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A review on heavy metals impact and marine Molluscs

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Abstract
In seafood, bivalve is one of the richest sources of balanced food but has a high level of heavy metal concentration in the aquatic environment and ultimately causing a negative effect on public health. Heavy metals are the common inorganic pollutant in the environment and their occurrence is a characteristic threat to human health due to their toxic effect on the biotic system. Most biological and geochemical factors affect the uptake and bioaccumulation in marine organisms. Marine organisms reflect the rising level of environmental contamination by industrial wastage and domestic discharges from urbanized areas. The objective of this work was to gather information on the presence of environmental contamination in different aquatic organisms and mollusks. A lack of researchers focused on nutritional composition, bioaccumulation, and mollusks as bioindicators for heavy metal pollution in aquatic organisms.

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Introduction

The phylum Molluscs is the second largest diversified, soft-bodied, most conspicuous, and familiar invertebrates (Ruppert *et al*., 2004 and Antit *et al*., 2013). They are filter feeders, aquatic and terrestrial in a habitat estimated around 200,000 living species around the world (Ponder and Lindberg, 2004). Metal-contaminated estuaries are particularly worthy of studies elucidating the chemical speciation of potentially toxic trace metals such as Cu, Zn, Pb, Cd, Cr, and Ni to gain insight into their environmental fate and effects. Some trace elements that are absorbed by living organisms accumulate in the food chain and therefore present a risk to humans, who are the final consumers at the top of the food chain (Hamilton 2004; Hillwalker *et al*. 2006). Bioaccumulation means the subsequent increase in the toxic substances in the tissue of living organisms because organisms can uptake high quantities of the toxic substances as compared to their excretion ability (Mariam M. Swaleh *et al* 2016) [3]. Heavy metal density is a minimum of 5g /cm³ (Duffs J.H. *et al* 2002). Heavy metals are cannot be decomposed by biological processes and bioaccumulate in the environment long time disclosure. They are hazardous pollutants that create a danger to marine organisms and also decline marine ecosystems, therefore awareness of the impact of heavy metals study in the marine environment is necessary (Mariam M. Swaleh *et al* 2016) [3].

Heavy metal admitted into the aquatic environment by releasing domestic and municipal waste, industrial effluents, Agricultural waste (Srinivasa *et al* 2007) [1]. The Marine mollusc has a great capacity to bioaccumulation heavy metals than water or sediment in their surrounding environment. Bivalves are filter feeder they feed through their gills (Jitar O. *et al* 2013) [8]. Bivalve is a key stone species in aquatic food chain because they are primary consumer in the ecosystem (Hamdani A. *et al*.). However marine environment has undergone pollution due to urbanization and increase the number of population in the coastal areas. Which leads to danger both the marine organisms and people along the coastline (Matoka C.M. *et al*.)

Nutritional benefits of bivalves

All over the world consumption rate of sea food increases with growth of world population. Recently the people have started more preference to consumption of sea food for nutritional food other than available and accessible food sources, therefore few of research studies have been focused on nutritive value of bivalve for human consumption (S. Anandkumar *et al*. 2018).

The tissue of D. cuneatus coastal bivalves contains 80.56 % of both non-essential and essential amino acids. The total amino acids composition in Pernaviridis, C. madrassensis and Meretrixcasta was near about 95.76, 98.4 and 65.17 % respectively. The D. cuneatus bivalve contain potential source for food value because high quality protein and essential amino acids. Bivalve is also rich source of fatty acids (Idaychandiran *et al*. 2014). Sea food products provide nutrient full and healthy diet for human because it provide source of easily digestible protein with high nutritive value, essential mineral like iodine and Selenium and vitamin such as vitamin, D, and B12 (Pastorelli *et al* 2012).

The bivalve mussel contains vitamin C in significant amount and saturated fat. They are also source of minerals like calcium (Ca), Potassium (K), iron (Fe), zinc (Zn), copper (Cu), phosphorus (P) (S. Anandkumar *et al*. 2018). There is important for safety concern related to the seafood product consumption because the presence of a large variety of chemical contaminants specifically heavy metals.

Importance of bivalve as an indicators

Marine organism is used widely as a bio monitor indicates the extent of metal pollution in water from coastal zone (Raposo *et al*. 2009) [11]. Marine bivalve such as oyster have many benefits as bioindicators for monitoring trace substances in coastal waters because their sessile life style, wide geographical distribution, resistance and high accumulation of wide range of chemicals (Prabal Barua, *et al*., 2011). Oyster is well known worldwide to almost 73 countries, they are ecosystem engineers, influencing many ecological process that preserve biodiversity, population, food web dynamics and nutrients cycling (Jacqueline *et al*. 2009).

M. casta has been use to study about toxicity and bioaccumulation of heavy metals (Kumarswamy *et al* 2006) and it also used as biological indicators for early detection of pesticide pollution (Devi *et al*. 2005) [32]. Detection of heavy metals in M. casta bivalve is necessary to prevent public health problem.

A several studies have reported that the green mussel *Perna viridis* is a Potential bioindicating agent for heavy metals in the aquatic environment (Soummady *et al*. 2011 and Putri *et al*. 2012) [28]. There was a characteristics correlation between mussel and concentration of mercury (Hg) and Cd in sediment. Sediment is main source of heavy metals to filter feeders among mussels and oysters (Yap *et al*. 2007) [30]. Soft mussel tissues of P. viridis is use as monitor for heavy metal accumulation due to its natural ability to accumulate elevate concentration of Cd, Hg, Pb (Yap *et al*. 2007) [30].

The shell of bivalve is gives the information about heavy metals pollution of the environment in their microhabitats over a period of time. This is because they express on the environmental history of the heavy metal in the environment (Hashem A.M. 2005).

Factors influence on heavy metals accumulation

Several environmental factors like water current, flow of water, pH, salinity, hardness etc. affects the heavy metals distribution in molluscs. A Small organism have grater metabolic rate in which higher concentration of the essential elements Zn and Cu (Sanjay kumar Gupta *et al*. 2011) [20]. Bioaccumulation of metals weightand Body size is also play important role. According to species concentration of metals may vary. Metals uptake and bioavailability are mostly depends on biochemical and geochemical factors. Accumulation of single species can be occurring of phenotype, genotype, and reproductive state and feeding activity (Boening DW. *et al*. 1997 and Sanjay kumar Gupta *et al*. 2011) [20].The bioaccumulation, uptake concentration of heavy metals in bivalves is depends on different factors such as; species (by sex, size and age), physical chemical changes, seasons, different sites on body surface, habitat and location (Sarkar S.K. 2008).The ratio of heavy metal accumulation is depends on several factors; physical environment (temperature, salinity, PH etc.), Biological parameters (Age, stage of sexual maturity, sex) (Mubiana V.K. 2006) [22].

The toxicity of heavy metals in aquatic organisms, in long time association with food chain, potentially harmful for human, therefore it is necessary to study the level of contaminates in marine organisms (Giarratano E *et al*. 2010) [23].

Effect of consumption of contaminated sea food

Heavy metals can be damage aquatic organisms as well as species diversity, due to uptake into the food chain, bio-magnification in the food chain, accumulation behavior (Yi Y. *et al*. 2011 and Nesreen K. Ibrhim *et al* 2014) [16, 15] finally incorporate by human sea food consumers entail health risk (Baeyens *et al*. 2005). Bivalve molluscs are at the top position in aquatic food chain; they concentrate high level of Cd, Hg, Pb like heavy metals in their body (censi *et al.* 2006 and Miedico *et al*. 2015).

The body of human required various amount of heavy metals like cobalt, manganese, zinc, iron in appropriate amount for human growth, development, reproduction (Hogstrand and Haux 2001). Other heavy metal such as mercury platinum, lead are toxic metals have no healthful effect on organisms and their accumulation over time can causes savior illness (Yi Y. *et al*. 2011) [16]. Metals such as mercury (Hg), Manganese (Mn), Cadmium (Cd), Lead (Pb), Arsenic (As), Cupper (Cu), Iron (Fe), Chromium (Cr), Zinc (Zn) etc. are generally non-degradable; therefore in the trophic chain these are accumulates. In the living organism accumulation of heavy metals leads to concentration higher than the surrounding water (Casas S. *et al*. 2008) [21].

Toxicity of heavy metals can causes neutralizes the central nervous functions, Weakness and lungs, liver, kidney and other vital organs. That results into neurological degenerative disorder like Parkinson's disease, Alzheimer's disease, multiple sclerosis and muscular dystrophy. Long time contact with some metals cause cancer (Hogstrand and Haux 2001).

Conclusion

This study has concluded that the marine bivalve has high concentration level of heavy metals. Bioaccumulation of the heavy metals in bivalve mollusc depends on body part and

several environmental factors. The bivalve is better accumulatorof heavy metals which compare with sediment and water. Bivalve molluscs are good Biomonitoring organism as well as determine the level of heavy metals pollution. In the marine environment pollution and accumulation of toxic pollutant in edible marine species are increasing throughout the world. The maximum heavy metals in the end accumulate in estuarine zone and continental shelf, since these areas are useful for suspended marine and associated land derived contaminants

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