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Review Article

# New Insights of Novel Genes of Pathogens Causing Toxicology in Fishes, Mechanism of Action, and Future Perspectives

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## Abstract

Copper nanoparticles are typically in black or brown powder form. Copper nanoparticles uses in heat exchange systems, bioscience, anti-microbial materials, Aluminum is extremely harmful to fish in the acid conditions. The primary targeted organ of fish is gill, and death is influenced by a variety of respiratory, osmo-regulatory, and ion regulatory dysfunction. To understand the effect of heavy metals on the aquatic biota, it is necessary to characterize the methods readily accessible to aquatic species for heavy metal mobility, immobilization, and excretion. The severe Ag toxicity to fish is very lower in the sea-water than in the freshwater. Tetrodotoxin is a highly poisonous toxin located primarily in gonads and liver of some fishes, including pufferfishes, toadfish and globefish as well as some shellfish, octopus, and amphibian species. Fish exposed to Cr for the first time displayed a variety of behavioural alterations, including loss of appetite, irregular swimming, changing in colour and mucous discharge. It is much more complicated than genome of humans because zebrafish possess two more sets of chromosomes than humans. Glutathione peroxidase and Catalase are anti - oxidant enzymes that have long been used to assess anti-oxidant injury and stress reaction.

**Keywords**: Tetrodotoxin, fishes, Fipronil, Cr, behavioural alterations, toxicity.



## INTRODUCTION

Copper nanoparticles are preferred components for a variety of applications due to their higher melting point, higher surface area and porosity, shape, higher thermal and electrical conductivity, catalytic activities, size, magnetism, oxidation reduction and low cost. Copper nanoparticles are typically in black or brown powder form. Copper nanoparticles are either synthesized in an inert gaseous environment or coated with the surfactants or protective polymers, as well as inorganic or organic coatings, such as carbon or silica, to counter this [1-3]. CuNPs are created using both "top-down" and "bottom-up" methods. Copper nanoparticles uses in heat exchange systems, bioscience, anti-microbial materials, and catalysis are still being researched. Copper nanoparticles have astounding anti-microbial and anti-bacterial properties. Metal ions are released in a solution and near the microbial membranes. Copper nanoparticles tend to emit Cu2+, that can generate -OH free radicals and damage any surface with which they come into contact. To profit from the comforting properties of copper nanoparticles, the toxicology mechanism must be evaluated in a wide range of parameters and conditions in order to determine safety margins for these copper nanoparticles [4, 5].

Epigenetics modifications, which can help in the regulation of stable gene expression without impacting the primary Sequence of DNA, are now cited as the most common method for the trans generational inheritance of physiological-phenotypes. But apart from meiotically consistent epigenetics modifications, mitotically consistent (namely, somatic) epigenetic alterations are critical for cellular development and differentiation, and also sustaining epigenetically monitored disease phenotypes inside an individual. Indeed, epigenetic methods have already been linked to various types of disease phenotypes (neurological diseases, infertility, metabolic syndromes and cancer) that arise during the development [5-8].

**Table-1: Shows the heavy metals toxicity and biological concerns**

| Type of heavy metal | Affected sources | Biological Effects |
|---|---|---|
| Toxic heavy metallic compounds | Which are directly spreads by mining, fuel combustion and waste disposals | Brain, liver gills |
| Sliver toxicity | Intrusion with the sodium excretion thru the gills could also play a part in toxicity of Ag | intestine seems to be a major caustic site of action |
| Chromium Toxicity | Toxicity of Cr to the aquatic life is influenced by different biotic variables such as developmental phase, age, and types of species | It also causes the the internal injuries and bleeding with an increased pH |

**New insights of causing toxicology**

Aluminum is extremely harmful to fish in the acid conditions. The primary targeted organ of fish is gill, and death is influenced by a variety of respiratory, osmo-regulatory, and ion regulatory dysfunction. The toxic process has previously received slight direct attention and is unidentified. The method of severe aluminum toxicity is examined from chemical standpoint in this article. Toxic indication from literature is combined through our own study is to develop a biologically active framework that predicts a potential mechanisms of acute aluminum toxicity in the fish [9-12].

Our surroundings are becoming progressively contaminated with the toxic heavy metallic compounds which are directly spreads by mining, fuel combustion and waste disposals. The aquatic environment absorbs wastages from these operations and may serve as the finished depository for such anthropogenic sources remobilized toxic substances. To understand the effect of heavy metals on the aquatic biota, it is necessary to characterize the methods readily accessible to aquatic species for heavy metal mobility, immobilization, and excretion [13, 25-28].

The high toxicity mechanism and the toxic Ag species in the seawater are largely unexplored. Nevertheless, osmo-regulatory inability is again at work; fish seem to die as a result of increased plasma Cl and Na+ accumulations as well as dehydration. The intestine seems to be a major caustic site of action in this case. Sea teleosts must drink to maintain fluid balance; the existence of Ag in the sea-water decrease drinking rates and interacts with the uptake of water in intestine, possibly by inhibiting active ions uptake processes that control water flux via osmosis. Intrusion with the sodium excretion thru the gills could also play a part in toxicity of Ag, but no conclusive proof for this influence has been found [8]. The severe Ag toxicity to fish is very lower in the sea-water than in the freshwater [9, 10].

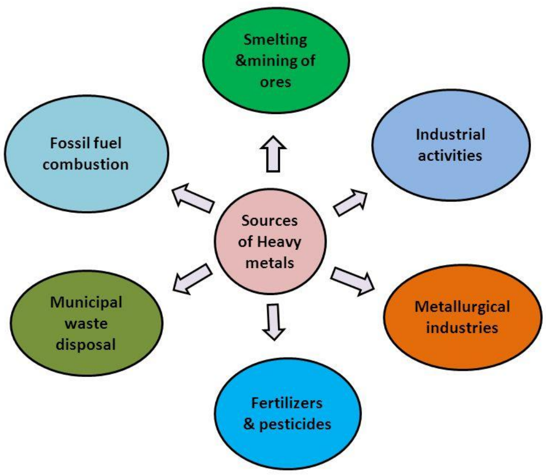


**Fig-1: Shows the metals that causing toxicology in fisher and aquatic animals**

A predator who catches a puffer even before inflates will not be happy for long. Just about all pufferfishes possess tetrodotoxin, a toxin that helps make them taste bad and mostly kills fishes. Tetrodotoxin is lethal to humans, up to 1200 times extra toxic than that of cyanides. One pufferfish contains sufficient poison to kill the thirty humans' adults, and that there's no established antidote. Pufferfish, also referred as blowfish, are thought to have evolved their popular "inflatability" because their steady, clumsy swimming style leaves them vulnerable to the predators. Instead of fleeing, pufferfish utilize their highly variable stomachs and ability to rapidly ingest massive amounts of water and sometimes even air when needed to transform themselves into a nearly indigestible ball so many times their actual size [11, 12].

Tetrodotoxin is a highly poisonous toxin located primarily in gonads and liver of some fishes, including pufferfishes, toadfish and globefish as well as some shellfish, octopus, and amphibian species. Human contaminations happen when fish organs are inadequately prepared and consumed. Tetrodotoxin disrupts the signals transmission from the nerves to muscle tissue, resulting in a progressive body's paralysis. Tetrodotoxin toxicity is potentially lethal [13].

Pyrethroids are synthetic drugs that are similar to pyrethrins obtained from the Chrysanthemum cinerariaefolium. Because of their lower toxicity to the birds and mammals, these toxins are extensively utilized in the agriculture. They are being utilized in aquaculture farms to regulate biological vectors and ectoparasites. Furthermore, they enter in rivers and streams through leaching and runoff [30-35]. Pyrethroids are categorized chemically into two different groups: those with α-cyano group, like cypermethrin, cyfluthrin, λ-cyhalothrin, and deltamethrin, and those without α-cyano group, like permethrin, permethrin and bifenthrin. Other modes of action must include calcium channel inhibition, Ca+/Mg+ ATPase inhibition and Ca+ enzyme inhibition. Pyrethroids are not toxic to animals or birds, but they are extremely harmful to aquatic life. Toxic effect to fish happens as a result of micrograms per liter due to a deficiency in the fishes' nervous system [14, 15].

Fipronil can be administered to fish via a variety of pathways, the most appropriate pathway is that which is determined by the aim of the research and the physicochemical properties of fipronil. Caspian kutum listed the benefits administration is indeed the best method for studying the harmful effects of fipronil on the fishes in a time dependent mechanism. Even though the method of fipronil toxic effects in the insects has indeed been completely defined and is associated to blocking gamma amino-butyric acid gated chlorides channels of receptors in the central nervous system [7], due to the prevailing complicated interplay, there is limited information about its method in vertebrate species. But even so, the method of toxic effects of prolonged organo-chlorinated pesticides may be clarified in general by some biochemical processes like binding to a certain receptors like aryl-hydrocarbon-receptor and induction of the bio-transformation enzymes including CYP1A, activating pathological related conditions, oxidative stress and DNA damage [15-19].

Toxicity of Cr to the aquatic life is influenced by different biotic variables such as developmental phase, age, and types of species, as well as some abiotic variables such as temperature, water alkalinity and pH. Fish exposed to Cr for the first time displayed a variety of behavioural alterations, including loss of appetite, irregular swimming, changing in colour and mucous discharge [20, 21]. Chronic Cr exposure at concentrations ranging from 2 to 200 mol/L in the Cyprinus carpio resulted in cytotoxicity, reduced functions of phagocyte, reduced mitogen induced lymphocyte initiation [22]. Blood clotting time was reduced in Tilapia sparrmanii exposure to Cr, which was reflected by the internal injuries and bleeding with an increased pH [23].

Endosulfan utilization has also been diminished due to its more endurance in the agricultural fields, elevated toxicity to the fishes in marine ecosystems, and harmful impacts on farmworkers [24-26]. Many states, such as Japan, China and Korea, have indicated on its long - term challenge. It was prohibited and forced to drop out from the market across several states, such as Korea, after it was added to list of organic contaminants. Endosulfan may be banned permanently from use, with the exception of some states who use it for specific applications [27, 28].

When comparison to mammals, the zebrafish and some other species of fishes may appear to be relatively simple organisms to the layperson. In the case of genome of zebrafish, even so, that's not the issue [29-32]. It is much more complicated than genome of humans because zebrafish possess two more sets of chromosomes than humans, who have 23 sets. This distinction arose as a result of a whole genome duplication event in teleost progression that did not happen in the mammals. As a consequence, there are many duplicate genes of those located in the mammals. Moreover, just a small percentage of such gene duplications are still present today [19, 20].

$H_2S$ naturally present in environment and as a by-product of several human's activities, including paper-making, gas exploration and sewage systems. It is commonly toxic at small doses and potentially lethal at large levels for most living creatures, such as humans. Nonetheless, some Atlantic populations of molly have adapted to survive in streams with elevated amounts of hydrogen H2S, whereas other groups of same organisms have stayed in the freshwater. These fishes, according to Kelley and her coworkers, provided a natural investigation to help answer questions about how evolution occurs [21, 22].

Water - borne lead accumulation in various tissues of sea organisms, interfering with the normal enzymatic metabolic activities and ultimately resulted in the ROS precipitation in tissues as well as peroxidation of proteins and lipids, likely to result oxidative stress. Glutathione peroxidase and Catalase are anti - oxidant enzymes that have long been used to assess anti-oxidant injury and stress reaction. As a result, GPx and CAT can be used to assess the impact of lead exposure on the aquatic animals [33-35].

## CONCLUSION

As a result, it is simple to incorporate into food and have an effect on public health. As some famous heavy metal elements such as chromium, copper, lead and cadmium could be concentrated in different fish tissues by the water - borne heavy-metals exposure and dietary heavy-metals exposure, putting harmful effects constantly. Furthermore, lead exposure causes immuno-suppression in the conjunction with the stress response.

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