



# Study of the Diversity of Pollution Control Plants with Potential as Phytoremediator Agents for Heavy Metals in the City of Surabaya

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**Abstract:** Surabaya City has a lot of problems with the environment because of excessive urbanization and industrial activities, which include soil, air and water pollution. Among the pollutants of particular concern is heavy metal pollution. One method that can be tried in environmental remediation is phytoremediation, which is the use of plants to restore the environment. The present study focuses on identifying plants in Surabaya that have the capacity to function as heavy metal phytoremediation agents. The present study employs a purposive sampling method in conjunction with a line transect method. The results indicate that 34 plant species possess the capacity to function as effective heavy metal phytoremediation agents. A comprehensive review of the extant literature revealed ten types of heavy metal pollutants with the potential to be accumulated by heavy metal phytoremediation plants in the city of Surabaya, namely Pb, Hg, Cu, As, Fe, Al, Cr, Cd, Zn, and Ni. The diversity index ( $H'$ ) of 2.628, categorized as moderate, and the evenness index of 0.745, categorized as high evenness, indicate that the optimization of phytoremediation plant use can still be maximized by implementing sustainable planting activities as an effective strategy in controlling environmental pollution in large cities such as Surabaya.

**Keywords:** Bioremediation; Environmental pollution; Heavy metals; Phytoremediation; Plant diversity

## Introduction

The city of Surabaya covers an area of only 350.54 km<sup>2</sup> according to data from the Surabaya City Statistics Agency in 2024, with a population of nearly 3 million people, making Surabaya a densely populated city. As a metropolitan city, Surabaya plays an important role in Indonesia's economy, trade, education, and culture. Surabaya has undergone rapid changes, marked by the development of infrastructure, industrial areas, and settlements (Hayati et al., 2022). This increase in population and urbanization has caused many environmental problems, such as a decline in soil quality, air pollution, and water pollution due to agricultural, industrial, and domestic waste activities. This pollution not only impacts environmental quality but also affects public health (Umah et al., 2024).

Although air pollution in large cities, especially Surabaya, is generally associated with the transportation and industrial sectors, specific studies on the largest sources of pollutants in Surabaya still need to be explored further. One of the identified sources of pollutants that has become the focus of monitoring is public transportation, such as buses, motorcycles, and cars (Nurlaili et al., 2023). In coastal and marine areas, pollution is usually caused by poor sanitation, suboptimal waste management, and inadequate drainage (Faathir et al., 2025).

The Surabaya area, especially the Surabaya River, experiences a mechanism of bioaccumulation of hazardous heavy metals. Contamination of Cu and Hg is feared to have an impact on the quality of the East Surabaya Coastal Waters (Pamurbaya) (Mahmiah et al., 2023), and sediments on Kenjeran Beach also show

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concentrations of Pb and Cu (Ferdiansyah et al., 2024; Sari et al., 2024). The Tambak Wedi Mangrove Waters are a tributary of the Tambak Wedi Estuary in Surabaya. This area is reported to be potentially contaminated with copper (Cu) heavy metals originating from waste in the city of Surabaya (Saleksi et al., 2025). In further laboratory tests, Pb concentrations in contaminated land in East Surabaya ranged from 3.24 ppm 3.83 mg/kg to 61.68 ppm 32.91 mg/kg (Muryani et al., 2025). The effects of bioaccumulation were also seen in biota, where keting fish were found to contain 0.4 ppm of Pb and 0.2 ppm of Cd (Islami et al., 2017).

Based on this issue, it is evident that several coastal areas, river estuaries, and several areas in Surabaya show signs of heavy metal pollution. Heavy metal pollution in Surabaya is a cause for concern because it can damage important ecosystems such as mangrove forests and threaten the health of marine life, as well as potentially enter the food chain (Farizky et al., 2022; Rahman et al., 2022). Heavy metal waste pollution is a serious environmental problem due to its toxic nature, non-degradable properties, and tendency to accumulate in living organisms. Therefore, research is important to maximize practical solutions related to effective management to control and reduce the burden of heavy metal pollutants contributed by activities in the city of Surabaya (Pratama et al., 2025; Sari et al., 2024; Widiasari, 2021).

Bioremediation is a type of biological technique that can be used to remove or eliminate pollutants from the environment using biological means such as algae, bacteria, fungi, and plants (Karnwal et al., 2024). Bioremediation is known as a more environmentally friendly technique compared to other techniques such as physics and chemistry. One of the bioremediation techniques is phytoremediation (Zaman et al., 2024).

Phytoremediation is an effort to reduce environmental damage, such as soil damage caused by high heavy metal accumulation, using plants. Phytoremediation is a more environmentally friendly and economical method that uses plants to absorb, detoxify, or accumulate pollutants found in soil, water, and air. Some plants can act as hyperaccumulators, which can absorb and store heavy metals from contaminated environments (Darmawan et al., 2024; Takarina et al., 2018). According to Nabila et al. (2025), phytoremediation is the use of plants to clean, assimilate, or collect toxic materials in soil, water, and air by utilizing plants.

Previously, there have been several studies that mention several plant species that are capable of absorbing pollutants, such as water hyacinth (*Eichhornia crassipes*), which is described as being able to absorb large amounts of heavy metals from domestic wastewater (Mediapro, 2021), and the glodokan tree

(*Polyalthia longifolia*), which is known to have the potential to absorb lead from the air (Fauzi et al., 2019).

Although phytoremediation has been widely developed in various countries, there is still little research that identifies and classifies various plant species that have the potential to become phytoremediation agents in various urban conditions in Indonesia, especially in Surabaya. Therefore, this study is novel in that it increases the data collection on plants that function as heavy metal phytoremediation agents. This is also a unique aspect of this study because it combines ecological inventory (biodiversity) with biotechnology potential (bioremediation) in situ in the urban ecosystem of Surabaya.

Research on plants as phytoremediation agents in the city of Surabaya has strategic value and uniqueness, especially in overcoming heavy metal pollution, which is a global problem in various countries. The uniqueness of this research also lies in the comparison of data from all plant species obtained directly at locations with moderate Muren (2025) to high levels of pollution (Anggraini, 2025), combined with an in-depth literature study related to the full potential of phytoremediation plants against heavy metals. The urgency of the research includes the process of optimizing the data collection of plants that have the potential to be phytoremediation agents to develop a local vegetation database that is adaptive to heavy metals. This is in line with the focus and scope of the JPPIPA Journal, which focuses on the development of biological and environmental science research.

Based on the above description, it can be said that this study is very important for the people of Surabaya to know what types of plants can be used as phytoremediation agents, which will later contribute to ensuring the success of environmental control efforts and creating a healthy environment. Therefore, it is hoped that all levels of society and the government will realize the importance of pollution control plants and encourage the use of phytoremediation as a sustainable way to improve environmental quality in big cities such as Surabaya.

## Method

### *Time and Place of Research*

This research was conducted from January 16, 2025 to February 12, 2025 in the city of Surabaya. Data collection was carried out by taking samples at nine locations in the city of Surabaya, in the Mulyorjo area, where there were two sampling sites, namely around the Surabaya City Environment Agency, Kali Surabaya Kampung Geblak, Wonorejo Nursery, Kalimas Asreboyo Bridge, Kali Surabaya at PJT Karah. The river at the Surabaya-Gersik border, Darmokali River, and



## Result and Discussion

### Plant Identification

Based on the research conducted, the data obtained is as shown in the table 1. Based on Table 1, the results of identifying plants with potential for bioremediation found 34 plant species with a total of 947 individuals. Each location had different numbers and species. Around the Surabaya Environmental Agency, 17 species with a total of 448 individuals were found; at the Wonorejo Nursery, 10 species with a total of 132 individuals were found; at the Asreboyo Bridge River, 3 species with a total of 18 individuals were found; at the Surabaya River in PJT Karah, 2 species with a total of 23 individuals were found; at the Surabaya Border River -

Gersik River, 3 species with 15 individuals were found; at the Surabaya River in Kampung Geblak, 3 species with 32 individuals were found; on Jalan Raya Mulyorejo, 7 species with 173 individuals were found; at the Darmokali River, 4 species with 46 individuals were found; and around Kenjeran Beach in Surabaya, 5 species with 60 individuals were found. Based on this, the differences in species found and the number of species at each location could be caused by several factors, one of which is the ability of a species to survive in a particular environment and differences in pollution levels. The differences in the number and species found can be caused by the ability to adapt to different environmental conditions and growth that depends on the environment (Kostić et al., 2022).

**Table 1.** Names of Species Found in the City of Surabaya

Species Name	Name Plant	Numbers of Individuals/plants
<i>Acrostichum aureum</i>	Golden feather fern	8
<i>Aglaonema commutatum</i>	Lipen	3
<i>Caladium bicolor</i>	Colored taro	24
<i>Canna indica</i>	Rosary flower	19
<i>Caesalpinia pulcherrima</i>	Peacock flower	7
<i>Centella asiatica</i>	Pegagan	50
<i>Cerbera manghas</i>	Sea mango	6
<i>Chlorophytum comosum</i>	Paris lily	22
<i>Codiaeum variegatum</i>	Yellow puring	40
<i>Cordyline fruticosa</i>	Ti plant	3
<i>Costus spicatus</i>	Spiral ginger	5
<i>Epipremnum aureum</i>	Devil's ivy	20
<i>Eichhornia crassipes</i>	Water hyacinth	42
<i>Ficus benjamina</i>	Banyan tree	4
<i>Ficus septica</i>	Hauili fig tree	20
<i>Hibiscus rosa-sinensis</i>	Chinese hibiscus	3
<i>Ipomoea aquatica</i>	Swamp morning glory	15
<i>Moringa oleifera</i>	Moringa	3
<i>Morus alba</i>	Mulberry tree	3
<i>Muntingia calabura</i>	Cherry tree	22
<i>Musa paradisiaca</i>	Banana	10
<i>Nymphaea pubescens</i>	Lotus flower	5
<i>Phoenix roebelenii</i>	Palm tree	7
<i>Platyterium coronarium</i>	Deer horn fern	11
<i>Plumeria alba</i>	Yellow frangipani	3
<i>Polyalthia longifolia</i>	Glodokan	63
<i>Pseuderanthemum reticulatum</i>	Japanese jasmine	325
<i>Rhapis excelsa</i>	Wergu shurb	40
<i>Ruellia simplex</i>	Mexican petunia	102
<i>Sansevieria trifasciata</i>	Mother-in-law's tongue	5
<i>Schefflera actinophylla</i>	Umbrella plant	17
<i>Syzygium myrtifolium</i>	Olivebery	19
<i>Talinum paniculatum</i>	Javanese panax	12
<i>Zamioculcas zamiifolia</i>	Dollar tree	10

Based on Table 1, the species *Pseuderanthemum reticulatum* (Japanese Jasmine) was the most commonly found species, reaching 325 individuals. *Pseuderanthemum reticulatum* (Japanese Jasmine) is a species that is adaptive to urban environmental

conditions, which causes its population to be high (Fascavetri et al., 2018).

*Species Divesity (H' Shannon-Wiener) and Distribution Evennes*

Based on Table 2, the results of calculations using the Shannon Weiner diversity index show that species diversity across all locations reached a value of  $H' = 2.628$ , which means that the level of diversity is moderate and close to the high criteria. This indicates that there are diverse plant communities in various urban habitats in Surabaya. The highest diversity (moderate) was found at the Wonorejo Nursery with a value of  $H' = 2.007$ . Meanwhile, the location with the

lowest diversity was found in Kali Surabaya in PJT Karah with  $H' = 0.387$ . This is in accordance with the statement by Wulandari et al. (2021), which states that the diversity index value ( $H'$ ) is classified as moderate if  $1 < H' < 3$  ( $H'$  value greater than 1 and less than 3) and the diversity index value is in the low category if  $H' \leq 1$  ( $H'$  value less than or equal to 1), as this is caused by the very small number of species and the dominance of certain species such as *Eichhornia crassipes* (water hyacinth) that dominates the area.

**Table 2.** Results of Species Divesity and Evenness Index Calculation

Location Name	Divesity Index/ $H'$ (Category)	Evenness Index/ $E$ (Category)
All Observation points	2.628 (Moderate)	0.745 (High)

In terms of species evenness calculated using the Evenness Index, Surabaya City is classified as high with a value of  $E = 0.745$ . For example, the highest value is found in Kalimas Jembatan Asreboyo with a value of  $E = 0.992$ , indicating that the number of individuals of each species is almost balanced at that location. Conversely, Mulyorejo street has the lowest evenness index with a value of  $E = 0.478$ , as stated by Kurniawan (Kurniawan et al., 2019) that the index value ( $e$ ) is in the high category if  $e \geq 0.6$  ( $e$  is greater than or equal to 0.6). The index value ( $e$ ) falls into the low criterion if  $e \leq 0.4$  ( $e$  value less than or equal to 0.4). There is a dominance of certain species, such as *Pseuderanthemum reticulatum* (Japanese Jasmine), which has a much higher number of individuals than other species.

*Analysis of Phytoremediation Potential*

Based on the results of identifying plants with potential as biomediation agents, the following is a review of some of the plants obtained in this study. A total of 34 species found in the city of Surabaya have functions and roles as phytoremediation agents that have been confirmed through primary references during the identification process. However, in this review, the researchers will only discuss a few dominant species with the highest frequency found in the city of Surabaya.

The identified plant species with high phytoremediation potential is *Pseuderanthemum reticulatum* (Japanese jasmine). Based on Table 1, the *Pseuderanthemum reticulatum* species is the most commonly found species, reaching 325 individuals. Fascavetri et al. (2018) stated that *Pseuderanthemum reticulatum* is a species that is adaptive to urban environmental conditions, which causes high plant populations. *Pseuderanthemum reticulatum* has potential as an important phytoremediation agent for controlling air pollutants, particularly heavy metals such as lead. In a study conducted by Fascavetri et al. (2018), this plant was able to absorb an average of 0.174 ppm-0.008 ppm

of Pb, which is considered effective in absorbing Pb contaminants. Based on the above description, the ecological role of this plant is very important in the city of Surabaya as an effective heavy metal bioaccumulator, accompanied by a very large quantity in the process of optimizing heavy metal absorption in places with abundant sources of Pb pollutants.

*Polyalthia longifolia* (Glodokan) also has significant potential for phytoremediation. *Polyalthia longifolia* has been proven to accumulate lead (Pb) pollutants from the air, making this plant very effective in reducing air pollution around industrial areas (Fauzi et al., 2019; Putri et al., 2025). In the city of Surabaya, this plant has a vital ecological role because it is often used as a shade plant on the side of the road, as evidenced by the large number of this species found in the city of Surabaya. Therefore, in its function as a bioaccumulator of Pb metal originating from motor vehicle exhaust and factories in Surabaya, this plant is a strong candidate for phytoremediation techniques, which are an alternative for removing highly toxic Pb from the soil.



**Figure 2.** *Polyalthia longifolia*

*Codiaeum variegatum* (Puring plants) are commonly found in various cities in Indonesia, including Surabaya,

where they are quite abundant. *Codiaeum variegatum* has significant potential as a phytoremediation agent for cleaning up heavy metal-contaminated environments. Several studies have shown that various Puring cultivars can be used for phytoremediation, especially in soils contaminated with copper, lead, and mercury (Rois et al., 2023). Puring cultivars can function as effective phytoremediation agents for copper. Their roots have a substantial ability to absorb and accumulate mercury and lead. The *Codiaeum variegatum* species has played an increasingly important ecological role in the city of Surabaya over time, based on its use as the primary choice for planting activities and as a beauty icon in the city. This primary choice is not merely conceptual, but also has greater benefits. Research conducted by Rois et al. (2023) reports that croton leaves are capable of absorbing approximately 2.05 mg/L of lead in the air, making it one of the best plants that can be used for air pollution mitigation.

The potential of *Ruellia simplex* C. Wright (Mexican Petunia) as a phytoremediation agent. Several studies have shown that *Ruellia simplex* has the potential to absorb lead (Pb) in the air (Alamsyah et al., 2021). The ability of plants to absorb metals, including Pb, is usually measured by calculating the bioconcentration factor to determine how effectively the plant accumulates pollutants (Alamsyah et al., 2021). As we know, air pollution in the city of Surabaya is very high, even reaching millions of ppb (Anggraeni et al., 2019). This makes it very relevant to address heavy metal contamination, especially in the air, by utilizing purple kencana plants, which are found in large numbers, as effective phytoremediation agents in reducing air pollution in the city of Surabaya.

*Centella asiatica* (Pegagan) has potential as a phytoremediation agent, particularly for addressing industrial wastewater pollution. Research using *Centella asiatica* shows its ability to remove aluminum (Al) and iron (Fe) from industrial wastewater (Muryani et al., 2025). Ecologically, gotu kola is an effective choice for conservation in the city of Surabaya. In addition to being easy and fast growing, *Centella asiatica* can be used as a health solution. As explained earlier, the absorption of heavy metals such as iron and aluminum is rarely found in other plants, so it is necessary to optimize its growth process as an environmentally friendly phytoremediation agent.

Next are several plants that have small quantities/numbers but are very effective as heavy metal phytoremediators. Among them are cherry, mother-in-law's tongue, and caladium. These three plants, cherry (*Muntingia calabura* L.), mother-in-law's tongue (*Sansevieria trifasciata*), and colored taro (*Caladium bicolor*), were found in quantities of less than 24 plants. *Muntingia calabura* L. (Cherry) has proven

potential as a phytoremediation agent for heavy metal-contaminated soil. Specifically, experimental research concluded that cherry plants can reduce mercury (Hg) levels in contaminated soil. *Muntingia calabura* L. has the most important contribution in the environmental field with its ability as a Hg metal phytoremediator in a bioreactor system (Borolla et al., 2019) so that ecologically and physiologically this plant has a significant role in the absorption of mercury waste with maximum support from the roots, stems and leaves (Rifai et al., 2021) in absorbing pollutants in the soil and air. Therefore, to maximize the role of this plant, efforts are needed to protect it from illegal logging in the city of Surabaya.



Figure 3. *Centella asiatica*

*Sansevieria trifasciata* (snake plant) has an effective ability to absorb air pollutants such as formaldehyde and benzene (Jhanji et al., 2021). *Sansevieria trifasciata* has the potential as a phytoremediation agent to clean soil contaminated with heavy metals. Its main potential lies in its ability to remediate copper (Ghazaryan et al., 2019). Several studies show that *S. trifasciata* has the potential to absorb contaminants in soil contaminated with copper (Cu), with effective results in reducing the lead and copper content in the soil (Ratnawati et al., 2018; Saleksi et al., 2025). There are several aspects that need attention in the observation and research process, namely that the number of *S. trifasciata* found at the research site is very small, so the direct ecological impact of its role as a phytoremediator is very small. Several options can be implemented to maximize the role of this plant in the city of Surabaya, namely by planting it periodically in several places in the city center.

#### *Correlation between the Fitormediator Plant Index, Heavy Metal Waste, and Environmental Conditions in the City of Surabaya*

Based on the results obtained, lead (Pb) is the heavy metal with the highest potential for accumulation by phytoremediation plants found in Surabaya, with a total

of 23 species. The high quantity or number of phytoremediation plants for lead heavy metals is in line with environmental conditions in Surabaya, which has lead pollution levels above the normal threshold (Sait, 2022) in Surabaya waters, which is set at 0.03 ppm, with abundant sources of lead pollution, especially in densely populated areas. Pb metal ions that pollute the water can come from various sources, including fuel combustion in large factories, the use of paint and ceramics, and lead deposits in the soil originating from fuel pollution containing lead (Setiawan, 2023) found in the city of Surabaya. Based on the facts presented, plants that have the ability to accumulate lead will be able to adapt optimally to the Surabaya environment with high levels of pollution. Thus, there is a correlation between the high level of heavy metal lead phytoremediation plants and the environmental conditions in the city of Surabaya.

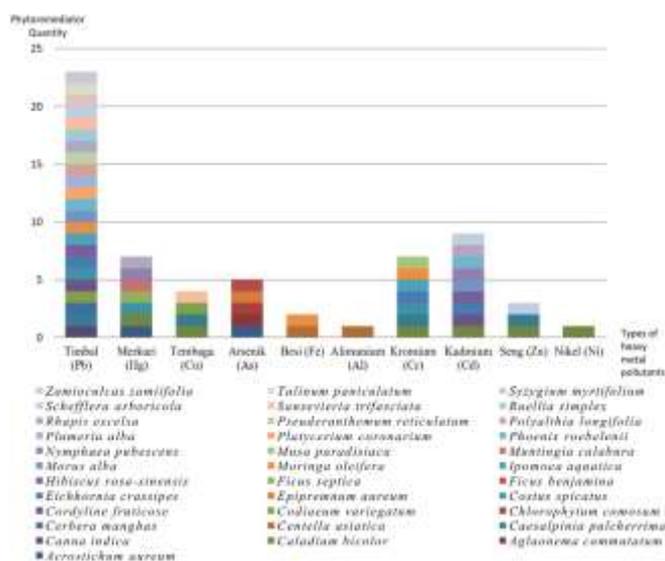


Figure 4. Quantity index of pollutants based on heavy metal phytoremediation in Surabaya City

Cadmium is the second heavy metal pollutant with the highest potential for accumulation, with 9 phytoremediation plants in the city of Surabaya. Several facts about cadmium (Cd) indicate that it is a heavy metal of concern in the waters and environment of the city of Surabaya (Martind, 2025). This is in line with the cadmium heavy metal contamination status in sediment samples in Surabaya City, which is at a low contamination level with observed concentrations ranging from 0.01 to 0.07 mg/kg (Martind, 2025; Surahmaida et al., 2017), with some places classified as moderately polluted with a range of 0.133 pm or equivalent to 0.004 mg/l (Surahmaida et al., 2017). The accumulation in the city of Surabaya is supported by several facts related to the conditions of the area. Heavy metals found in rivers surrounded by various human

activities, which are the main sources of pollution, such as industry and densely populated settlements (Martind, 2025). Based on the previous description, there is a correlation between the high number of plants that have the potential to be heavy metal cadmium phytoremediator and environmental conditions that fully support the level of heavy metal cadmium pollution. Therefore, these ecological conditions have become a concern for the city government in order to maximize the use of plants that can be cadmium phytoremediation agents to realize a healthy environment.

Chromium is a heavy metal pollutant that has the potential to be accumulated by phytoremediation plants, with 9 plant species in the city of Surabaya. Chromium can be toxic to the human body if consumed above normal limits. The content of this heavy metal is a serious concern for the Surabaya city government because it has polluted the water environment in Surabaya, particularly in the Surabaya River and Muara Wonorejo above the normal threshold of around 2.7761 mg/L (Surahmaida et al., 2017). The main sources of chromium in Surabaya are domestic and industrial waste, where all waste accumulates in the waters and rivers of Surabaya because most of the waste is dumped into the river (Restiani et al., 2024; Sajad et al., 2020). This confirms the relationship between the high number of plants that have the potential to be heavy metal chromium phytoremediation and the environmental conditions in the city of Surabaya, so that ecologically, plants that have the ability to accumulate and utilize chromium content in the soil or water will grow well and be fertile.

Mercury is a heavy metal pollutant that has the greatest potential to be utilized by plants that have the ability to accumulate these contents to maximize their growth and development processes. Nine plant species in the city of Surabaya have been identified as capable of acting as phytoremediator for mercury heavy metals. Mercury is a toxic heavy metal that has become a concern in cases of widespread environmental pollution in Surabaya, with a focus on analysis in aquatic environments. Hg metal can accumulate in aquatic biota (Ismail et al., 2020; Wulandari et al., 2021). This fact explains that the accumulation of mercury pollutants in several waters in Surabaya needs to be minimized or controlled through the process of optimizing the number of phytoremediation plants for chromium heavy metals to minimize and reduce the level of pollution in the city of Surabaya.

Some also apply to other heavy metal pollutants. Optimization in developing a healthy environment must consider the balance between pollutant sources and heavy metal phytoremediation agents (Kurniawan et al., 2019). The urban environment of Surabaya, which is

fully utilized by all levels of society, will automatically create sources of pollution with various classifications of pollutants. However, this can be maintained if there is a balance between the number of heavy metal phytoremediation plants, which are a sustainable solution for creating a protected, clean, and healthy environment, especially in the city of Surabaya.

#### *Relationship between Diversity and Environmental Conditions*

Locations with high diversity, such as the Wonorejo Nursery ( $H' = 2.007$ ), reflect that these locations have more stable environmental conditions and minimal disturbance (Kurniawan et al., 2019). Conversely, locations with low diversity, such as the Surabaya River in PJT Karah ( $H' = 0.387$ ), are likely to experience high environmental pressures, such as pollution, excessive contamination, and drastic habitat changes. Air, soil, and water pollution can impact biodiversity, endangering the health of species. Biodiversity and environmental conditions are closely related, with biodiversity playing an important role in maintaining environmental balance (Kurniawan et al., 2019; Meena et al., 2023). Environmental conditions and biodiversity are closely related; when pollution damages biodiversity (biodiversity collapse), environmental balance is threatened, which can also have an impact on health issues (Kurniawan et al., 2019). Therefore, biodiversity, especially in plants that act as phytoremediators, plays an important role in maintaining healthy environmental functions and balance (Kurniawan et al., 2019).

#### **Conclusion**

Based on the results of the research on Exploring Pollution Control Plants: a study to identify plants with the potential to become phytoremediation agents for heavy metals in the city of Surabaya, the following conclusions can be drawn: A total of 34 plant species from 18 different families have been identified as having the capacity to function as phytoremediation agents for heavy metals. The diversity index ( $H'$ ) of 2.682, classified as moderate, and the evenness index of 0.745, designated as high evenness, suggest that the optimization process of phytoremediation plant use can be further enhanced through the implementation of sustainable planting practices. A total of ten types of heavy metal pollutants have been identified as potentially capable of being accumulated and remediated by metal phytoremediation plants located at the research site. These ten pollutants include lead (Pb), mercury (Hg), copper (Cu), arsenic (As), iron (Fe), aluminum (Al), chromium (Cr), cadmium (Cd), zinc (Zn), and nickel (Ni). Heavy metals such as Pb, Cd, Cr, and Cu have the highest potential for accumulation by several species of

phytoremediation plants in the city of Surabaya. These phytoremediation plants have the capacity to be utilized in environmental remediation and restoration from heavy metal exposure.

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#### **Author Contributions**

Conceptualization; methodology; validation; formal analysis; investigation; resources; data curation; writing—original draft preparation; writing—review and editing; visualization: R. R. S. All authors have read and agreed to the published version of the manuscript.

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