



Evaluation of the bioaccumulation of mercury (Hg) and fluorine (F) in garden produce in south Benin

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ABSTRACT

Objectives: The richness of the soils in metallic trace elements (MTEs) and Fluorine, which are potentially toxic elements, makes it necessary to pay attention to the risks of transfer of these elements to the food chain. The aim of this study is to evaluate the content of mercury and fluorine in soils, irrigation water and market garden products in South Benin.

Methodology and Results: A total of 21 composite soil samples (0-20cm), 21 samples of irrigation water per growing area and 87 plant samples were collected. After sampling under aseptic conditions, they were sent for analysis in laboratories. The Excel spreadsheet calculated the contents and the GraphPad Prism 8.0 calculated the averages and tests of two ways. Before determining the bioaccumulation, the contents were compared to the minimum concentration referenced by international standards. All matrices were contaminated with mercury and fluorine. The minimum reference concentration (0.55mg/Kg) was higher than the average levels of the study soils in Mercury ($0.11 \pm 0.1 \cdot 10^{-2}$ to $0.164 \pm 0.345 \cdot 10^{-3}$ mg/Kg) and in Fluorine (8.123 ± 1.772 to 23.5 ± 1.126 mg/Kg). Mercury and Fluorine levels in site irrigation water were below the standards. The levels of mercury ($0.46 \cdot 10^{-3} \pm 0.13 \cdot 10^{-4}$ to $0.001 \pm 0.38 \cdot 10^{-4}$ mg/L) and fluorine (0.15 ± 0.07 to 2.17 ± 0.41 mg/L) in the irrigation water of the sites are lower than the standards, except for the Houéyiho borehole. In leaves such as amaranth, there was a very significant difference ($0.001 < p < 0.01$) at Sèmè-kpodji and Grand-popo. Amaranth is a leaf that is in direct contact with the chemicals used in the environment and could absorb mercury. Fluorine levels exceed the maximum recommended concentration (0.05 mg/Kg) so the vegetables are polluted with fluorine.

Conclusion and application of results: In Houéyiho, a medium bioaccumulation in amaranths and carrots was observed while in chili peppers bioaccumulation was low. On the other hand, in Sèmè-kpodji and Grand-popo, a low bioaccumulation of mercury in all the vegetables was observed. Fluorine bioaccumulation is medium in amaranth and carrot at Houéyiho and Sèmè-kpodji and low in chilli peppers at both sites. While bioaccumulation is low in vegetables produced at the Grand-popo site.

Key words: bioaccumulation, soil contamination, vegetable contamination, mercury, fluorine, MRC, Benin