

Evaluation of the status of use of chemicals and antibiotics in freshwater aquaculture activities with special emphasis to fish health management

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Abstract

The study was carried out to understand current status of use of chemicals and antibiotics in fish health management in freshwater aquaculture activities. Data were collected through questionnaire interview, personal contact, market survey and participatory rural appraisal like focus group discussion with fish and prawn farmers, retailers of animal medicine and representatives of pharmaceutical companies. A range of chemicals including antibiotics were found available in market. Fish health management and disease treatment were the major areas where majority of such chemicals have been used. Other uses included pond preparation and management, growth promotion and improvement of water quality to enhance pond productivity. Commonly found traditional chemicals in health management included Lime, Salt, Potassium permanganate, Sumithion, Melathion, Formalin, Bleaching powder and Malachite green. Of the new products JVzeolite, Geotox, Green zeolite, Orgavit aqua, Fish vitaplus, AQ grow-G, Oxy flow, Oxy max and O₂-marine were most widely used compounds. Fourteen branded antibiotics were found in market of which Oxysentin, Renamox, Renamycin and Orgamycine were being widely used. Thirty three pharmaceutical companies were producing and marketing these products. The study also identified the problems associated with the use of chemicals which included lack of knowledge regarding use of chemicals, appropriate dose, method of application and indiscriminate use of chemicals.

Keywords: Chemicals, Antibiotics, Aquaculture, Health management

Introduction

Aquaculture in Bangladesh is expanding rapidly. Over the last decade it has expanded, diversified, intensified and technologically advanced. In aquaculture, as in all food production sectors, one of the inputs required for successful fish production is chemical. Chemicals are indeed an essential ingredient to successful aquaculture, which has been used in various forms for centuries (Subasinghe *et al.*, 1996). Chemicals used in aquaculture can be classified as purpose of use, the type of organisms under culture, the life cycle stage for which they are used, the culture system and intensity of culture, and the type of people who are using them. Chemicals and antibiotics are important components in health management of aquatic animals, pond construction, soil and water management, improve aquatic productivity, transportation of live fish, 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 other chemicals are also used in aquaculture for health management of fish apart from antibiotics. Some common chemicals include sodium chloride, formalin, malachite green, methylene blue, potassium permanganate, hydrogen per oxide, copper compounds, glutaraldehyde and trifluralin (Plumb, 1992).

A range of disease could be found in farmed aquatic animals in Bangladesh (Karim and Stellwagen, 1998; BFRl, 1999 and Faruk *et al.*, 2004). Farmers are using a range of chemicals and antibiotic for the treatment of diseased animal. Also, pharmaceutical companies and chemical sellers are influencing fish and prawn farmers to buy their products. The farmers have been using these chemicals without knowing their necessity and effectiveness.

There are problems associated with the use of chemicals. With the expansion of aquaculture in Bangladesh, there has been increasing trend in using chemicals in aquatic animal health management. Commonly used chemicals in Bangladesh aquaculture are lime, rotenone, various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion, melathion etc. (Phillips, 1996; Hasan and Ahmed, 2002; Brown and Brooks, 2002; DoF, 2002 and Faruk *et al.*, 2005).

Unfortunately, little attention has been paid on the documentation of chemicals and antibiotics used in aquaculture industry in the country. As a result, there is a lack of information regarding the present status and consequences of chemicals and antibiotics using in aquaculture sector especially in aquatic animal health management and needs examination. Hence, the objectives of the present study were i) to identify types of chemical and antibiotic used in aquatic animal health management; ii) to know the purpose, dose and methods of their application and iii) to identify the problems associated with their use.

Materials and Methods

The study focused mainly on different upazillas in Mymensingh district where aquaculture clusters are located. Data were collected through questionnaire interview, personal contact, market survey and participatory rural appraisal like focus group discussion with fish and prawn farmers, retailers of animal medicine and representatives of pharmaceutical companies. For questionnaire survey a set of preliminary questionnaire based on the objectives of the study was prepared. The preliminary questionnaire was tested twice at the field level with few farmers and based on the response, the final set questionnaire was prepared. For the interview, simple random sampling method was followed.

PRA tools such as focus group discussion were conducted with rural fish farmers. Six to twelve fish farmers were selected for each discussion. Key informants such as District Fisheries Officer, *Upazilla* Fisheries Officer and NGO workers were interviewed by a semi-structured questionnaire. Key issues that came from focus group discussion were also discussed with key informants to have more logical explanation.

Results and Discussion

The chemicals available 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 prawn disease treatment have been collected and compiled. Fish disease treatment was the major area where plenty of such compounds were used. The local animal feed and chemical shops are the main sources of such compounds.

Chemicals used for pond preparation and water quality management

A number of traditional as well as new compounds were seen in the market which are being used to pond preparation and improving water quality of fish pond. The list of such chemicals with their active ingredients, prescribed dose, source and approximate price are shown in Table 1.

Chemicals like Rotenone and Predator are used for controlling unwanted fishes as well as other harmful aquatic animals. Fertilizers are used to increase primary productivity. Controller and Plankto Forte are used as a good source of mineral.

Table 1. Chemicals used for pond preparation and water quality management

| Trade Name | Active ingredient | Dose | Source | Price (Tk.) |
|-----------------|--|---|--------------------------------|-------------|
| Geotox | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | For 3-6 feet deep water body 20-25Kg /100 dec. After stocking 10-20 kg/100 dec. | Novartis Pharmaceuticals | 55/kg |
| JV Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O, K ₂ O | During pond preparation 7 kg/33dec. During culture 3.5Kg/33 dec. every 15 days | Eon Animal health Products | 50 /kg |
| Green Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O, K ₂ O, | During pond preparation 20-25 Kg/100 dec. During culture 10-15 kg/100dec. | Organic Pharmaceuticals | 55 /kg |
| Pontox plus | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | For 3-6 feet deep water body 15 kg/100 dec. After stocking 10-20 kg . | Rals Agro Ltd. | 55 /kg |
| Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | 20-30 kg/acre | National Agricare Imp. Exp Ltd | 50/kg |
| Benzo | Tetra acetyl ethylin diamin + Sodium perborate | 200 gm/acre | Synzenta | 400/250g |
| Zeocare | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | 20-30 kg/acre | Nature Care | 50/kg |
| Mega Zeo | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O, K ₂ O, Mn, | For 3-6 feet deep water body 25 kg /100 dec. After stocking 15-20 kg in same water body. | ACI Animal Health | 45/kg |
| Lime | CaO, Ca(OH) ₂ | 1-2 kg/dec. | Chemical seller | 12 /kg |
| Agriculturelime | CaCO ₃ | Spread with water 6-10 ppm | Chemical seller | 8-15/kg |
| Bis Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | 20-30Kg/acre | Avon Animal Health | 50/kg |
| SupureZeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | 20-30 kg/acre | Avon Animal Health | 50/kg |
| Bio-Tuff | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O, K ₂ O, TiO ₂ | During pond preparation 15-20 kg/100 dec. During culture 7-10 kg/100dec. Every 30- 40 days. | Organic Pharmaceuticals Ltd. | 50/kg |
| Well Zeolite | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | For 3-6 feet deep water body 6-8 kg /33dec dec. After stocking 3-6 kg | SK+F | 50/kg |
| Bio Aqua | Extract of Uka cidizera tree | 2 ml/100 dec (1m depth) | Eon Animal health Products | 330/100 ml |
| Aquazet | SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ CaO, MgO, Na ₂ O | 20-30/acre | Lion Overseas | 50/kg |

Chemicals use as disinfectant

Disinfectants are widely used in many spheres of aquaculture. They are used both in hatchery and grow-out systems mainly for equipment cleaning, to maintain hygiene and in some cases to treat disease. The disinfectants listed in Table 2 were found available in the market.

According to the leaflet provided by the company, Timsen and Emsen are also very effective in prevention of some bacterial and fungal infection as well as they destroy viruses. 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.

Chemicals used to increase oxygen concentration

Several chemicals were seen readily available in the chemical shops to use for increasing dissolved oxygen in fish pond. Oxydizing agent, hydrogen peroxide are the major active ingredients of such chemical (Table 3).

Table 2. Chemicals used as disinfectant

| Trade Name | Active ingredient | Dose | Source | Price (Tk.) |
|----------------------|--|---|---------------------------------|------------------|
| EDTA | Sodium thio sulfate | 0.1-1 ppm | Chemical seller | 40/kg |
| Bleaching | Chlorine | 60 ppm | Chemical seller | 50/kg |
| Timsen | n-alkyl dimethyl benzyl ammonium chloride+ stabilized urea | 20 g/33dec. (For prevention) 80 g/33dec. (For Treatment) | Eon Animal Health Products Ltd. | 238/50 g |
| Emsen | n-alkyl dimethyl benzyl ammonium chloride+ stabilized urea | 80 g/33 dec. | SK+FEskayef Bangladesh Ltd. | 238/50 g |
| Water clear | Sodium Thiosulphate | In case of 5-6 feet deep water body 2-3 L/100 dec. | Organic Pharmaceuticals Ltd. | 300/L |
| Pathocide | Benzyl chromium + Natural polymer of glucosamine | 200 ml/33 dec. | Penta Agrovet Ltd | 100/100 ml |
| Omicide | Benzyl ammonium chloride+ urea | 200 ml/33dec. After 24 hours 150 ml | Lion Overseas Trading Company | 100/100 ml |
| Lenocide | Alkyl benzyl dimethyl ammonium chloride+Poly-2-deoxy-2 Amino glucose | 500-1000 ml/acre | Nature Care Com. | 100/100 ml |
| Microdine-Iodine 20% | Nonyl alkyl ohenoxy poly ethane oxide iodine complex | 2-2.5 L/ccre | Rals Agro Ltd. | 80/400 g |
| Formalin | 38% formaldehyde | 1-3 ppm | Chemical seller | 70/kg |
| BKC | Benzal Konium chloride | Spread with water, 0.5 ppm | Chemical seller | Tk. 1000-1500/Kg |
| Efinol | Efinol | 5-8 g/1000 Liter water | Eon Animal health Products Ltd. | - |

Table 3. Chemicals used for oxygen supply

| Trade Name | Active ingredient | Dose | Source | Price (Tk.) |
|------------------------|--|---|----------------------------------|-------------|
| Oxyflow | H ₂ O ₂ 10% | General dose 250-350 g/acre In case of high deficiency 500 gm/acre in same water body. | Novartis Pharmaceuticals Ltd. | 600/kg |
| Oxymax | H ₂ O ₂ 10% | 250-500gm/acre (1 m deep water body) | Eon Animal health Products Ltd. | 600/kg |
| O ₂ -Marine | H ₂ O ₂ 10% | 33-40 Tab./33dec. (Generally) 66-90Tab/33dec | Organic Pharmaceuticals Ltd. | 530/kg |
| Bio care | Sodium Lorile Ether Sulphate | 80-120 ml/100 dec. | ACI Animal Health | 350/L |
| Bio- Ox | Sodium carbonat, H ₂ O ₂ | General dose 2.5-5.0 g/acre In case of high deficiency 5-8 g/acre in same water body. | ACI Animal Health | 500/kg |
| Oxy plus | Na ₂ O ₂ .AlOH Na ₂ O ₂ -90% | 500 g/acre | Navana Animal Health | 530/kg |
| Oxygen Plus | O ₂ Promoter (H ₂ O ₂ /Ca ₂ O ₂) | General dose 250-500 g/acre; In case of high deficiency 750-1000 gm/acre | Avon Animal Health | 530/kg |
| Oxymore | Sodium carbonat peroxyhydrat | General dose 250-500 g/acre; In case of high deficiency 750-1000 gm/acre | SK+F Bangladesh Ltd. | 500/kg |
| Quick Oxygen | Sodium per carbonat+free Oxygen | General dose 250-350 g/acre; In case of high deficiency 500 g/acre | Organic Pharmaceuticals Ltd. | 600/kg |
| Oxy-Plus | O ₂ Promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500 g/acre | Penta Agrovet Ltd | 530/kg |
| O-Plus | O ₂ Promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500 g/acre | Nature Care | 500/kg |
| Oxygrow | O ₂ Promoter (H ₂ O ₂ /Ca ₂ O ₂) | 500 g/acre | Century Agro Ltd | 530/kg |
| Oxysun | Sodium peroxide, Calcium Peroxide, Magnesium Oxide, Zinc Oxide | 500 g/acre | Rals Agro Ltd. Bangladesh | 530/5kg |
| Fish care powder | Oxide of Ca,P,S,Mn, Mg,Cu,N. | 1kg/33dec. | S.S.S. Agro Care Ltd | 70/400 g |
| Fish Curepas | Oxide of Ca,P,S,Mn, Mg,Cu,N. | 1kg/33dec | M.R. Food and Protein Industries | 70/400 g |
| Best oxygen | Sodium percarbonate | 250-500 g/acre | Univet Ltd. | - |
| Oxy-Gold | Sodium Percarbonate | 250-500 g/acre | Fishtech Ltd | - |

It was found that some of the above chemicals are also used to remove hardness and poisonous gases e.g. Oxyflow and Quick oxygen. Some chemicals like Oxymax, O₂-Marrine and Oxy plus also help in preventing diseases in fish.

Chemicals used for disease treatment

Apart from antibiotics a handful of chemicals mostly traditional were seen available in the shops for treating fish disease. No information leaflet was available on dose and methods of application of such chemicals. No pharmaceutical companies are dealing with the basic traditional chemical rather they are engaged in producing new products. These types of chemical are shown in Table 4.

Table 4. Chemicals used for disease treatment

| Trade Name | Active ingredient | Source | Price (Tk.) |
|-----------------|---|---------------------------------|-------------|
| Potash | KMnO ₄ | Chemical seller | 185/kg |
| Eco- solution | Eco-Solution | Chemical seller | 85/L |
| Lime | CaO, Ca(OH) ₂ | Chemical seller | 12/kg |
| Formalin | 40 % HCHO | Chemical seller | 70/kg |
| Salt | NaCl | Chemical seller | 8/kg |
| Albez | Doxycyclin, colistine sulphate + vitamin premix + mineral | Syngenta | 253/250 g |
| Protacide | C ₂₂ H ₄₂ ClN+C ₂₃ H ₂₅ ClN ₂ +C ₂ H ₅ OH + Some inert component | Elwellas | - |
| Methylene Blue | C ₁₀ H ₁₈ ClN ₃ S _x H ₂ O | Chemical seller | 350/25 g |
| Malachite green | C ₂ H ₂ O ₄ | Chemical seller | 500/25 g |
| Melathion | Active melathion | Chemical seller | 60/100 ml |
| Spa | Protein, chloesteren, Ca, Vitamin-D, Carotinaid | Syngenta | 4100/kg |
| Timsen | n-alkyl dimethyl benzyl ammonium chloride+ stabilized urea | Eon Animal Health Products Ltd. | 238/50 g |
| Sumithion | Fanitrothion | Chemical seller | 90/100 ml |

From above chemicals in Table 4, Eco-solution is effective for viral diseases. Melathion, Diptex, Melachite green, Formalin, Salt, Methylin blue, etc. are useful for eradication of external parasites as well as fungal diseases. Lime is also used for common fish diseases. Spa is effective for both disease treatment and growth promotion purposes. Moreover, timsen is used for treatment of several diseases and as a disinfectant.

Antibiotics for disease treatment

In the present investigation about 14 branded antibiotics with different trade names were seen in the market as well as used by the fish farmers which are shown in Table 5. The active ingredients of such antibiotics are mainly Oxytetracycline, Chloro-tetracyclin, Amoxicillin, Co-trimoxa zole, Sulphadiazine and Sulphamethoxazole. The price seems quite affordable by the commercial aqua farmers.

Table 5. Antibiotics for disease treatment

| Trade name | Active ingredient | Dose | Source | Price (Tk.) |
|---------------------|----------------------------------|--|------------------------------|-------------|
| Oxysentin 20% | Oxytetracine HCl BP | 100-200 g/100 kg feed,5-7 days (For treatment) | Novartis Pharmaceuticals | 700/kg |
| Chlorsteclin | Chlortetracycline | 200-300 g/100 Kg feed (5-7days) | Novartis Pharmaceuticals | 300/kg |
| Ranamox | Amoxicillin Trihydrate | 28-40 g/100 bd of fish, 10 days continuously. | Renata Pharmaceuticals Ltd | 140/100 g |
| Renamycin | Oxytetracycline | 28-42 g/100 kg feed, 10 days. | Renata Pharmaceuticals | 82/100 g |
| Fish cure | Chloro-tetracyclin HCl | 500 g/100 kg feed (3-5 days) | Rals Agro Ltd. | 275/kg |
| Orgamycin 15 % | Oxytracycline HCl BP (WSP) | In case of prevention 60 gm/100 kg feed 10days In treatment 120-240 g/100 kg feed, 5-7 days | Organic Pharmaceuticals Ltd. | 70/100 g |
| Orgacycline-15% | Chlorotetracycline | 200-300 g/100 kg feed (5-7days) | Organic Pharmaceuticals Ltd | - |
| Acimox(vet) Powder | Amoxiciline (Trihydrate) | 1 g/1 kg feed | ACI Animal Health | 75/100 g |
| Bactitab | Oxytetracyclin 20% | 50 g/kg body weight , 5-7 days | ACI Animal Health | 70-80/100 g |
| Contrim vet Bolus | Co-Trimoxa zole | Mixed with feed; 1bolus/ 10-12 kg body wt | Square Pharmaceuticals | 64 /100 g |
| Otetra vet power 50 | Oxytetracycline | Mixed with feed; 11-16 g/ 100 kg body wt | Square Pharmaceuticals | 156/100 g |
| Sulfatrim | Sulphadiazine & Trimethoprim | 50 g/kg body weight , 5-7 days | Square Pharmaceuticals | 70-80/100 g |
| Oxin WS | Oxytetracycline 20% | 50 mg/kg body weight | Navana | 70-80/100 g |
| Cotrim-Vet | Sulphamethoxazole + Trimethoprim | 0.50mg/kg body weight | Square Pharmaceuticals | 70-80/100 g |

According to the information leaflet, all of these antibiotics are effective against bacterial disease. According to the leaflet, Oxysentin 20%, Orgamycin 15 % and Orgacycline-15% are also effective against EUS. It was also mentioned that Chlorsteclin and Fish cure plays vital role in growth promotion as well as effective against some disease like dropsy, tail and fin rot, gill rot of fish etc.

Chemicals used as growth promoter

Chemicals found in the chemical shops which are used as growth promoter as well as to increase production included Megavit Aqua, Aqua Boost, Aqua Savor, Vitamin premix, Fibosol, Grow fast, Orgavit aqua, AQ-Cell , AQGrow-G, Fish vita plus, AQ Grow-L, Growmax, Nature Aqua GP, Vitamix, F Aqua , ACmix and many more. Aqua boost contains β -glucan, immunostimulant, which enhance non-specific immunity in fish.

Widely used traditional chemicals in freshwater aquaculture for health management

Data from 50 freshwater fish farmers were analyzed to know the status of use of commonly available traditional chemicals which are shown in Table 6.

Table 6. Widely used traditional chemicals in freshwater aquaculture

| Chemicals | Number of respondents (n = 50) | % of farmer |
|-----------|-----------------------------------|-------------|
| Lime | 40 | 80 |
| Salt | 30 | 60 |
| Potash | 20 | 40 |
| Melathion | 10 | 20 |

Some previous studies also revealed the similar outcome regarding the use of chemicals in aquaculture in Bangladesh (Phillips, 1996; Brown and Brooks, 2002; DoF, 2002 and Faruk *et al.*, 2005).

Widely used new chemicals in freshwater aquaculture

From the list of a number of new chemicals found in market an attempt was made to find widely used new products by farmers. It was found that Geotox, JVzeolite, Green Zeolite, Megavit Aqua, Fish Vitaplus, AQ Grow-G, Oxy flow, Oxy max, O₂-Marine were the most widely used new chemicals in freshwater aquaculture in the study area (Table 7).

Table 7. Widely used new chemicals in freshwater aquaculture

| Chemicals | Number of farmers (n = 50) | % of farmer |
|------------------------|----------------------------|-------------|
| Geotox | 12 | 24 |
| JVzeolite | 14 | 28 |
| Green Zeolite | 18 | 36 |
| Megavit Aqua | 14 | 28 |
| Fish Vitaplus | 13 | 26 |
| AQ Grow-G | 12 | 24 |
| Oxy flow | 11 | 22 |
| Oxy max | 14 | 28 |
| O ₂ -Marine | 18 | 36 |

Widely used antibiotics in freshwater aquaculture

The use of antibiotic substances is the cause of much controversy. Bacterial diseases of fish can be successfully treated with antibiotics. It is widely recognized that excessive use of antibiotics contributes the development of resistant strains of bacteria (Inglis, 1996). Of the antibiotics four antibiotics like Oxysentin 20%, Renamox, Renamycin and Orgamycine 15% were used widely by the farmers (Table 8) for the treatment of fish diseases.

Table 8. Widely used antibiotics in freshwater aquaculture

| Chemicals | Number of farmers (n = 50) | % of farmer |
|----------------|----------------------------|-------------|
| Oxysentin 20% | 17 | 34 |
| Renamox | 6 | 12 |
| Renamycin | 14 | 28 |
| Orgamycine 15% | 11 | 22 |

Chemical producing pharmaceutical companies

In the present study, about 33 companies were found either producing or marketing products targeting aquaculture. ACI Animal Health Ltd., Organic Pharmaceuticals Ltd., Renata Ltd., Square Pharmaceuticals Ltd., Acme Laboratories, Novartis Animal Health Ltd etc. were seen to produce different products for aquaculture. While Eon Animal Health Products Ltd., CP Company, Rals Agro Ltd., Ellwellas Marketing Ltd. have been marketing various products from different countries including India, USA, Thailand, Taiwan, Indonesia, Malaysia and Spain. They provide detail information about the purposes, dosages, duration and method of application of chemicals in the leaflet. However, farmers had different opinion about the use and efficacy of many of the products. Some companies were seen to provide technical assistance to the farmers. Thus, the farmers fetch considerable pressure from the commercial companies to use a variety of products in their farms. Several products have been sold without any explanation of their action. The present survey revealed that among the 33 companies more than 50 % of the products were produced by seven companies like Organic Pharmaceuticals Ltd. (11.32%), Rals Agro Ltd. (9.43%), Novartis Animal Health Ltd. (5.66%), Eon animal Health Product Ltd. (7.55%), ACI Animal Health Ltd. (11.32%), CP Aquaculture (5.66%), Square Pharmaceuticals Ltd. (5.66%), and the rest (43.40%) were supplied by the 26 companies (Table 9).

Table 9. Supply of Aquatic Chemicals (%) producing pharmaceutical companies

| Name of Company | Number of products n=106 | Product (%) |
|---------------------|--------------------------|-------------|
| Organic | 12 | 11.32 |
| Rals Agro | 10 | 9.43 |
| Novartis | 6 | 5.66 |
| Eon | 8 | 7.55 |
| ACI | 12 | 11.32 |
| CP | 6 | 5.66 |
| Square | 6 | 5.66 |
| Other 26 Companies. | 46 | 43.40 |

It was also found from the present survey that the farmers were using most of the chemicals indiscriminately. There is no regulation on the use of chemicals in aquaculture in Bangladesh. On a worldwide basis, only a small number of chemicals are legally approved for use in aquaculture. The use of drugs and chemicals by the US aquaculture industry is strictly regulated by the US Food and Drug Administration (FDA) and the US Environmental Protection Agency (EPA). In the present investigation, some chemicals were found with only trade names. The sellers or farmers or extension workers do not have clear idea about the active ingredient of that particular chemical although they are using those without hesitation.

Problems in use of chemicals and antibiotics

The present study identified some problems associated with the use of chemicals and antibiotics which included i) lack of technical knowledge of fish farmers on fish health management ii) lack of knowledge about use of chemicals iii) unavailability of appropriate therapeutic iv) lack of knowledge of application of chemicals and antibiotics v) indiscriminate

use of chemicals vi) pressure on farmers from pharmaceutical companies and pesticide sellers vii) poor quality chemicals viii) lack of assistance from GO and NGOs ix) lack of awareness about the safety issues in using hazardous chemicals x) lack of information on the label of chemical about possible hazard xi) lack of knowledge about residual effect and expiry date xii) lack of diagnostic facilities for proper disease diagnosis and xiii) lack of trained manpower to prescribe fish medicine.

Conclusion

The present study demonstrated current status of chemicals and antibiotics used in aquatic animal health management and pointed out some problems of use of these chemicals by the farmers. Simply less use of chemicals is the best alternative to minimize the adverse effects of chemicals in aquaculture. Other alternatives could be used as bioremediation and use of probiotics, immunostimulants, vaccination and alternative therapeutic. However, policy makers, researchers, and scientists should work together in addressing the issues of chemical use in aquaculture with the view to reduce the negative impacts.

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