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Toxic Effect of Arsenic on organs of Labeo Rohita, Catla catla Fishes in Affected Areas of West Bengal

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Abstract : Arsenic (As) is a dangerous contaminant in the aquatic world, existing in inorganic and organic forms. Arsenic being most common heavy metal pollutant in fresh water, comes from industry, chemical manufacturing and other anthropogenic sources, the PH label falls and increasing metal solubility causes demolishing effect the aquatic organism. Generally ionic forms of heavy metals are more toxic because it can form toxic compounds with other ions, causes serious cellular damage of fishes. So arsenic are easily available to fish, resulting in considerable amount of metal accumulation in the fish tissue. Relationship between metal accumulation in fish organs and in water has been studied in field and laboratory. So we have tried to carry out the survey in effective district of West Bengal, newspaper and published research papers in pumped. The toxic effect due to arsenic on the importance organs of fishes like Gills, Liver, Kidney and Flesh.

Keywords:- Arsenic ,Toxicity, Fish, and Organs.

Introduction: Arsenic occurs in the environment in inorganic and organic forms, both in trivalent and pentavalent state. Toxicity of trivalent arsenic compounds is more than pentavalent forms because trivalent are more soluble in aquatic environment. According to the data inorganic forms (arsenite and arsenate) shows highest toxicity level compared to the organo-arsenicals (Duker et al., 2005). Arsenic is released into the aquatic environment through anthropogenic activities such as metal smelting, chemical manufacturing, and agriculture (Singh and Banerjee, 2008). Although it is toxic trace element but release of large amount as result of industrial and agricultural activities (Canivet et al., 2001) of it becomes threat to ecosystem. It is believed that variations in the absorption and depuration times of specific metals are the primary cause of metal bioaccumulation in fish. Many factors, in cluding the time of year, the physical and chemical properties of the water, industrial development, fertilizers, livestock manure, air pollution, mining, and excessive pesticide use, can lead to metal accumulation in different fish tissues (Tucker, 1997). Human is mainly exposed for such toxic metals through ingestion of contaminated food and water, which accounted for more than 90 % compared to inhalation and other exposure routes (Loutfy et al., 2006). Arsenic is one of the most prominent toxicants in the aquatic environment, polluting water severely. It is a metalloid toxicant widely found in rivers, canals, ponds, groundwater, lakes and seawater due to the uncontrolled influx of industrial wastes and pesticides in the aquatic environment. The World Health Organization (WHO) has classified arsenic as one of the most dangerous chemicals to public health. Arsenic levels have been

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documented up to 800 and 2500 ppm in many countries, including Chile and Bangladesh. High-level arsenic exposure is directly associated with many diseases, such as skin and lung cancer as well as cardiovascular disease and liver disorder. Previous research has demonstrated the negative effects of arsenic on fish growth, mortality, development. Fish exposed to high concentrations of arsenic experience changes in body physiology, including effects on growth, mortality, ion exchange, immune system, reproduction, enzyme activity, histology and gene regulation.

Sources of Arsenic:

The most common source of elevated As concentrations in the environment is attributable to anthropogenic activities. Mining activities have contributed to the contamination of soil and water primarily. However, other anthropogenic activities using As, such as agriculture, forestry, and industry have also contaminated soil and water at a localized scale (Smith et al., 2003). As in soil can be transported by wind or water; as runoff, or may leach into the soil from arseniferous rocks, mining waste, processing plants and industrial waste. Many As compounds are present in the aquifer; it may be released in ionic form into the soil under oxidizing conditions. Rainwater or snowmelt may leach soluble forms into surface water or groundwater. Oxidation, reduction, adsorption, dissolution, precipitation, and volatilization of As reactions commonly occur in soil. Water is the major means of transport of As under natural conditions. Arsenic and arsenic compounds are produced and used commercially for centuries. Arsenic was used in some medicinal applications until 1970s. Inorganic arsenic was used in the treatment of leukemia, psoriasis, and chronic bronchial asthma, and organic arsenic was used in antibiotics for the treatment of spirochetal and protozoal disease (ATSDR, 2007). Inorganic arsenic is an active component of antifungal wood preservatives.

Arsenic Exposure Levels in Aquatic System:-

Arsenic, from both natural and anthropogenic sources, is mainly transported in the environment through water. Naturally it is introduced through the dissolution of rocks, minerals, and ores, and anthropogenically by agriculture, forestry, industrial effluents, including mining wastes, and via atmospheric deposition (Smith et al.,2003). Some researchers have described the molecular mechanisms in heavy-metal-induced f ish. A researcher studied the effect of metal toxicity. Exposure to high levels of arsenic in drinking-water has been recognized for many decades in some regions of the world, notably in China and some countries of Central and South America. More recently, several other regions have reported to have highly arsenic contaminated drinking ground water resources due to geological formations. High concentration of arsenic in water is reported in Bangladesh, West Bengal in India and smaller areas in Australia.

Effect of Arsenic on Fish on fish organs:-

Arsenic produce toxicity in fish organs. Acute toxicity effects liver, gill, kidney and others organs, sub-acute toxicity of arsenic effects respiratory, gastrointestinal, cardiovascular, nervous, and hemopoietic systems on long term exposure.

Gills:

Gills carry out three main functions gas exchange, ion regulation and expression of metabolic waste product. A high rate of absorption of As through gills also makes fish a vulnerable of toxicity. Arsenic affects antioxidant response in gills even at safer concentrations (Lima et al., 2009). Exposure to 12.0 mg/l of arsenic trioxide, gills of Channa punctatus showed degenerative changes in cartilaginous bars of gills, increase in mucous secretion between the space of primary gill lamella, degeneration of basal lamellar region, vacuolization at tip of primary gill ray and destruction of epithelial cells of secondary gill lamella (Agnihotri et al., 2010). when exposed to different concentration of arsenic then changes in gill were characterized by epithelial hyperplasia, epithelial lifting and oedema, lamellar fusion, aneurism, desquamation, and necrosis (Das and Goswami). Hence , damage in gills may impair their respiratory efficacy.

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Liver:

Liver is the major organ involved in the regulation of metabolic function. Most of the biotransformation of inorganic As take place in the liver. Arsenic is metabolized in the liver. Its accumulation and detoxification cause alteration in liver such as irregular-shaped nuclei, nuclear hypertrophy, nuclear vacuolation and the presence of eosinophilic granules in the cytoplasm hepatocytes. Bile stagnation was identified as brownish-yellow granules in cytoplasm. Melan macrophages were identified as rounded aggregates of cells with dark yellowish granules. Increase in arsenic dose, increases the severity and cellular rupture, pyknotic nucleus, and bile stagnation (Hossain, 2012). Lliver, when exposed to different concentration of arsenic showed, focal lymphocytic and macrophage infiltration, congestion, vacuolization and shrinkage of hepatocytes, dilation of sinusoids, cloudy swelling, vacuolar degeneration, focal necrosis, and nuclear hypertrophy. Sodium arsenite causes liver chromosomal fragmentation and expression of certain proteins (Das et al., 2012) . Kumar and Banerjee (2012)

Kidney:

Kidney is the major route of As expression as well as a major site of conversion of pentavalent arsenic. Arsenic causes shrinkage of the glomerulus and increase in the Bowman's space consequently increase in urine amount. Irregularities in the renal tubule including apoptotic and necrotic cells. Decreased intratubular space and enlargement of the height of the brush border cells (Roy and Bhattacharya, 2006). Glomerulus shrinkage, congestion of vessels and ruptured bowman's capsule was reported . Exposed to sub-lethal concentrations of sodium arsenite brought ultra structural changes in renal tissues. Hypertrophy of the epithelial cells of renal tubules along with reduction in the size of the tubular lumens was seen in the kidney tissue of the fishes with acute exposure.

Conclusion:-

Conmination of water bodies by As and its compound is big threat to all the aquatic organism specically fishes. They entered inside the body via skin, gills, and gastrointestinal tract. Aquatic organism accumulates arsenic mainly as inorganic forms. The findings of the present studies prove that arsenic as a heavy metal pollutant has strong negative effects of fishes.

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