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Amazon types of waters, BSAF (Biota Sediment Accumulation Factor), biomagnification and bioaccumulation of Hg

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Abstract

Amazonian rainforest aquatic ecosystem is a very unique ecosystem in the Earth, which waters from the Amazon basin have distinct physicochemical and optical characteristics (black, clear and white). In this mini review paper, Amazon status of bioaccumulation and biomagnifications of Hg and MeHg is discussed. Emphasis has been given to understand the effect of BSAF on the aquatic trophic chain (plankton, macroinvertebrates).

Keywords: Mercury; Methylmercury; Amazon

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Introduction

Hg is bioccumulated up to a million times above the aquatic trophic chain [1]. Bioaccumulation refers to the way metals enter a food chain and is related to the accumulation of contaminants from water, sediments, particulate matter in biological tissues of aquatic organisms (Wang and Fisher 1999). Biomagnification refers to the propensity of metals, like Hg, to concentrate as they move in the trophic chain from one trophic level to the next [2,3]. A [Hg] that enters in the river is adsorbed in sediments, a way to metals enter in biota. Hg mobilized in sediment is bioconcentrate in phytoplankton. Thus, sediments play an important role in the accumulation of mercury. The concentration of Hg in each type of Amazon water is used to calculate Biota Sediment Accumulation Factor (BSAF), which is a parameter of evaluation of bioaccumulation. After Hg enters through phytoplankton in food chain is biomagnified in secondary consumers [4-12].

Bioaccumulation and biomagnifications in trophic chain occur and are influenced by environmental and ecological factors: age, trophic position, pH, particular characteristics of each area, DOC (Dissolved organic carbon), trophic structure and food chain length [13-17]. Due to the difficulty of comparing the magnification processes, because there are several factors and particularities of each region, this review is focused in Amazon region [17]. Types of water (Black, white and clear) have different pH and Eh conditions, organic matter and suspended solids concentrations [18-21]. Water acidity, effects of water chemistry in the Amazon is an important chemical attribute in evaluating Hg contamination of sediments and bioaccumulation in the aquatic food web [22]. When comparing [Hg] in different types of water together the dynamics of this chemical element is better understood. Due the three types of water have different physical chemical properties [18,23]. wich will consider Hg in each type of aquatic environment after. The few previous studies that consider the white, black and clear waters together (Table 1).

Table 1: Summary of papers and respective type of water.

Paper	Black	White	Clear
Guimarães et al 2000			x
Maurice-Bourgoin et al 2003	x	x	
Dórea et al 2004	x		
Mascarenhas et al 2004		x	
Zara et al 2016	x	x	x
Vieira et al 2018	x	x	x
Pestana et al 2019	x	x	

Difference in the BSAFs (Biota Sediment Accumulation Factor) between THg and MeHg assistance the use of this factor for evaluating the bioaccumulation potential of sediment-bound Hg [22]. This algorithm is used for interpreting the Hg and MeHg accumulation patterns [24]. BSAFs is calculated by the ratio: [Hg in organism]/ [Hg in each type of aquatic environment after] [25]. The information significant to assessing environmental and health chances related to Hg methylation and potential fish-MeHg contamination, particularly in tropical aquatic environments [22].

Conclusion

The factors, water type and water acidity, particularly BSAF and methylation of Hg could be a significant factor for bioaccumulation and biomagnification of tropical environment systems. The assessment of environmental and health risks associated to Mercury methylation and potential fish-Me-Hg contamination.

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