

Use Of Chemicals In Aquaculture-Issues Of Concern

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Majority of aquaculture practices are still based on extensive and semi-intensive farming systems though a trend to intensify operations to enhance yields and improve the efficiency of the production process has emerged in recent years. Apart from better management of water resources and water quality, use of high quality seed, optimising stocking densities of seed fish and refining feed and feeding techniques, usage of chemicals has contributed in increase in production efficiency as well as reduction of wastes and losses. Disease outbreak is a constant threat to the cultured stock that makes aquaculturists apply disease control chemicals to treat or prevent such outbreaks. A key problem however is a lack of sufficient knowledge and experience in use of chemicals that leads to their use or misuse. The chemicals used in intensive and sometimes in semi-intensive aquaculture typically include chemotherapeutants, feed additives, hormones, pesticides and parasiticides. Major environmental and human health issues associated with their use in aquaculture are as follows:

a) Persistence in aquatic habitats.

Although many chemicals used in aquaculture degrade rapidly in water, there are some which persist for several days and even months. Thus, though formalin, a widely used parasiticide and fungicide, has a half life of 36 hours in water. dichlorovos, a parasiticide may persist for over a week in seawater. Metal based compounds, such as organotin, can however persist for several months in sediment. Antibiotics, notably oxytetracycline, oxolinic acid and flumequine have been detected in sediments even after 6 months following treatment.

b) Residue in non-cultured organisms:

Use of pesticides, antibacterials and other therapeutants in aquaculture exposes the wild fauna of the local

environment to these chemicals. For instance, unutilised medicated feeds, and faeces of culture organisms rich in drug residues, are often consumed by the wild fishes and molluscs and their subsequent human consumption can potentially transfer these chemicals to man.

c) Toxicity to non-target species

Chemicals such as pesticides and disinfectants used in aquaculture and those leaching from the antifouling coatings applied to the structures can cause toxicity to non-target species. Thus for instances, organophosphate ectoparasiticides when used, result in the release of significant quantities of toxic material in the surrounding waters and can affect larval stages of crustaceans as well as other organisms.

d) Drug resistance

Antibacterial agents are used extensively in intensive aquaculture to treat bacterial diseases in addition to customary prophylactic applications. The preferred routes of application are oral or by immersion. In the process, significant quantities of these chemicals are released to the environment and can lead to selective resistance of native bacteria to drugs. Such applications have resulted in increased resistance in obligate fish pathogens such as *Aeromonas salmonicida* as well as in opportunistic pathogens including *Vibrio* spp and the motile aeromonads. It is also feared that non-pathogenic bacteria in the marine environment may transfer resistance to human pathogens by plasmid relocation. The frequency of resistance increases by the presence of antibacterial agents whose concentrations are not sufficient to kill bacteria. This can result from inappropriate choice of drug, failure to apply an adequate dose, faulty treatment methods, use of antibacterials for prophylactic treatment and dependence on only a very limited number of antibacterials.

e) Modification in sediment biogeo-chemistry:

The organic matter incorporated in the sediment is oxidised by microbial communities present in the sediment. Under aerobic conditions, the decomposition results in low-toxicity products such as carbon dioxide and nitrate. Hence, pond management techniques strive to maintain aerobic decomposition. Presence of antibacterial residues inhibits microbial activity and reduces the extent of aerobic degradation process leading to accumulation of organic matter in the sediment. Subsequent, anaerobic degradation can result in increased production of toxic products such as sulphides and ammonia which can be detrimental to the animals under culture.

f) Nutrient enrichment

Fertilizers often used in pond culture to increase primary productivity increase the nutrient levels of water receiving the pond discharge. Whether these nutrient inputs are of significant ecological consequence depends on the local environment. In areas of restricted water exchange, algal blooms may occur locally leading to modified ecosystems.

g) Residues in cultured animals

Possibility of residues of persistent chemicals if used in aquaculture, in the products is a serious source of anxiety among consumers. Developed countries are increasingly imposing restrictions on occurrence of such residues in cultured organisms and also introducing monitoring programmes for imports. For this purpose, the concept of maximum residue limit has been introduced and used by food safety experts. Hence, the producing countries who wish to continue exporting their aquaculture products to the international markets will be forced to create facilities for monitoring the levels of objectionable

residues in their products before effecting shipment.

From the foregoing analysis it is imperative that safe and effective use of chemicals in aquaculture should be promoted. For this purpose, it is necessary to:

(a) implement a system of registration for 'approved' chemicals for use in aquaculture,

(b) establish withdrawal periods specific to each chemotherapeutant for cultured species and enforce the use of such practices,

(c) conduct training programmes for aquaculturists in safe and effective use of chemicals in their farms,

(d) enhance collaboration among manufacturers, suppliers and users of chemicals in aquaculture,

(e) avoid prophylactic treatment,

(f) use chemotherapeutants only as a last resort,

(g) optimise environmental quality, nutrition and hygiene to minimise the need of prophylactic treatment,

(h) select appropriate drug if unavoidable, and apply it in required concentration over the optimum period,

(i) select antibacterials with narrow spectrum of activity as possible but without loss of efficacy and

(j) avoid discharge of effluent containing chemical residues at concentrations that can adversely affect the local biota.

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- Mangroves being ecologically rich grounds for breeding of aquatic organisms, such areas should not be destroyed for establishing aquaculture farms.
- Since site selection is very important in establishing a farm, proper site selection with investigations on soil, water

source, adjacent land use pattern, probable long term impacts etc. should be done.

- Potential aquaculture sites should be identified through remote sensing and buffer zones have to be delineated for developing waste water discharge systems etc.
- Quality of seed plays a vital role in achieving the targeted production. The seed obtained from different hatcheries must be tested and only disease free seed should be stocked.
- Regulation of feeding practices, identification of exact quantum of feed required and use of pellet
- Use of antibiotics, chemicals and drugs should be avoided in the culture practices which might lead to

feeds required to be standardized on a scientific manner, optimising the feed conversion ratio(FCR).

- long term disadvantages. Similarly, use of bio-degradable piscicides needs to be encouraged.
- Untreated water from the culture medium results in increase in carbon-di-oxide and ammonia loads which is harmful. Hence establishment of treatment plants/settlement ponds in farms essential.
- Development of powerful extension agencies for bringing about awareness in the farming community plays a key role in making the enterprise sustainable.



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