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ROLE OF CHEMICALS AND ANTIBIOTICS IN AQUACULTURE

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ABSTRACT Annual global aquaculture production has more than tripled within the past 15 years, and by 2015, aquaculture is predicted to account for 39% of total global seafood production by weight. However, as production surges, aquaculture facilities increasingly relay on the heavy input of formulated feeds, antibiotics, antifungal, and agrochemicals. A large number of products are used for water treatments in case of aqua culture are disinfectants, pesticides, herbicides, organic and inorganic fertilizers, feed additives, therapeutants, and anesthetics. It should be noted that in addition to the chemicals that are deliberately used, fish raised in aquaculture are also susceptible to contamination. The various kinds of chemicals involved in the methods to promote the growth of the aquatics may also cause some complications when entered into the food chain that becomes more aggressive as it reaches the ultimate consumer like man. In this juncture it is very essential to know about the hazards posed by them and impacts resulting from chemical use in aquaculture. Hence the present study has been undertaken.

Key words: Aquaculture, Chemicals, Herbicides, Health Hazards, Disinfectants

Introduction

Aquaculture has been practiced in India in both freshwater and coastal saline waters from time immemorial. During the last decade, aquaculture has slowly and steadily transformed itself into a profitable business activity. With the increase in area devoted to aquaculture and also the intensification of culture practices, environmental issues have come into focus, particularly issues concerning the planning and regulation of aquaculture in coastal areas .

Brackish water aquaculture in coastal areas primarily involves shrimp culture and is widespread on the east coast in the states of West Bengal, Andhra Pradesh, Orissa and Tamil Nadu. Along the west coast, Kerala has a predominantly traditional culture system. Huge concentrations of shrimp farms are situated in Nellore, Bhimavaram and Kakinada in Andhra Pradesh. Compared to coastal aquaculture, freshwater carp culture is widespread in the country, particularly in the state of Andhra Pradesh the traditional coastal shrimp farming

systems, production is a mixture of several species of shrimp and fish. Basically, aquaculture in India is largely of the extensive type and primarily related to carp farming. However, there has been an emergence of large-scale commercial, semi-intensive culture of carps in a few states, especially in Andhra Pradesh, where nearly 50,000 ha of carp culture ponds and 35,000 ha of shrimp culture ponds are under commercial operation. With the increase in productivity in semi-intensive carp culture, semi-intensive or intensive shrimp farms, and related hatchery operations, there has been increased usage of artificial inputs in the form of chemicals. Fish farmers faced with serious fish health problems have resorted to management practices involving the use of chemicals and therapeutants. This has resulted in environmental problems that were not previously encountered. Although carp culture is practiced in self-enclosed systems with limited effluent release to the environment, coastal aquaculture farms need large volumes of water daily. Thus, the hazards posed by the release of effluents containing chemicals with residual effect and high nutrient loads into receiving waters are a new dimension that has unfolded in the aquaculture scenario of the country. The sudden change in culture practices that has occurred in India has caught the nation off-guard as regard to effluents affecting the environment.

Use of Chemicals In Aquaculture The various chemicals used in grow-out farming and hatchery operations in both freshwater and coastal aquaculture in India can be classified into the following broad categories. They are water/soil treatment products, disinfectants, pesticides, herbicides, organic fertilizers, inorganic fertilizers, feed additives, therapeutants and anesthetics.

Application of Organic fertilizers in aquaculture is a common practice to promote the yielding. This manure used comes mainly from farm animals. The commonly used manures being Cattle manure, cow dung, pig dung, poultry droppings, etc. The application of raw cow dung slurry helps to boost diatom bloom.(Sarkar 1983)[1] ensuring quick zooplankton production.

Farm Management and use of Chemicals:

Preventive Methods

The persistence of therapeutic agents in the aquatic environment may also cause adverse effects on the ecosystem (Anon 1988)[2], (Choo 1994)[3]. The best strategy in the management of aquaculture enterprises is to prevent the occurrence of disease. The industry

in India, by and large, takes very appropriate precautions to prevent disease in hatcheries as well as in grow-out farms where several Therapeutic Measures will be taken into

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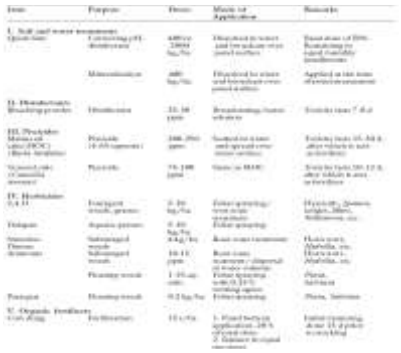
account, The Criteria for Selection of Drugs for Disease Control and methods of Application of Drugs are also viewed very seriously.

General effects of pesticides on edible aquatic organisms

Use of chemotherapeutants in controlling diseases is a common practice in Aqua culture.The negative effects of pesticides on fish are well known. The widespread use of pesticides, besides causing mass kills, may hamper growth and reproduction in fish, produce severe lesions in the vital organs, inhibit gut enzyme activity, affect hatching, and reduce feeding and respiratory rate. Extreme pH levels enhance the toxicity of organophosphorus pesticides (Konar *et al.* 1990)[4].

Table 1. Use of chemicals (other than therapeutants) in freshwater grow-out culture and hatchery systems in India



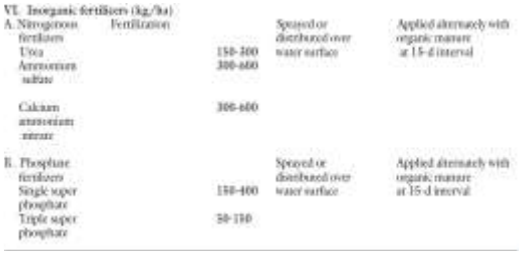


Table 2. Use of chemotherapeutants in freshwater aquaculture and hatchery systems in India (Rao *et al.* 1990)[5].

Table 3. Use of chemicals (other than therapeutants) in coastal aquaculture and hatchery systems in Andhra Pradesh.

Table 4. Use of feed additives and therapeutants in coastal aquaculture and hatchery systems in Andhra

Formalin	Protozoan fouling	15-25 ppm	Applied into ponds
		50-100 ppm	Dip treatment for 30 min
2. Hatcheries			
EDTA	Vibriosis	10-15 ppm	
Copper sulphate	Filamentous bacterial disease	0.25-1 ppm	Dip treatment for 4-6 h
Trefan	Larval mysis	0.1-0.2 ppm	Bath for 1 d
Preforan	Bacterial necrosis Vibrio infection	1 ppm	

Therapeutic Measures

Disease control programs in aquaculture must consider various factors such as stocking density, environmental parameters, rate of water exchange, the type of feed used, and phytoplanktons. Some drugs have been advocated for treatment of diseases should be employed only. The dosages, intervals of administration, duration of exposure of fish, their effect and efficacy in controlling the disease, withdrawal period from the tissues, effects on non-target species, etc. are to be clearly understood. As drugs are useful only if they are applied during the early phase of disease, correct diagnosis at an early stage is a very important aspect that will help to control the disease.

Criteria for Selection of Drugs for Disease Control:

The sensitivity of the pathogen to the drug or antibiotics must be known. Antibiotic or chemical should reach the pathogen and kill it without adversely affecting host. The antibiotic or drug should not adversely affect the user and the natural flora and fauna. The drug should rapidly be broken down to avoid problems with tissue residues. The metabolites of the drug should be harmless to the cultured animal and the consumer. The drug should be stable under normal storage conditions.

Methods of Application of Drugs:

The treatment methods currently being followed include applying the therapeutic agent to thepond water or administering it along with feed. The various methods that are commonly followed are Oral route, Immersion treatment method,Dip treatment, Bath treatmentOne-time application, Injection,Topical application

Other approaches to disease prevention

The guidelines developed are exhaustive and only important aspects are Crop Holiday, Adequate Pond Preparation, Regulating Stocking Density etc. The GOI study conducted in 1995 found that stocking density has a strong influence on the performance of shrimp culture farms (Pathak and Palanisamy 1995)[6].A significant increase in problems is noted when stocking densities exceed 20 PL/m2. This information appears to strongly support the government's policy of not promoting intensive shrimp culture (Government of India 1995).

National Regulations on the use of Chemicals in Aquaculture

At present, there are no regulations to control the use of chemicals and drugs in aquaculture, mainly because the use of chemicals in aquaculture is a recent phenomenon in India and the issue was non-existent a decade ago. Only after the outbreaks of disease in shrimp culture farms has discussion on the need to introduce regulations commenced.

The Central Pollution Control Board and State Pollution Control Boards have certain regulations state that "A number of antibiotics used in shrimp culture for preventing outbreak of diseases are harmful and incorrect usage may result in development of shrimp pathogens resistant to such drugs. The transfer of these pathogens into human beings might result in the development of resistance among human pathogens. Therefore, the use of antibiotics and drugs in the culture system should be avoided. The GOI (Government of india) guideline also stipulates that any farm of 40 ha and above should obtain consent from the State Pollution Control Board under Sec. 25/26 of the Water (Prevention & Control of Pollution) Act, 1974. Farms with 10 ha or less watered area shall obtain a No Objection Certificate of the State Pollution Control Boards.

Conclusion

Findings from this review indicate that current aquaculture practices can lead to elevated levels of antibiotic residues, antibiotic-resistant bacteria, persistent organic pollutants, metals, parasites, and viruses in aquaculture finfish and shellfish. Specific populations at risk of exposure to these contaminants include individuals working in aquaculture facilities, populations living around these facilities and consumers of aquaculture food products. In order to adequately understand, address and prevent these impacts at local, national and global scales, researchers, policy makers, governments, and aquaculture industries must collaborate and cooperate in exchanging critical information and developing targeted policies that are practical, effective and enforceable.

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