



Removal of pollutants from domestic and rainwater wastewater from Bietry (Abidjan, Ivory Coast) using three local macrophytes

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Abstract: The lack of drinking water in the autonomous district of Abidjan has become a major social concern due to the high demand for this resource. The Ebrie Lagoon, a huge body of water, could be an alternative to the dwindling groundwater reserves, but it is polluted, particularly by domestic and rainwater wastewater with which it is interconnected. These effluents drain organic and mineral pollutants, including trace metals (TMs). The objective of this work is to evaluate the effectiveness of plant filters made from local macrophytes in removing these TMs from effluents. To this end, an experiment was conducted in a greenhouse in which three species of grasses (*Panicum maximum*, *Pennisetum purpureum*, *Vetivera zizanioides*) grown on substrates comprising sand, clay, biochar, and gravel were used as biological filters to remove lead (Pb) and copper (Cu) from wastewater from Bietry flowing into the Ebrie lagoon. The results obtained from analyses using Atomic Absorption Fluorescence Spectrometry (SAAF) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) show that the presence of plants leads to the efficient removal of copper and lead from the environment. This “plant” effect is most pronounced for *Pennisetum purpureum*, followed by *Vetivera zizanioides* and *Panicum maximum*. In addition, all three plant species have a higher absorption rate for lead, indicating greater tolerance for this metal.

1. Introduction

Abidjan, the economic capital of Cote d'Ivoire in West Africa, was established as a district about ten years ago. This city is a rapidly expanding metropolis with an annual growth rate of 3.17% (United Nations, 2024). Its rapid urbanization is correlated with significant population growth, with an estimated population of 5,866,700 according to the latest general population and housing census conducted in 2021. Its density of 10,000 inhabitants per km² far exceeds the global average of 3,000 inhabitants/km² for urban areas, according to reports published in 2022 by the United Nations (United Nations, 2022). Based on these data, the district of Abidjan can be ranked among the most densely populated urban areas in the world, making it comparable in size to metropolises such as Dhaka in Bangladesh and Manila in the Philippines, where density can reach 44,000 inhabitants per km² in

some areas (United Nations, 2021). For such demographics, the demand for natural resources becomes a major and crucial issue for public policy. The autonomous district of Abidjan is no exception to this reality, as it has faced high demand for drinking water over the past 20 years. Studies by the National Office for Drinking Water (NODW) indicate that only 69% of the population has access to drinking water (National Office for Drinking Water, 2016), even though the district is located within the Ebrie Lagoon, the largest lagoon in West Africa, covering an area of 566 km². While the use of this body of water should be considered as a palliative solution to alleviate the shortage of drinking water, this alternative cannot be considered as it stands because this water reserve is subject to a permanent inflow of domestic and industrial wastewater (Bakary *et al.*, 2009). This wastewater unfortunately, contains high levels of anthropogenic and industrial metal and organic pollutants (Douagui *et al.*, 2009). The study by Bakary *et al.*, (2009) on the mapping of connection areas has shown that the connection areas for urban wastewater (domestic, rainwater) and runoff that communicate with the Ebrie lagoon are contaminated with trace metals (TMs) in proportions well above the standards recommended by the World Health Organization (WHO). This pollution of the lagoon is closely linked to increased urban waste production, with the lagoon being the final disposal site. The establishment of industrial zones and human activities in the immediate vicinity of the Ebrie lagoon also generate a relatively high quantity of organic and metallic pollutants that are transferred to the lagoon (Adjiri *et al.*, 2008). This situation likely has an impact on ecosystems, causing various dysfunctions within them. For example, pollution of the Ebrie lagoon by heavy metals and industrial chemicals alters the chemical composition of the water. This is particularly the case with zinc and mercury, which alter parameters such as pH and conductivity, making the environment unfavorable for the survival of certain aquatic species (Gauthier *et al.*, 2019). Chemical pollutants from pesticides also disrupt the biological mechanisms of aquatic organisms, affecting their reproduction, growth, and survival (Cairns and Pratt, 2018). It should be noted that pollutants deposited in sediments, where they persist, make the latter a continuous source of contamination. As a result, sediments threaten benthic organisms that may ingest accumulated toxins. The dissolved chemicals affect aquatic fauna by disrupting their metabolism, development, and reproduction, increasing the risk of mortality and long-term ecological dysfunction (Sharma *et al.*, 2022). The pollution of wastewater by heavy metals transmitted to the lagoon through connection areas therefore remains a key component of the problem to be solved in order to consider using the Ebrie lagoon as a source of drinking water. The conventional methods used to remove these metals are based on chemical processes such as precipitation, ion exchange, and membrane processes (Seghairi *et al.*, 2013; Akartasse *et al.*, 2022; El Hammari *et al.*, 2022; Latifi *et al.*, 2025), as well as biological processes involving biosorption. However, these methods remain relatively costly (Salahat *et al.*, 2023). It is therefore imperative to find an economically viable and equally effective solution for wastewater treatment (Zaaboul *et al.*, 2024). In this context, an alternative solution is the use of metal-hyperaccumulating plants. This method has the advantage of using natural and readily available biomass. In this technique, biological filters such as aquatic plants significantly reduce heavy metal concentrations in water by absorbing these elements and binding them in plant roots (Gauthier *et al.*, 2019). Another beneficial effect of biological filters is that they modify sediment chemistry by promoting the precipitation of heavy metals into less bioavailable forms, thereby reducing their long-term toxicity (Sharma *et al.*, 2022) and limiting their impact on aquatic fauna (Cairns and Pratt, 2018). Although metal hyperaccumulating plants, as biological filters, represent an effective and sustainable means of managing heavy metal pollution in aquatic ecosystems, there are only a few scattered studies in the

literature on tropical species in wastewater treatment. In addition to acquiring experimental data for this purpose, the objective of this study is to contribute to the decontamination of domestic and industrial wastewater using heavy metal hyperaccumulator plants as biological filters. It is in this context that three local plant species were selected and tested for treating domestic and rainwater urban wastewater in the effluent-lagoon connection area in Bietry (Abidjan, Côte d'Ivoire).

2 Materials and methods

2.1 Study area

Domestic wastewater and stormwater were collected in the Ebrie effluent-lagoon connection area in the residential district of Bietry in Marcory (Abidjan, Ivory Coast) (Figure 1). This collection site is located approximately 50 m from the Ebrie lagoon and its geographical coordinates are 5° 17'15" north latitude and 3° 59'4" west longitude. The climate of the study area is equatorial, with two dry seasons and two rainy seasons and an average annual rainfall of 250 mm (Kouakou *et al.*, 2017). According to measurements taken between 1961 and 2016, the humidity level in the study area is 82% and the average annual air temperature is 26°C (Yao and Oulé, 2013).

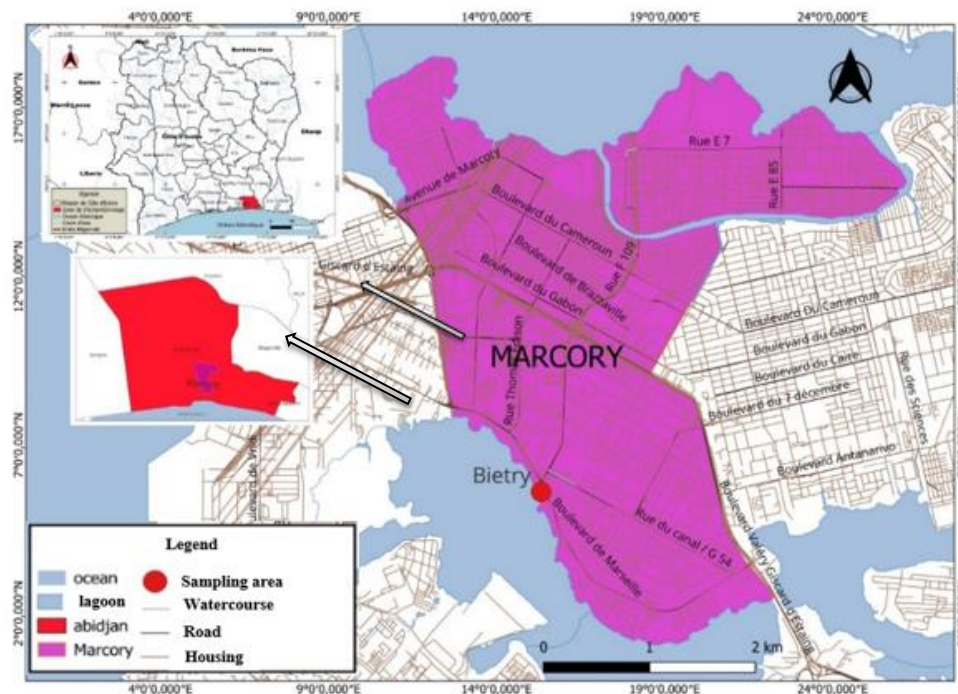


Figure 1. Map showing the location of the study area

2.2 Experimental wastewater filtration device

Three species of grasses were selected for this study: *Pennisetum purpureum* (Elephant grass), *Panicum maximum* (Guinea grass), and *Vetiveria zizanioides* (vetiver). These macrophytes were chosen based on their ability to accumulate heavy metals and their suitability for the local study conditions. In addition, these plants combine the advantages of rapid growth, high biomass production, and a dense root system. They also have low migration capacity and are easy to manage, making them particularly suitable for this experiment. Before the experiment, the three plants were grown on a substrate consisting of gravel with a diameter of 2 mm, variegated clay with a diameter of less than 2 µm, fine sand with a diameter between 100 µm and 150 µm, and biochar, sieved to 2 µm. The biochar was produced by pyrolyzing wood chips at 450°C. The gravel and sand were

collected from a quarry in Ahoue, a village located 5 km from Abidjan. After collection, these two substrates were washed with 5% acidified water, then with hydrochloric acid, and finally rinsed thoroughly with distilled water until the rinsing solution reached a pH of 7. The clay was taken from a deposit in the commune of Bingerville (southeast of Abidjan). Finely ground with a mortar, this clay was rinsed with distilled water using a water flow over filter columns and dried in an oven at 70°C. All the materials were arranged in six parallel layers in the following order (gravel-fine sand-clay-biochar-clay-fine sand) in cylindrical polypropylene containers. Wastewater was fed into the containers upstream via a gravity flow system, and the treated water was collected downstream of the device in polyethylene bottles prior to analysis.

2.3 Physicochemical analysis of effluents and statistical data processing

2.3.1 Physicochemical analysis of effluents

The pH, temperature, and electrical conductivity of water samples collected during each campaign were measured in situ using a portable waterproof pH meter (HI 9124 / HI 9125, HANNA®) and a conductivity meter referenced HANNA HI 99300 0-3999uS/CM & 0-200MG/L mV/SdT. Qualitative and quantitative analyses of the lead (Pb) and copper (Cu) content in the water were carried out using Fluorescence Atomic Absorption Spectrometry (FAAS) and, for extremely low concentrations, Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

2.3.2 Computer processing of data

Statistical analyses of the acquired data were performed using JMP Pro software (Statistica Analysis System), and the map featured in this article was created using a Garmin ETREX 10 GPS device and QGIS software.

3. Results

3.1 Initial characteristics of wastewater sampled at Bietry

The wastewater sampled at the study site underwent preliminary analysis. **Table 1** shows the values obtained for the physicochemical parameters. The results show that the pH value of the water in Bietry complies with WHO standards, which is not the case for the temperature, which is significantly higher than the WHO standard value, by a margin of approximately 30%. This difference could be explained by the warming of the waters, which is regulated by the recurring heat of the tropical zones during the dry season. Experimental data also show that the concentration of total dissolved solids (TDS) is an order of magnitude higher than the WHO standard. This result reflects the presence in the water of large quantities of metals, minerals, salts, and ions dissolved in the environment. These results are consistent with the relatively high values of electrical conductivity and turbidity measured. With regard to the presence of heavy metals in the water, the results show that the copper II (Cu) content is below the WHO standard, unlike lead, which is almost 50 times higher than the WHO standard value.

Table 1. Physicochemical parameters of wastewater from Bietry and WHO standard values (W.S.V.), 2006.

	pH	T ^o C	EC (µs/cm)	Turb (NTU)	D.O. (ppm)	TDS (g/L)	Cu (mg/L)	Pb (mg/L)
This study	8.45	32.2	3080	20.50	1.83	15.50	0.06	0.46
W. S V.	6.5-9.5	25	-	-	-	<1	2	0.01

3.2 Physicochemical characteristics of filtered water

The wastewater samples were brought into contact with plants through the biological filtration system in order to remove heavy metals. After filtration, the water was collected and analyzed. The comparative results of the physicochemical parameters are shown in Figures 2 to 6. **Figure 2** shows the change in average pH of the water treated by each of the three plants and by all three plants together over a period of 24 days. The results show that the filtration process had a significant effect on pH. While unfiltered wastewater is distinctly alkaline, the situation is different in the presence of plants, where the pH of the water decreases significantly by up to two pH units when filtered. Thus, the treated wastewater tends to be neutral, and this behavior is reproduced regardless of the type of plant considered, showing that the biological activity of all these plants increases the acidity of the environment by a factor of 2 compared to untreated water.

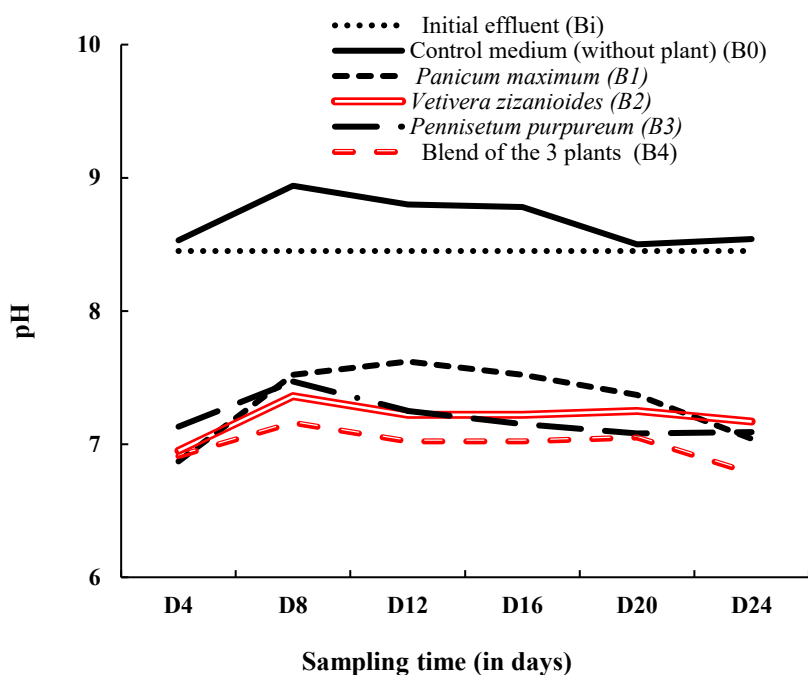


Figure 2. Temporal evolution of the average pH of wastewater before and after treatment by biological filters

The change in the average temperature of effluents treated by plant matrices is shown in **Figure 3**. The temperatures recorded, both in the environment with plants and in the environment without plants, are well above the WHO standard value of 25°C, but the temperature difference from the standard value, which is more pronounced in the early days, decreases over time. It is clear that the presence of plants in the environment causes it to cool significantly. It is as if a longer contact time between the plants and the wastewater leads the system to a state of thermal equilibrium close to the standard normal conditions of 25°C. **Figure 4** shows the evolution over time of the average electrical conductivity of effluents in environments with and without plant filters. Analysis of the results shows that the electrical conductivity measured at the initial stage, i.e., in situ, is significantly higher than that of the control and biological filtration environments. Clearly, the presence of substrates in the latter two environments modifies the behavior of charged species in such a way as to immobilize and significantly neutralize them. This situation is amplified by the presence of plants, whose biological action probably has an inhibitory effect on electrical conductivity, particularly during longer contact times with wastewater, as can be seen on days 20 and 24.

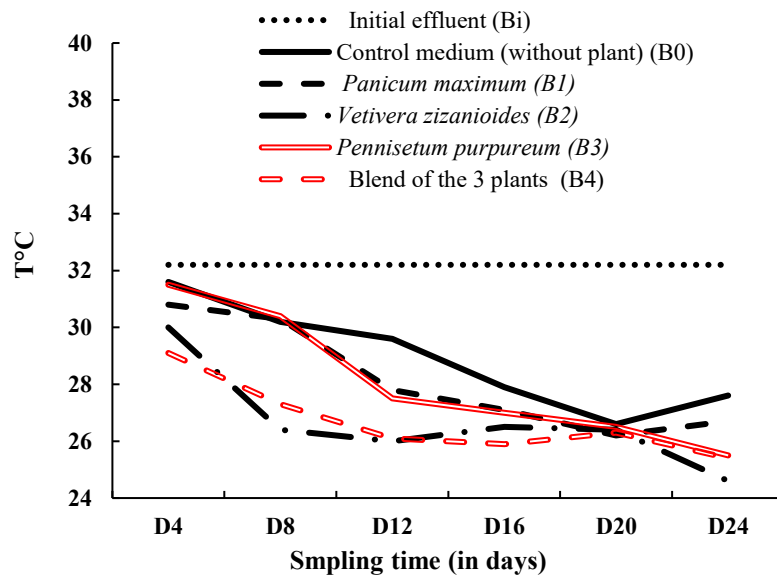


Figure 3. Temporal evolution of average wastewater temperatures before and after treatment by biological filters

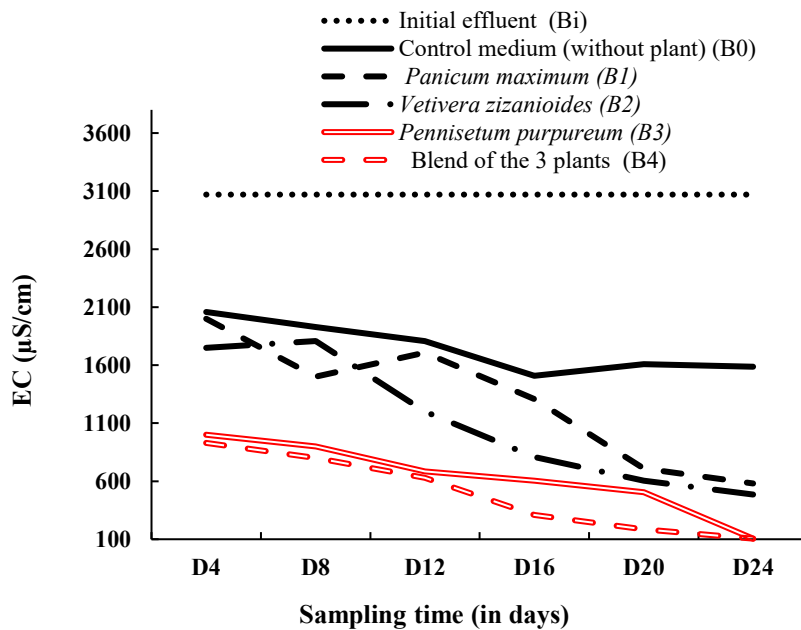


Figure 4. Temporal evolution of average electrical conductivities of wastewater before and after treatment by biological filters

3.3 Trace metal content (copper and lead) and their absorption rates by filter media with and without plants

In order to evaluate the effectiveness of wastewater treatment by the three macrophytes in our study, the residual copper and lead content in the filtered water was quantified and compared to the concentrations prior to filtration. The results obtained are shown in **Figures 5** and **6**.

3.3.1 Copper

Tests carried out with different filtration systems reveal significant variations in copper removal. At the start of the experiment, all media remove copper, but this activity occurs with varying absorption rates. All plant-based filters show absorption capacity, but with different temporal

dynamics. Up to day 16, panicum maximum had a copper removal rate relatively close to that of the control medium. A decrease in the copper content in the medium is indicative of the removal of this metal in the medium in question, which means that the effectiveness of panicum was low, as its impact was not noticeable during this period. It is necessary to wait beyond D16 to distinguish its effect on copper, even though the concentration of copper in the medium seems to indicate saturation.

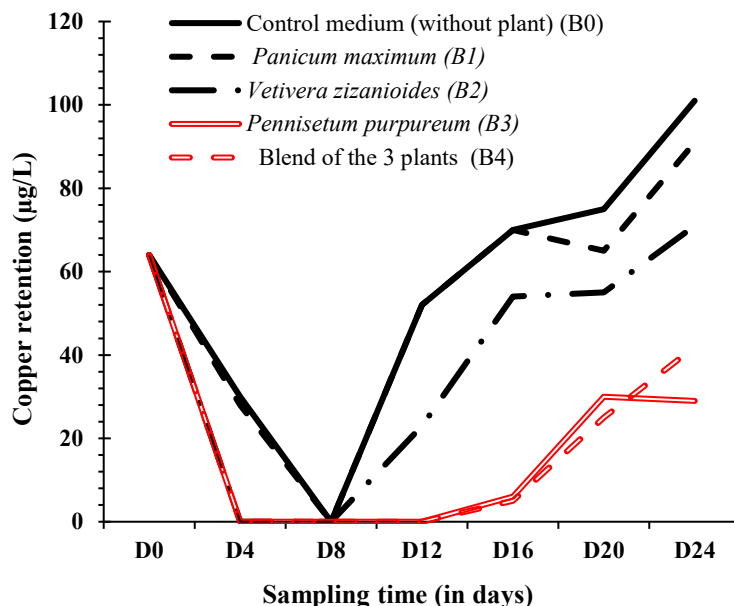


Figure 5. Temporal evolution of average copper levels in wastewater before and after treatment by biological filters in µg/L

Copper absorption phases are more intense for *Vetivera* up to day 8, for *Pennisetum purpureum* and the combination of the three plants up to day 12. Beyond these limits, copper becomes abundant in the environment, indicating that the plants' fixation sites have reached a saturation level that prevents them from absorbing and therefore eliminating copper. However, this sequence occurs later among the three plants for *Pennisetum purpureum*, making it the most absorbent filter over time and therefore the most effective. The combination of the three plants seems to support this hypothesis, as the kinetics of copper elimination in both cases are not significantly different. *Vetivera zizanioides* stands out as the plant with intermediate efficiency. Overall, these results with plant filters are better than those of the control filter. Thus, filters without plants confirm the essential contribution of plants in the water filtration process. This study demonstrates the value of plant-based solutions for treating polluted water, while highlighting the importance of choosing the right species for the desired filtration time. While *pennisetum* is particularly suitable for prolonged applications, *Vetivera zizanioides* offers interesting performance for intermediate uses.

3.3.2 Lead

As was previously the case for copper, **Figure 6** also shows that filters, with or without plants, have varying effectiveness in reducing lead in water. Compared to the control filter, systems with planted filters effectively and significantly reduce lead in the study environment. For all three plants, lead removal is optimal between D0 and D4 before declining until D8 and then almost stabilizing thereafter. It is likely that the absorption process occurs in three stages. The availability of fixation sites in the plant allows it to easily fix lead, hence the rapid kinetics up to D4. Gradually, the available sites decrease and fixation is reduced. At this stage, it is possible that the plant's roots reorganize

themselves to fix more lead, hence the second phase of slow absorption after D4. After D12, the sites are saturated and the plants no longer allow lead to be eliminated, hence the almost stable phase. Clearly, *Pennisetum purpureum* appears to be the most effective plant for removing copper. It reduces the residual lead content in the environment by an order of magnitude compared to the initial concentration. Curiously, combining it with the other two plants in the environment does not achieve such a low residual lead concentration threshold. Although lead absorption kinetics are rapid, demonstrating their relatively high affinity for lead, the plants' binding sites consequently become saturated fairly quickly. This situation is quickly exacerbated for *Panicum* and, to a lesser extent, for *Vetivera zizanioides*, which appears here to be the most suitable plant for intermediate performance.

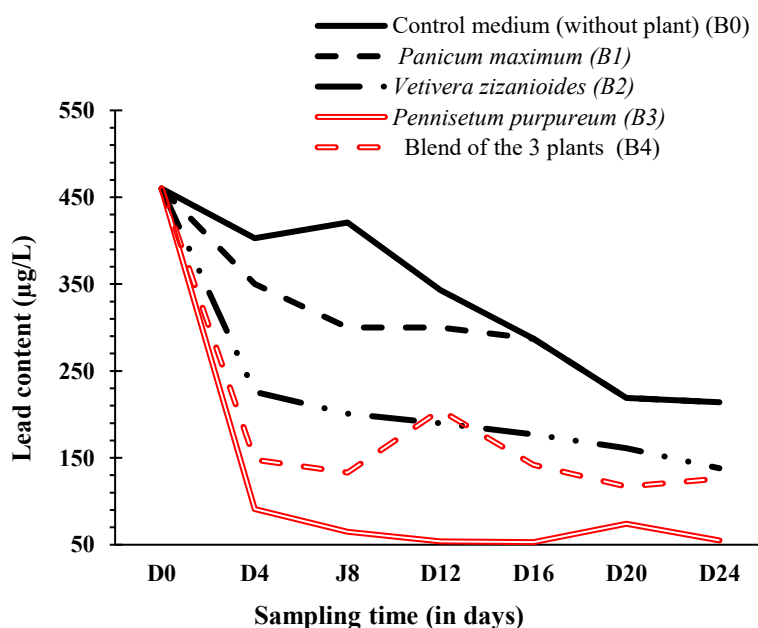


Figure 6. Temporal evolution of average lead levels in wastewater before and after treatment by biological filters in µg/L

3.4 Retention factor for trace metals (copper and lead)

In order to evaluate the effectiveness of the filters in more detail, the retention factor for trace metals (copper and lead) was calculated based on the results shown in [Figures 5](#) and [6](#). The retention rates for the two TMs determined in this way are shown in [Figures 7](#) and [8](#).

3.4.1 Copper

Observation of the retention curves shows variable behavior depending on the nature of the filtration medium, as shown in [Figures 7](#). Between D0 and D12, the filtration systems consisting of *vetivera zizanioides*, *pennisetum purpureum*, and a combination of the three plants have a copper retention factor that is constant and stabilizes at 100% before falling drastically for *vetivera* and linearly for *Pennisetum purpureum* and the combination of plants beyond D12. Before D12, the availability of plant fixation sites is optimal and allows for effective copper removal. At a certain point in this process, the sites become saturated and can no longer absorb additional amounts of copper, hence the drop in the curves. The decrease is drastic for *vetivera zizanioides* and gradual for *pennisetum purpureum*, indicating a difference in the specific desorption of copper by each of the two plants.

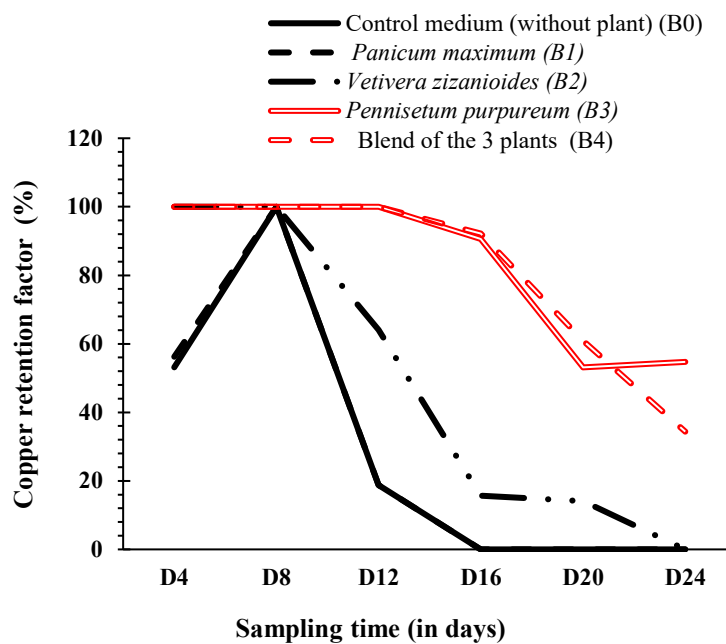


Figure 7. Temporal evolution of the average copper retention factor in wastewater treated by biological filters, expressed as a percentage

The situation is quite different for environments without plants and *Panicum maximum*, which both behave in a similar way. It is as if these two environments were similar. The presence of *panicum maximum* has no effect on the retention process at this level. Overall, a comparison of retention factors confirms that *pennisetum purpureum* is initially the most effective and appropriate filter for removing copper. *Vetivera*, meanwhile, performs at an intermediate level. The choice of filter can therefore be correlated with the desired duration of use. This 24-day experiment reveals marked differences in the ability of various filters to retain copper particles. Observation of the retention curves shows distinct behaviors depending on the types of filters tested. Overall, *Pennisetum purpureum* and the plant mixture proved to be the most effective, while *Panicum maximum* and the control, although effective, were surpassed by *Vetivera zizanioides* after the first week. These results confirm the value of plant filters for treating copper-contaminated water, while highlighting the importance of adapting the choice of filter to the desired duration of use.

3.4.2 Lead

All of the retention factor curves shown in **Figure 8**, whether for media with or without plants, clearly show two contrasting phases. In the first period from D0 to D4, the retention factor decreases linearly, with a greater overall decrease for the control medium and the medium containing maximum *panicum*, but this decrease is less pronounced for the other three medium combinations. In this first phase, *Pennisetum purpureum* clearly has the highest retention factor percentage, with a minimum value that remains above 80%. In the second phase, after D4, the performance of *Pennisetum purpureum* continues and dominates all other environments, even though there is a resumption of growth in the retention factor in these environments. It is as if the substrates and plants reorganize themselves to retain lead. This behavior is predominant in the control medium, to the extent that it even masks the effect of *panicum* on D16.

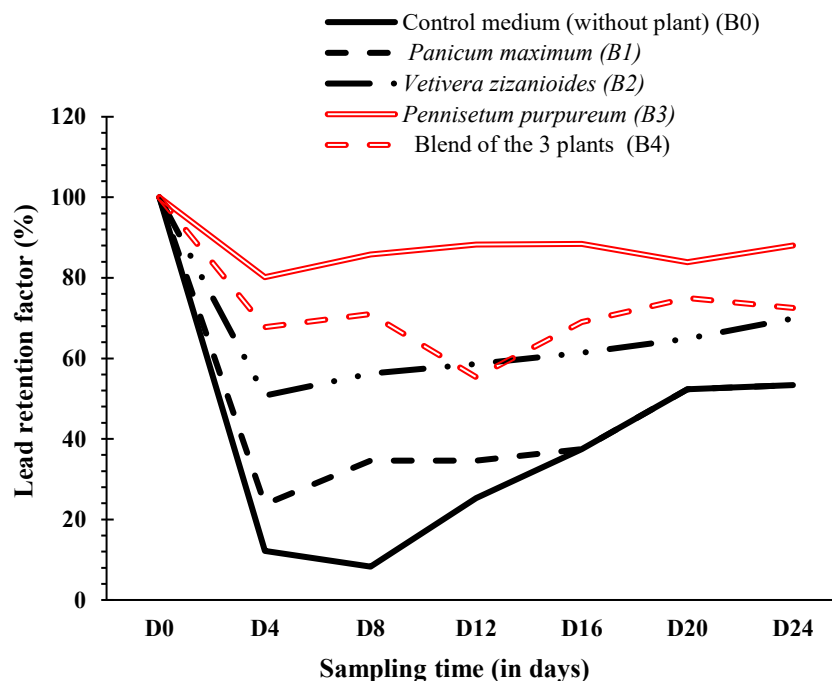


Figure 8. Temporal evolution of the retention rate of lead from wastewater by biological filters in (%)

4 Discussion

Data on physical and chemical parameters reveal several concerns regarding the quality of the waters of Bietry. The water temperature exceeds 25°C, which can affect the solubility of chemical compounds and aquatic life. This temperature also influences the availability of metals by regulating the proliferation of microorganisms, which impacts the decomposition of organic matter and the capture of MWEs (Moudouma, 2010). The high electrical conductivity indicates a high presence of dissolved salts, suggesting possible contamination of these waters (Djadouni, 2017). Dissolved oxygen levels are lower than those found in other studies (Yao, 2009), probably due to the oxidation of organic matter and low water agitation. Domestic discharges exacerbate deoxygenation, compromising the health of aquatic organisms and accelerating the appearance of anoxic zones, which can lead to significant fish mortality (Guiral and Chantraine (1983), Guiral and Etien, (1994)). In addition, lead concentrations are relatively high and well above WHO standards, highlighting the urgent need to identify sources of pollution and implement corrective measures to improve water quality.

4.1 Effect of filters on the physical and chemical characteristics of treated water

The pH values measured for the initial effluent and the control medium show that the wastewater from these two environments is alkaline. Under such conditions, lead and copper form hydroxyl complexes or carbonates with greatly reduced solubility and mobility (Seregin and Kozhevnikova (2008), Zhao *et al.*, (2020), Zheng *et al.*, (2022)). Several studies (Aranguren (2008), Yin *et al.* (2020), Kumar *et al.*, (2021)) report that these ETMs are mainly present in the form of $Pb(OH)_2$ hydroxide complexes and carbonate complexes ($PbCO_3$) for lead, and in the form of hydroxides ($Cu(OH)_2$) and carbonate complexes ($CuCO_3$, $Cu_2(CO_3)_2^{2-}$) for copper. Wastewater treatment in filtration systems shows a notable variation in pH, ranging from alkaline to generally neutral for all filters. This variation indicates a certain effectiveness of the treatments applied, with a significant effect on the pH of wastewater influenced by water components and environmental conditions. These results are

consistent with previous studies (Seghairi *et al.*, (2013), Mahmood (2025), Ugya and Priatamby (2016)) which reported similar values.

In the presence of plants, rhizosphere exudates released by roots chelate heavy metals and form more soluble organometallic complexes (Chaignon, 2001). This process induces increased mobilization of insoluble forms of metals, which are mainly adsorbed by roots (Mallhi *et al.*, 2019). In this regard, lead is more sensitive to this dynamic. Compared to copper, it is more strongly bound to the cell walls of roots and complexed by exudates, which mobilize its insoluble forms to a greater extent. In short, pH adjustment in filters can be attributed to elements such as plant roots and clay, which are capable of buffering and stabilizing pH, and to microbial processes generated by plants (Hartmann *et al.*, (2009), Husson (2012), Charlotte (2022)).

Plants and microorganisms thus modify pH through ion absorption, microbial metabolism, and organic decomposition, impacting the chemical composition of water. With regard to temperature changes, treated effluents show a decrease linked to system operation and ambient conditions. Processes such as evapotranspiration occur in the presence of plants, which is essential for ensuring effective treatment of TMs. As for electrical conductivity which is initially high, it gradually decreases, particularly in *pennisetum purpureum* and mixed plant filters, indicating a reduction in dissolved ions, which is a sign of improved water quality (Coulibaly *et al.*, 2008).

4.2 Trace metals

The experimental results showed significant variations in the absorption capacity of heavy metals (copper and lead) between the different plant species tested. Remarkable absorption of these metals, coupled with increased efficiency, occurred for *pennisetum purpureum* filters and, to a lesser extent, for the mixture of plants ahead of *vetivera zizanioides* and *panicum maximum*. The excellent performance of *pennisetum purpureum* in the phytoextraction of heavy metals was also observed in the work of Amin *et al.*, (2020). The specific and distinct absorptions of the plant species present can be explained mainly by their intrinsic physiological characteristics, which govern the mechanisms of interaction between their root ligands and metal ions. In fact, the absorption mechanism is based on a complex process involving plant transpiration, a phenomenon whereby the roots capture metal ions present in the water, which are then transported via the xylem to the leaves where the water is released in gaseous form (Barazani *et al.*, (2003)). However, its efficiency depends on the physiological characteristics of the plants. This phenomenon is particularly effective and pronounced in *pennisetum purpureum* and, to a certain extent, in *vetivera zizainoides*, two species recognized as good metal accumulators with good tolerance to trace metals thanks to their ability to produce large amounts of biomass (Chen *et al.*, 2000). It should also be added that edaphic parameters are of crucial importance in soil-plant interactions. The chemical properties of the substrate, in particular its cation exchange capacity and pH, directly influence the bioavailability of metals (Kariuki *et al.*, 2017). Thus, the variations observed in the control filter (environment without plants), with metal concentrations sometimes higher than those in the initial effluent, could be explained by desorption phenomena linked to fluctuations in redox conditions, as also observed in the work of Orłowska *et al.* (2002). Furthermore, the marked difference in behavior between copper and lead observed in the results could be due to several factors, including (i) the distinct metabolic regulation of membrane transporters specific to each metal, (ii) the formation of stable organometallic complexes in the rhizosphere that reduce the bioavailability of metals, (iii) the influence of pH on the chemical speciation of elements (Kumar *et al.*, (2006), Al-Saadi *et al.*, (2013)). In addition, soil particles, due to their negative charge, have an increased capacity to retain copper and lead, making them accessible to plants and thus

promoting their absorption (Kariuki *et al.*, 2017). The antagonistic absorption between lead and copper could be due to the fact that plants have specific transporters for the absorption of these heavy metals. Copper transport is more strictly regulated, as this metal is essential in small quantities for enzymatic functions. On the other hand, lead, which is a non-essential metal, can be passively absorbed in greater quantities when it is available. High pH levels also promote metal precipitation, which reduces their solubility and mobility (Kumar *et al.*, (2006), Al-Saadi *et al.*, (2013)). Lead is therefore often present in the form of compounds that are less soluble than copper. However, these less soluble forms can accumulate more easily in the rhizosphere of plants, which can alter the pH and chemical conditions of the soil, making lead more available for absorption. Finally, the yellowing observed during the experiment on *panicum maximum* on the eighth day could illustrate the occurrence of phytotoxicity at high lead concentrations (Zulfiqar *et al.*, 2019), highlighting the limited metal accumulation capacity of *panicum maximum*, unlike *pennisetum purpureum* and *vetivera zizanioides*, which show greater resilience to heavy metals.

Conclusion

The objective of this study was to contribute to the removal of heavy metals (copper and lead) from domestic and rainwater wastewater in Bietry, which drains into the Ebrie lagoon. This treatment was carried out using plants such as *pennisetum purpureum*, *panicum maximum*, *vetivera zizanioides*, and a mixture of these plants. Experiments were conducted over a specific period under controlled environmental conditions. The filters containing plants absorbed more metals than the control filter (i.e., the filter without plants) in the order *pennisetum*, *vetivera*, and *panicum maximum*. Lead was clearly the most absorbed metal, indicating a greater tolerance of the plants to lead. Metal retention rates were highest for *pennisetum*, followed by *vetivera* and *panicum*. Plants with *pennisetum* in the lead, followed by the mixture of plants and finally *vetivera*, would therefore be good phytoremediators, while *panicum* would be a fairly moderate phytoremediator.

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