

Effect of Heavy Metals on Fishes: Toxicity and Bioaccumulation

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ABSTRACT

Heavy metal pollution is a serious problem for the environment due to their toxicity, persistency, bioaccumulation, and bio magnifications property. Heavy metal contamination in the environment can occur from different natural and anthropogenic sources. The natural sources of heavy metals are mainly volcanic eruption and weathering of metal-bearing rocks, while the anthropogenic sources of heavy metals include agricultural and industrial activities, combustion of fossil fuel and gasoline, waste incinerators, mining, etc. The mobilization of these heavy metals to the aquatic ecosystem alters the physicochemical property of water which is hazardous for aquatic organisms. Heavy metals mainly enter the fish body through gills, body surface and digestive tract during ingestion of metal accumulated food materials. Cadmium, chromium, nickel, arsenic, copper, mercury, lead and zinc are the most common heavy metal pollutants that cause severe toxicity in fishes. Development of oxidative stress is the fundamental molecular mechanism of metal toxicity. The stress weakens the immune system, causes tissue and organ damage, growth defect and reduces reproductive ability. The rich source of high-quality protein filled with vitamins and omega-3 fatty acids encourage the human being to uptake fish as a major food source. So, accumulated heavy metals in the fish tissues directly transfer to the human body and cause toxic effects to expedite various diseases. Therefore, it is necessary to discuss the sources of heavy metals and their toxic effect on fish health to enforce the law and legislations regarding their protection in the aquatic environment and also to save human life.

Keywords: Heavy metal; Aquatic ecosystem; Bioaccumulation; Toxicity; Oxidative stress

INTRODUCTION

Environmental pollution is one of the major challenges for human society nowadays [1]. Due to the fast-growing industries, increased energy demand and careless destruction of natural resources from the last few decades environmental pollution is increasing day by day [2]. Different organic and inorganic toxic materials are constantly releasing from various natural and anthropogenic sources in the soil and aquatic ecosystem. Among them, heavy metals are playing a major role in environmental pollution, not only for their toxic nature but also possessing the potentiality of bioaccumulation in the food chain [3]. Heavy metals are mostly releasing from domestic and agricultural waste products, industrial waste materials, combustion of fossil fuels, mining, waste water treatment plants to the natural ecosystem [4].

Since heavy metals are persistent in the natural ecosystem, once enter into the living organism, it can accumulate inside. The heavy metals that contaminate the soil are easily taken up by the plants and lead to different adversity e.g. chlorosis, growth inhibition, defect in water balance and photosynthesis, senescence, and finally death [5]. The soil contamination of heavy metals also affects

the microbiological balance and reduced soil fertility [6]. The heavy metals can easily dissolved in the aquatic environment and subsequently enter into the body of aquatic organisms [7]. In the course of the food chain, those metals then enter into the body of higher animals. Bioaccumulation of toxic heavy metals in the different tissues may harm animal health and causes damage to their normal physiological processes [8]. Heavy metal toxicity drastically affects the rate of survivability and reproductive capacity of the organisms. Some of these have been reported to be highly carcinogenic, mutagenic and teratogenic depending on the species, dose and exposure time [9].

Aquatic biota directly exposed to the heavy metals that dissolved in water or present as sediment in the water body [10]. Being the top consumers of the aquatic ecosystem fishes are affected most [11]. Heavy metal toxicity sometimes damages the nervous system of fish that affects the interaction of fish with its environment [12]. Humans are omnivorous and exposed to toxic heavy metals by different food items such as fish, vegetables and cereals. Therefore, the heavy metal contamination in the body of aquatic organisms or plants can biomagnified and persist in the food chain, results in

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