six months.

Primary and secondary data were used during the study. For gathering data, combinations of several survey techniques were adopted. Secondary source of information consist of published material such as journals, textbooks, newspaper, etc. Moreover, appropriate government and non-government organizations

as like Fish Inspection and Quality Control (FIQC) office. The existing problems associated with the use of aquaculture drugs were also collected from the secondary source. For the confirmation of the secondary data, primary data was used also. By using questionnaire interviews and direct observations, primary data were gathered for this survey. Primary data were collected through questionnaire interview with hatchery owner, culture farm, chemical seller, medical representative of Pharmaceuticals Company.

The questionnaire form was filled in by interviewing from 25 hatcheries owner, 15 chemical sellers and 10 medical representatives of Pharmaceuticals Company directly from the study area. Questionnaire was examined in the field before interviews.

One of the PRA tool, such as Focus Group Discussion (FGD) was conducted with hatcheries owner, chemical sellers and medical representatives of Pharmaceuticals Company. In this research, FGD was used to get an overview of particular issues such as the existing problems associated with the use of aquaculture drugs. A total of 4 FGD sessions was conducted where each group size of FGD was 6 to 8 people. FGD session was held in front of hatchery, representative offices, chemical sellers shop, etc.

Crosscheck interviews were conducted with Upazila Fisheries Officer, Assistant Fisheries Officer, relevant NGO workers, hatchery owner, chemical seller and medical representative of Pharmaceuticals Company at their offices or home.

### **Data Processing and Analysis**

The summary tables were prepared in accordance to the objective of the study. Data

collected from various sources were entered into a data base system using Microsoft office Software. The processed data were transferred to a master sheet from which classified tables were prepared revealing the findings of the study. At each stage of survey data sheets were compared with original data sheets to ensure the accuracy of data entered.

## **RESULTS AND DISCUSSION**

Available aquaculture drugs in the market used at different stages of aquatic animal health management like pond preparation, growth promotion, increasing oxygen concentration, disinfectant, probiotic and fish and shellfish disease treatment were collected and compiled in the study. Fish disease treatment was the major area where sufficiently of such compounds were used. The local animal feed and chemical shops are the main sources of these compounds.

### **Use of Chemicals for Pond Preparation and Water Quality Management**

Pond preparation is necessary to enhance the production of fish. The present study identified a range of chemicals were used to preparing and refining water quality of fish pond. The list of such chemicals with their active ingredients, prescribed dose and Manufacturer Company are shown in Table 1. Chemicals like Geotox, Zeolite, Zeocare, Lime, Mega zeo, Bio Aqua, Aquanone, Zeo prime are used for the pond preparation and water quality management. Aquanone are used for controlling unwanted fishes as well as other harmful aquatic animals. Jelani *et al.* (2012) reported that lime, zeolite, fish toxin, insecticides and different fertilizers are used for the preparation and water quality management in Noakhali district. In Bangladesh lime is the most commonly used

**Table 1: Chemicals Use for Pond Preparation and Water Quality Management**

Trade Name	Active Ingredients	Dose	Manufacturer
Geotox	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	For 3-6ft water 20-25kg/100dec	Novartis
Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	20-30kg/acre	Syngenta
Zeocare	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O	200g/acre	Nature care
Lime	CaO, Ca(OH) <sub>2</sub>	Spread with water 6-10 ppm	Chemical seller
Mega zeo	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, Na <sub>2</sub> O, Mn	For 3-6ft water 20-25kg/100dec	ACI animal health
Super Zeolite	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, LoI, K <sub>2</sub> O	20-30kg/acre	Avon animal health
Bio Aqua	Extract of Uka cidizera tree	2ml/100dec	Eon animal health
Aquanone	Rotenone	5-7kg/acre	Square
Zeo prime	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , CaO, MgO, LoI, K <sub>2</sub> O	20-24kg/acre	SK+F

chemicals due to its low price and effectiveness in water quality management (Sultana, 2004)

### Use of Chemicals as Disinfectant

Disinfectants are widely used throughout the world in many spheres of aquaculture. The greatest quantities are used in intensive culture, particularly in finfish and grow-out facilities. They are used in site and equipment preparation, to maintain hygiene throughout the production cycle and, in some cases, to treat disease. There is little or no use in extensive systems. Bleaching, Aquakleen, BKC, EDTA, Efinol, Formalin, Water clear were the used drugs for disease treatment. Formalin is also used to control protozoan disease. BKC (Benzal Konium Chloride) used for controlling bacterial disease and Efinol can also be used as stress resistance. The fish farmers used a variety of chemicals in the treatment of disease or to avoid its occurrence. The list of disinfectants is presented in Table 2.

### Use of Chemicals to Increase Oxygen Concentration

Most chemicals are used for the purpose of oxygen supply. Several chemicals were seen

readily available in the chemical shops to use for increasing dissolved oxygen in fish and shellfish pond. Bio-ox, Best oxygen, Oxygen plus, Oxyflow, Oxylife, Oxymax, Oxymore and Oxyplus are the available chemicals for increasing oxygen concentration in pond. Oxydizing agent, hydrogen peroxide are the major active ingredients of such chemical (Table 3).

In the present study, it was found that some of the above chemicals are also used to eliminate hardness and poisonous gases, e.g., Oxyflow. Some chemicals like Oxymax, and Oxy plus also support in preventing diseases in fish and shellfish. Faruk *et al.* (2008) observed that oxymax are also used to remove hardness and toxic gases.

### Use of Antibiotics for Disease Treatment

Renamycin, Bactitab, Chlorsteclin, Cotrim-Vet, Orgacycline-15%, Oxsyentin 20% and Sulfatrim are antibiotics with different trade names were seen in the market as well as used by the fish farmers which are shown in Table 4. The active ingredients of such antibiotics are mainly

**Table 2: Chemicals used as Disinfectant**

Trade Name	Active Ingredients	Dose	Manufacturer
EDTA	Sodium thio sulphate	0.1-1 ppm	Chemical seller
Bleaching	Chlorine	60 ppm	Chemical seller
Water clear	Sodium thio sulphate	2-3L/100dec	Organic Pharmaceuticals
Formalin	38%formaldehyde	1-3ppm	Chemical seller
BKC	Benzal Konium chloride	Spread with water 0.5ppm	Chemical seller
Efinol	Efinol	5-8g/1000L water	Eon animal health
Aquakleen	Tetradesile Aminonitrogen	24kg/acre	Square

**Table 3: Chemicals used as Oxygen Supply**

Trade Name	Active Ingredients	Dose	Manufacturer
Oxyflow	H <sub>2</sub> O <sub>2</sub> 10%	250-350g/acre	Novartis
Oxymax	H <sub>2</sub> O <sub>2</sub> 10%	250-500g/acre	Eon animal health
Bio-ox	Sodium carbonat ,H <sub>2</sub> O <sub>2</sub> 10%	2.5-5g/acre	ACI animal health
Oxyplus	Na <sub>2</sub> O <sub>2</sub> + AlOH,Na <sub>2</sub> O <sub>2</sub> -90%	500g/acre	Navana animal health
Oxygen plus	O <sub>2</sub> Promoter (H <sub>2</sub> O <sub>2</sub> /Ca <sub>2</sub> O <sub>2</sub> )	250-500g/acre	Avon animal health
Oxymore	Sodium carbonat peroxyhydrat	250-500g/acre	SK+F
Oxylife	Oxygen precursors	400g/acre	Square

**Table 4: Antibiotics used for Disease Treatment**

Trade Name	Active Ingredients	Dose	Manufacturer
Oxysentin 20%	Oxytetracline HCl BP	100-200 g/100 kg feed,5-7 days	Novartis
Chlorsteclin	Chlorsteclin	200-300 g/100 Kg feed	Novartis
Renamycin	Oxytetracyclin	28-42 g/100 kg feed	Renata
Orgacycline-15%	Chlorotetracycline	200-300 g/100 kg feed	Organic Pharma Ltd
Bactitab	Oxytetracyclin 20%	50 g/kg body weight	ACI Animal Health
Sulfatrim	Sulphadiazine & Trimethoprim	50 g/kg body weight	Square
Cotrim-Vet	Sulphamethoxazole +Trimethoprime	0.50mg/kg body weight	Square

Oxytetracycline, Chloro-tetracyclin, Amoxicillin, Co-trimoxa zole, Sulphadiazine and Sulpha-methoxazole.

All of these antibiotics are effective against

bacterial disease. According to the leaflet, Oxysentin 20% and Orgacycline-15% are also effective against EUS. It was also mentioned that Chlorsteclin plays vital role in growth promotion

as well as effective against some disease like dropsy, tail and fin rot, gill rot of fish, etc.

### Use of Chemicals for Disease Treatment

In the aquaculture activities there are different chemicals are used for the treatment of fish disease. These types of chemical are displayed in Table 5.

From these chemicals Eco-solution is effective for viral diseases. Melathion and Salt are also useful for eradication of external parasites as well as fungal diseases.

### Use of Chemicals as Growth Promoter

There are different chemicals found in the chemical shops which are used as growth promoter as well as to rise production including Megavit Aqua, Aqua Boost, Aqua Savor, Vitamin premix, Fibosol, Grow fast, Orgavit aqua, AQGrow-G, Fish vita plus, AQ Grow-L, Nature Aqua GP, Vitamix, F Aqua, ACmix and many more. Aqua boost contains immune stimulant which enhance non-specific immunity in fish.

### Widely used Chemicals, Antibiotics and Disinfectants in the Patuakhali

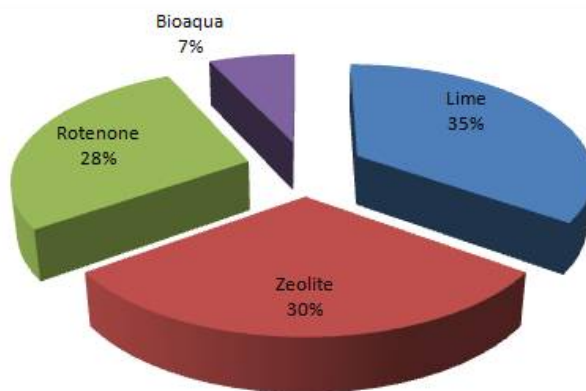
Data from 80 fish farmers were analyzed to know the commonly used chemicals, antibiotics and disinfectants which are shown in Figures 1 to 4. From the study, it is found that lime, zeolite and rotenone were widely used for pond preparation and water quality management. 35% farmers used lime due to its low price and effectiveness in water quality management. Zeolite was chosen for quick result of water quality maintenance. It is also effective to remove toxic gases such as ammonia (NH<sub>3</sub>), hydrogen sulfide (H<sub>2</sub>S), carbon dioxide (CO<sub>2</sub>) and nitrate (Jilani *et al.*, 2012). In case of disinfectants bleaching is commonly used to disinfect the hatchery equipments. In the present study it was observed that 46% and 31% farmers used lime and potash to control the dactylogyrosis, gyrodactylosis and argulosis. Whereas renamycin is widely used to control the bacterial diseases.

Most of the farmers usually do not maintain the recommended dose during use of different

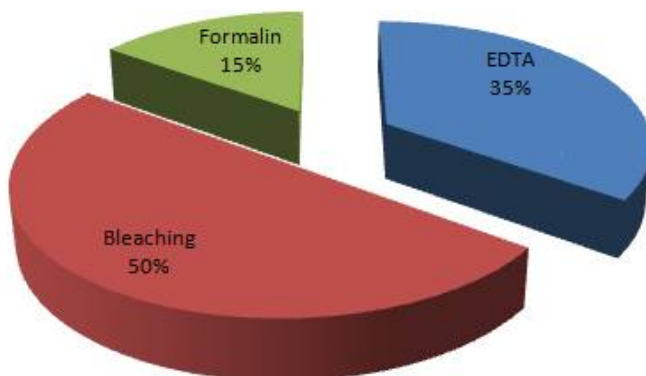
**Table 5: Chemical used for Disease Treatment**

Trade Name	Active Ingredients	Dose	Manufacturer
Potash	KMnO <sub>4</sub>	5-15 mg/dec	Chemical seller
Lime	CaO, Ca(OH) <sub>2</sub>	100kg/ha	Chemical seller
Formaline	40% formaldehyde	1-3ppm	Chemical seller
Salt	NaCl	Spread with water 6-10 ppm	Chemical seller
Methylene blue	C <sub>10</sub> H <sub>18</sub> CIN <sub>3</sub> S <sub>x</sub> H <sub>2</sub> O	2-3ppm bath for 1h/10-20 mg/L for 15 min.	Chemical seller
Malachite green	C <sub>2</sub> H <sub>2</sub> O <sub>4</sub>	1ppm; 1min; dip	Chemical seller
Malthion	Malthion	500g/acre	Century Agro Ltd
Eco- solution	Eco-Solution	200-250g/acre	Fish tech Ltd
Registrol	Betain, Calcium, P, Vit-C	5-10ml/kg feed	Square

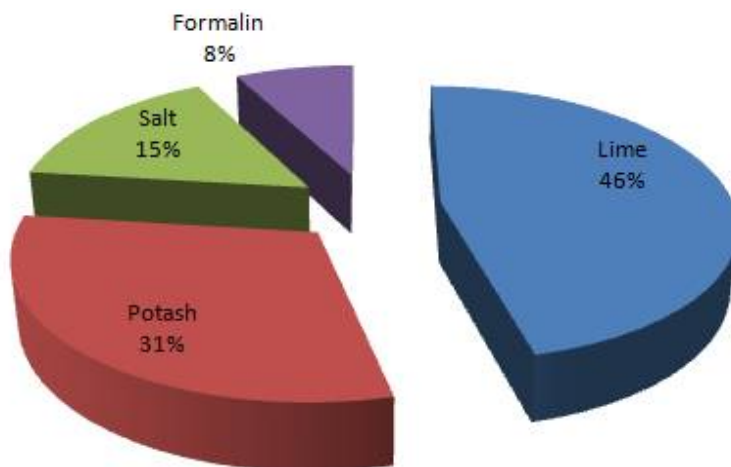
**Figure 1: Most Commonly Used Chemicals for Pond Preparation and Water Quality Management**



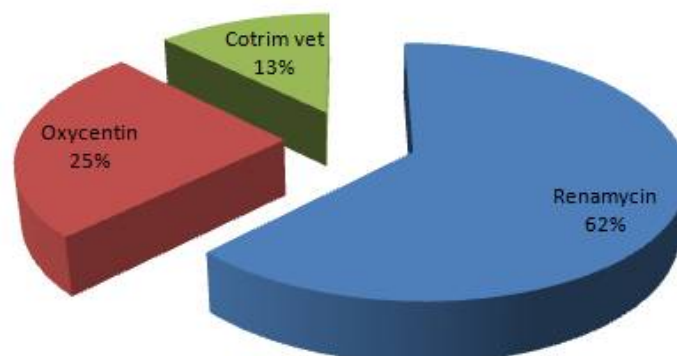
**Figure 2: Widely Used Disinfectants in Major Farm in Patuakhali District**



**Figure 3: Commonly Used Chemicals in Disease Treatment of Fish in Patuakhali Region**





**Figure 4: Commonly Used Antibiotics in Disease Treatment of Fish in Patuakhali Region**

chemicals in aquaculture activities. Sometimes they observed that recommended dose is not effective to control the diseases. As a result they apply higher doses than recommended dose.

This higher dose cannot be tolerated by other organisms which causes serious loss of biodiversity (Ravindran *et al.*, 2012; Sharif, 2012).

#### Problems Associated in Use of Chemicals

Several problems were identified in the present study associated with the use of aquaculture drugs which included lack of knowledge regarding use of chemicals, lack of knowledge of application of chemicals and antibiotics, indiscriminate use of chemicals, lack of knowledge about residual effect and expiry date and lack of diagnostic facilities for proper disease diagnosis. Farmers of Patuakhali district usually do not maintain the recommended dose. Sometimes farmers experiential that recommended doses are not effective in case of fish poisoning, insect killing and disease treatment. Therefore, they apply higher dose than the recommended dose. This higher dose cannot be tolerated by other organisms which results serious biodiversity loss of aquatic organisms.

## CONCLUSION

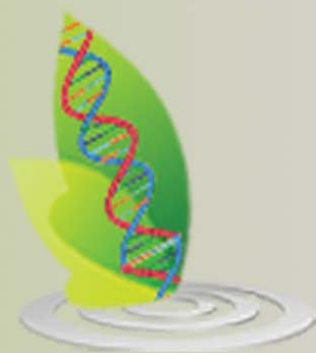
Considering the present situation, it can be assumed that with the further advancement of the aquaculture industry in Bangladesh, particularly in systems undergoing intensification, the applications of chemicals would be increased. The present study described the existing status of aquaculture drugs used in fish and shrimp health management by the fish and shrimp farmers. By the survey, farmers did not have proper knowledge about the chemicals they were using especially those were available in the markets known by their trade names only. However, policy makers, researchers and scientists should work together in addressing the issues of drugs used in aquaculture with the view to decrease the negative impacts. Therefore, both the government and nongovernment organizations should take initiative for better understanding of chemical uses in aquaculture management.

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