Chapter 4

A Statistical Investigation of the Influence of Toxicity and Bioaccumulation of Heavy Metals Contained in the Various Organs of Eggplant Plant Water

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ABSTRACT

This study used the method of principal component analysis (PCA) to explore the characteristics and causes of variation in various types of oil mill wastewater (OMWW) from two soil types. In this approach, eigenvalues were used as indicators of change and explained by each principal component (PC). This principal component was selected on the basis of eigenvalue coefficients greater than 1. The weighting

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elements in the principal component reflect the contribution and importance of the starting characteristics. The greater the weighting factor, the greater the influence. The weighting factors were classified as "strong," "medium," and "weak," with absolute weighting values > 0.75, 0.75-0.50, and 0.50-0.30, respectively, in line with the literature. Evaluation of OMWW and PCA analysis revealed that Cd and As parameters are more important during eggplant irrigation.

1. INTRODUCTION

Environmental conservation and natural resource preservation, both key components of sustainable development, are increasingly critical in Morocco due to recent severe water stress, which is linked to drought, climate change, and a significant rise in water demand (Eddaoukhi, Berradi, El Rhayam, Rissouli, Grou, et al. 2023; Hbaiz EM et al. 2014). Addressing this challenge requires the use and valorization of treated wastewater for agricultural and green space irrigation to reduce water demand while protecting both surface and subsurface water resources, thereby safeguarding drinking water supplies (Eddaoukhi, Berradi, El Rhayam, Rissouli, El Yacoubi, et al. 2023; Eddaoukhi, Berradi, El Rhayam, Rissouli, Grou, et al. 2023). Treated wastewater, as a primary source for reuse and recovery, plays a crucial role in conserving high-quality water for drinking, preserving natural ecosystems, and reducing reliance on chemical fertilizers through its fertilizing potential. The composition of treated margines reveals that it contains significant amounts of essential nutrients including nitrogen (N), phosphorus (P), and potassium (K), as well as secondary fertilizers such as calcium (Ca), magnesium (Mg), manganese (Mn). Additionally, it contains trace elements like iron (Fe), copper (Cu), nickel (Ni), and zinc (Zn), along with a high concentration of organic matter. These nutrients are essential for the growth and development of many crops, particularly vegetables (Abbou, Bougarne, and Haji 2020; Eddaoukhi, Berradi, El Yacoubi, et al. 2023; Houbrechts, Vaessen, and Peeters 2022; Larif, Soulaymani, and Elmidaoui 2013; Prévost et al. 2002). In a previous study, *Solanum melongena* (eggplant) plants, grow on two different soils, were irrigated with crude margines diluted in different proportions (0%, 25%, 50%, 75%, and 100%) and treated using two different methods, denoted as I and II (Eddaoukhi, Berradi, El Rhayam, Rissouli, El Yacoubi, et al. 2023; Eddaoukhi, Berradi, El Rhayam, Rissouli, Grou, et al. 2023). Method I involved aerated/adsorption lagooning with powdered activated carbon alone under electric agitation, while method II included aerated/adsorption lagooning with both powdered activated carbon and lime, also under electric agitation. The first sort of soil was sourced from the Gharb-Sidi Yahia region, while the second came from the Loukkos Ksar El Kebir region. We then performed physicochemical and spectroscopic analyses on various types of irrigation margins, along with physicochemical and granulometric evaluations of these soils(Eddaoukhi, Berradi, El Rhayam, Rissouli, Grou, et al. 2023; Elkacmi et al. 2017; Papaioannou et al. 2020; Rais and Zemzami 2014). Principal component analysis (PCA) was used to statistically assess the toxicity of raw, diluted, and treated margines. Additionally, we will examine their impact on the bioaccumulation of heavy metal in different eggplant organs, including the roots, stems, leaves, and fruits.