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Review Article

Physiochemical and biological heavy Metals Toxicity in Fisheries at Cellular Level and Management through Advanced Technologies

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Abstract

The basic mechanism for the absorption for the metals is not known in case of fish but some information is available that these metals absorb across gills and intestinal tract and then distributed via circulation in the whole body of fish. Heavy metals include cadmium, arsenic mercury and lead etc. which are existing in natural environment or in other hand these metals are present in the earth crust naturally in a very minute amount. Fish containing products contain different amount of metals. Copper is required in certain limit by human bodies, but when its amount of intake is increasing then it causes serious disorders like kidney failure, liver damage especially During Wilson's disorder. Some fish varieties like those of shellfish etc. accumulate mercury in their bodies which form methylmercury which is extremely toxic that causes organ mercury compound. To be effective, bubbler/diffuser systems must be turned on early in the spring and run nonstop all summer until temperatures begin to cool in the fall.

Keywords: Toxic metals, leads copper, arsenic, fisheries management system.

1. INTRODUCTION

In previous time up to a very great extent work has been done on the absorption in case of fish [1]. According to research findings it has been cleared that absorption in fish related to the type of fish varieties and the type of metals as well. Of these heavy metal ions Research has shown that extent of accumulation of heavy metals in fish is dependent on the metal types, fish species and their type of tissues in which the absorption of metal take place. The water with high metals also has great role in absorption heavy metals in fish body. The soil and sand contents of the water having fish inhabitant is also contributing the accumulation of ions in the fish body. Soil and sand having highest metal contents is the main cause of metal toxicity to those fish species which habitually feeds in the bottom of the water [2-4].

The absorption amount of metal is proportional to the time of exposure, temperature of the environment, hardness and salinity of the water in which the fish live [5, 6]. Beside this some other factors like fish age, feeding habits may also matter. Every metal has its own absorption power to fish. Metal absorption may vary. They may get accumulated in the liver and gills of the fish mostly [7].

The basic mechanism for the absorption for the metals is not known in case of fish but some information is available that these metals absorb across gills and intestinal tract and then distributed via circulation in the whole body of fish. These metals get bound with a protein which is transported to the different tissue of the body. Metals have play an important role in the normal functioning in the fish body and also work in detoxification when bind with proteins called metalothionein abbreviated as MT. Within the cell the concentration of metals may regulated by transporters which carry the metals across the plasma membrane of the cell. Remember metals cannot have metabolized or degraded by the fish body

so it can only be excreted through excretion only [8-10].

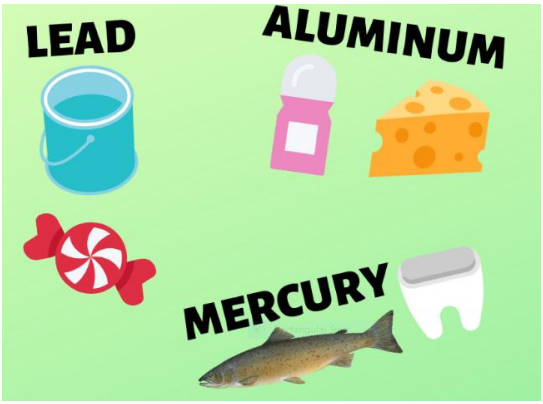

Fig-1: Shows the risks of heavy metals and cellular toxicity

2.1 Accumulation of Heavy Metals through Food Chain

Heavy metals include cadmium, arsenic mercury and lead etc. which are existing in natural environment or in other hand these metals are present in the earth crust naturally in a very minute amount [11,12]. These metals become a part of the food via water and as marine or sea food they get inter into our body which resulting into metal toxicity. These metal are then cannot broken or digested by the human nor a body of fish. The indirect intake of these metals for long time lead to the health problem. The users are suggested to take variety of food items not taking fish on daily bases so that to avoid the metal toxicity and reduce the health risks [13].

The other metals like lead and mercury are toxic especially for little children's. The prolong intake of lead and mercury is harmful nervous system especially for lower level babies which effect the development of fetus in case of pregnant mothers[14]. In presence of the available information metal intake by fish and subsequent distribution in organs is greatly interspecific. Beside this many other factors can effect metal uptake like sex, age, size, reproductive cycle, swimming pattern, feeding behavior of the fishes [15].

Fish is well-thought-out a significant part of a healthy, well-proportioned food because of its outstanding dietetic properties like high-quality proteins, vitamins, essential omega-3 fatty acids etc. their present in their flesh. Fish and are exclusive nutritional sources of cardioprotective docosahexaenoic (DHA) and eicosapentaenoic (EPA) fatty acids. That is why many public health experts endorse regular fish consumption equivalent to at least 1–2 serving per week in order to prevent diet-related fetal diseases [16].

Unluckily environmental impacts like industry, agriculture, mining etc significantly increase the naturally occurring amounts of heavy metals in the environment due to eradication of the earth crust this hugely impact marine ecosystem. Therefore, marine organisms like fish, shellfish, crustaceans can gather these metals to possibly toxic concentrations. Regularly fish and other seafood exemplify one of the central sources of coverage to metals in the general population. Diets that contain toxic metals above the legalized levels are measured to be damaging to human health and are excluded for trade by many national and international authorities [17].

2.2 Toxicity due to Arsenic

Taking the heavy metals for long-term such as arsenic and cadmium may lead to health problems such as skin lesions, brain damage, skin cancer and diseases that affect the blood vessels. One of the toxic metal arsenic found basically in two different forms - organic arsenic and inorganic arsenic. Organic arsenic mainly presents in marine food which is not more harmful [18].

2.3 Toxicity due to Copper

Copper is required in certain limit by human bodies, but when its amount of intake is increasing then it causes serious disorders like kidney failure, liver damage especially During Wilson's disorder. The problem of cupper like metal may happened due to the drinking of water from the copper pipes because they are design with copper in such way to avoid the algae growth [19].

2.4 Toxicity due to Zinc

Zinc also causes health problems as well as well as creating ecological problems. Mostly zinc accumulated in the human body only 2-3 g and up to 90% bones and muscles. The rest of the human organ has low concentration of zinc which include the gastrointestinal tract, skin, kidney, brain, heart etc. The absorption of oral uptake of zinc leads to the absorption of the small intestine and then forward it via the serum to several proteins like albumin, α-macroglobulin, and transporting to the main blood stream of the body [20].

2.5 Toxicity due to Lead

Lead is also a toxic metal because it is more sensitive to infant to adult. The severity of the lead problem depends upon the level of absorption of the lead. Lead causes environmental problems Mostly the lead is received mistakenly in food forms especially that is contaminated by the lead. Some lead problem may be happened due the use of water which is continually thrown through lead pipe. Environmentally lead problem may have happened with point where lead emission takes place. The lead contamination may happen due to soil having lead partials, dust etc. and due to the use of some paint flakes in old houses or contaminated land as well [20-22].

Some fish varieties like those of shellfish etc. accumulate mercury in their bodies which form methylmercury which is extremely toxic that causes organ mercury compound. Fish containing products contain different amount of metals. According to available information some species of fish which are long-lived and have high value in the food chain like marlin, tuna, shark, swordfish, king mackerel and tilefish have higher amount of mercury than other fishes [23].

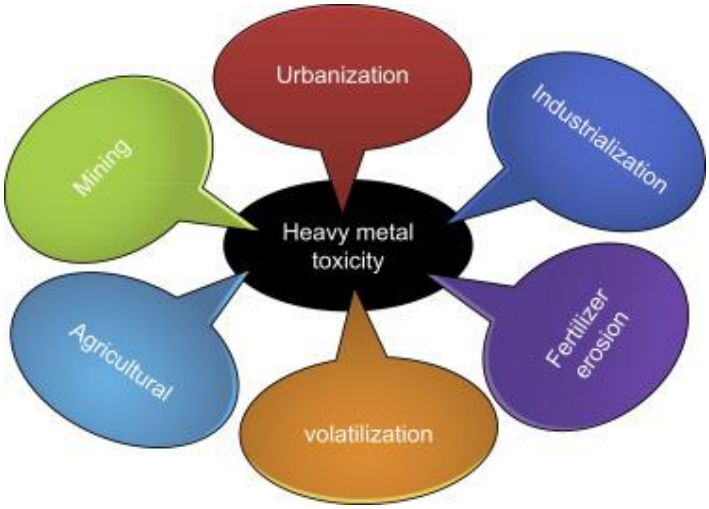

Fig-2: Shows the accumulation and toxicity in fish due to physiochemical factors

2.6 Management of Fisheries through technologies

Threats to the health of our ocean are intensifying. Overfishing, bycatch and destructive fishing gear remain major culprits in the destruction of marine life and habitats, which are also threatened by ocean warming caused by fossil fuel emissions, sea level rise and ocean acidification. To a lesser degree, such spatio-temporal management measures have been used to reduce by-catch of finfish or protected specie [24-26].

From a fisheries perspective, the specific driving factors of climate change include rising water temperature, alterations in the hydrologic cycle, changes in nutrient fluxes, and relocation of spawning and nursery habitat. Further, changes in such factors would affect resources at all levels of biological organization, including the genetic, organism, population, and ecosystem levels. Fisheries are classified as renewable because the organisms of interest (e.g., fish, shellfish, reptiles, amphibians, and marine mammals) usually produce an annual biological surplus that with judicious management can be harvested without reducing future productivity [27].

Mixed-population fishing has a selective effect if the differences in productivity among the different populations have a genetic basis, and variations in components of productivity such as fecundity, fertility, mating behavior, growth rates, and maximum size are influenced by genetic variations. Like humans and animals, fish require oxygen in the form of dissolved oxygen (DO) to survive. However, DO can fluctuate by season, weather or even time of day. The dissolved oxygen requirement in lakes and ponds is highest in the summer when water temperatures reach into the 80's and 90's. During these warm temperatures, the water's ability to hold oxygen is at its lowest. These two factors can reduce the stability of a waterbody, creating the conditions that can lead to fish kills [28-32].

COCNLUSION

Installing an aeration system to circulate and aerate oxygen-deficient water is recommended. Several types of aerators are available, including fountains and pump-operated bubblers or diffusers that sit on the bottom of ponds. To be effective, bubbler/diffuser systems must be turned on early in the spring and run nonstop all summer until temperatures begin to cool in the fall. Many, but not all, fish kills in the summer result from low concentrations of dissolved oxygen in the water. Fish, like all other complex life forms, need oxygen to survive.

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