e-palli

American Journal of Environment and Climate (AJEC)

ISSN: 2832-403X (ONLINE)

VOLUME 4 ISSUE 2 (2025)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Environment and Climate (AJEC)

Volume 4 Issue 2, Year 2025
ISSN: 2832-403X (Online)
DOI: https://doi.org/10.54536/ajec.v4i2.4503
https://journals.e-palli.com/home/index.php/ajec

Suitability of Grey-water Treated with Common Reed in Constructed Wetland for Irrigation Purposes in Akure, Nigeria

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Article Information

Received: February 02, 2025

Accepted: March 08, 2025

Published: May 07, 2025

Keywords

BOD, COD, Common Reed, Constructed Wetland, Grey-Water, Water Treatment

ABSTRACT

Effective grey-water management plays a crucial role in promoting environmentally sustainable practices. This research focuses on assessing the suitability of grey-water treated with common reed for irrigation purposes in Akure, Nigeria. Grey-water samples were sourced from a university hostel and subjected to treatment through a Constructed Wetland (CW) system, which was planted with common reed (Phragmites australis). The study spanned a three-year period (2016-2018), during which both the physico-chemical and microbial parameters of the raw and treated grey-water were evaluated before and after treatment. The findings revealed notable reductions in the treated grey-water's physico-chemical and microbial characteristics, thereby indicating the effectiveness of the treatment process. Additionally, the levels of heavy metals in the treated grey-water were significantly reduced, meeting the World Health Organization (WHO) standards for safe use in irrigation. The study highlights the potential of common reed-based constructed wetlands to effectively remove contaminants from grey-water, underscoring their viability as a low-cost, eco-friendly solution for grey-water treatment in Akure, Nigeria, and similar regions. The study also concludes that common reed-treated grey-water can be a viable alternative for irrigation in agricultural settings, contributing to sustainable water management practices in areas like Akure. Consequently, the treated grey-water from this system is deemed safe and suitable for agricultural use, aligning with guidelines for wastewater reuse in irrigation.

INTRODUCTION

The composition of grey-water directly mirrors household activities and is shaped by factors such as living standards, cultural and social practices, household size, and the choice of cleaning products (Oladejo & Olanipekun, 2018). Grey-water from sources like showers, bathtubs, and hand-washing sinks usually contains fewer contaminants, while water from laundry and dishwashing often has elevated phosphorus levels due to detergents. Kitchen grey-water is typically the primary source of nitrogen, whereas grey-water from bathrooms and laundry generally has lower nitrogen concentrations (Olanipekun *et al.*, 2024). The rising global production of grey-water is raising environmental concerns, highlighting the importance of treating it for reuse. Historically, wastewater treatment is primarily aimed to ensure safe disposal, thereby reducing risks to public health and preventing environmental harm (WHO, 2006).

However, the purpose of wastewater treatment has evolved to also emphasize resource recovery, including the extraction of energy, nutrients and water from waste. Still, the core objective remains the safe discharge of both domestic and industrial effluents, ensuring they do not pose health hazards or cause significant harm to the environment (Aiyelokun *et al.*, 2024a). Utilizing wastewater for irrigation provides two significant advantages: it not only offers a method of waste disposal but also promotes resource recovery by reusing water in productive ways. This practice is particularly beneficial when applied in slow-rate land treatment processes, where wastewater is gradually absorbed and utilized by plants and soil systems. Despite these advantages, raw municipal wastewater is typically unsuitable for direct use in agricultural irrigation, landscaping, or aquaculture without undergoing preliminary treatment (Aiyelokun *et al.*, 2024b).

The degree and quality of treatment are essential for determining how effectively wastewater can be integrated into soil-plant systems or aquatic environments, as they influence the health and sustainability of these ecosystems .Inadequate treatment can compromise the performance of these systems, underscoring the importance of proper wastewater treatment before agricultural use (Metcalf & Eddy, 2003). With the growing strain on global water resources, the treatment and reuse of wastewater offer a sustainable solution that helps preserve the environment, while also reclaiming valuable resources. The quality standards for treated wastewater intended for irrigation depend on several factors, such as the specific crops being cultivated, the characteristics of the soil, and the method used to apply the treated effluent (Oladejo, 2014;

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Olanipekun & Idusuyi, 2023). Selecting crop types or irrigation techniques that lower health risks can potentially reduce the level of treatment required before wastewater is applied.

This position was affirmed by Ghosh and Chakraborty (2025), in a reported study which utilized water hyacinth (Pontederia crassipes) as a carefully selected wetland plant for adapting agricultural practice in Bangladesh to the deleterious effects of climate change. The study found that water hyacinth was instrumental coping with salinity, drought, water logging and flooding in selected farmlands across Bangladesh. However, this strategy is less feasible for aquaculture, where stricter wastewater treatment protocols are necessary to ensure safety for both aquatic organisms and human health. Aquaculture systems require higher water quality standards to prevent contamination and to maintain a healthy aquatic environment, making advanced treatment essential in these settings. This will not only guarantee success when the entire process is completed, but will also ensure that another environmental challenge is not inadvertently created in a bid to solve an already existing one.

According to Metcalf & Eddy (2003), the ideal form of wastewater treatment for agricultural reuse should ensure the effluent meets recommended microbiological and chemical standards, while also being cost-effective and requiring minimal operational complexity and maintenance (Gholipour *et al.* 2020). Constructed wetlands (CWs) that incorporate common reed (Phragmites australis) offer an affordable and eco-friendly approach to treating grey-water, largely due to their minimal design, construction, and maintenance costs. These engineered wetland systems capitalize on natural purification processes, making them an effective and sustainable method for improving water quality. CWs work by combining several mechanisms to remove contaminants from wastewater. Physical processes, such as filtration and sedimentation, help separate particles and impurities, while biological activities, including microbial breakdown and nutrient absorption by plants, aid in reducing pollutants (Li *et al.* 2020; Sijimol & Joseph, 2021).

Additionally, various chemical reactions, such as precipitation and adsorption, further enhance the system's capacity to purify grey-water. Collectively, these processes enable CWs to reduce harmful substances in wastewater, supporting a low-impact, resource-efficient treatment strategy (Kadlec & Knight, 1996). Typically, these systems are equipped with impermeable clay or synthetic liners and structures that help control flow direction, water retention time, and water levels. Furthermore, some setups may utilize inert porous materials such as rocks, gravel, or sand. Similarly, vegetation within constructed wetlands serves an essential function in the treatment process, contributing significantly to the system's overall effectiveness. Plants not only provide oxygen to the rhizosphere, a zone of intense biological activity around their roots but also create a supportive environment for the beneficial microorganisms residing there. This oxygen transfer helps maintain aerobic conditions in parts of the wetland bed, promoting microbial processes that break down pollutants.

Also, the vegetation actively absorbs nutrients from the wastewater, which reduces nutrient loads that might otherwise lead to issues like eutrophication if discharged untreated into natural water bodies. The plants' roots, stems and leaves also expand the available surface area for microbial colonization, facilitating more sites for microbial communities to thrive and carry out pollutant-degrading processes (Oladejo & Olanipekun, 2018). In this way, plants are central to the wetland's ability to function as a self-sustaining water treatment ecosystem, enhancing both nutrient cycling and contaminant removal (Brix, 1993). In summary, these constructed wetlands aim to enhance the physical, chemical, and biological functions of natural wetlands to decrease levels of biochemical oxygen demand (BOD), total suspended solids (TSS), total nitrogen (TN), phosphorus, and pathogens as wastewater flows across the vegetated surface (Reed *et al.*, 1987; Reed, 1993).

It is therefore important to mention that when choosing plants for CWs, important factors to consider are their tolerance for waterlogged and low-oxygen conditions, their capacity to thrive in nutrient-rich settings, their ability to absorb pollutants, and their adaptability to harsh climatic conditions. While over 150 species of macrophytes have been utilized in CWs worldwide, only a few are frequently employed in practice (Vymazal, 2013). The most commonly used emergent plants include Phragmites spp. (Poaceae), Typha spp. (Typhaceae), Scirpus spp. (Cyperaceae), Iris spp. (Iridaceae), Juncus spp. (Juncaceae), and Eleocharis spp. (Spikerush). Common submerged plants include Hydrilla verticillata, Ceratophyllum demersum, Vallisneria natans, Myriophyllum verticillatum, and Potamogeton crispus. Floating-leaved species often used are Nymphaea tetragona, Nymphoides peltata, Trapa bispinosa, and Marsilea quadrifolia, while free-floating plants include Eichhornia crassipes, Salvinia natans, Hydrocharis dubia, and Lemna minor (Kumar *et al.*, 2008; Akhtar, 2017).

Emergent macrophytes are more efficient in removing pollutants and are better adapted to handle various wastewater sources (Napaldet & Buot, 2019; Said et al., 2021; Beauclair, 2021). A survey by Vymazal (2013) on emergent plants in free water surface (FWS) constructed wetlands found that Phragmites australis is the most commonly used species in Europe and Asia, while Typha latifolia dominates in North America, Cyperus papyrus in Africa, P. australis and Typha domingensis in Central and South America, and Scirpus validus in Oceania. Additionally, Vymazal (2011) reviewed plants in subsurface flow (SSF) wetlands and reported that P. australis is the most widely used species globally, especially in Europe, Canada, Australia, and large parts of Asia and Africa. Wetland plants play a crucial role in enhancing water quality in constructed wetlands, serving as the primary biological component. These plants aid in purification processes by facilitating the removal of nutrients and directly absorbing nitrogen, phosphorus, and other nutrients (Liu *et al.*, 2011; Zu *et al*; 2020; Ko, 2024).

Similarly, they have the capacity to accumulate harmful substances, including heavy metals and antibiotics (Liu *et al.*, 2013). For instance, Wu *et al.* (2013) found that four emergent wetland plants absorbed between 6.50 - 26.57 g N/m² and 0.27–1.48 g P/m² when treating polluted river water. The ability of plants to uptake nutrients differs depending on several factors, including system design, retention time, loading rate, type of wastewater, and climate (Saeed & Sun, 2013). In general, plants can help remove between 15% to 80% of nitrogen and 24% to 80% of phosphorus from the wastewater (Greenway & Woolley, 2001), though some studies show lower removal rates, such as 14.29 - 51.89% for nitrogen and 10.76 - 34.17% for phosphorus (Wu *et al.*, 2013). In the case of emerging contaminants, plants have been effective in removing substances like carbamazepine, sulfonamides, and trimethoprim from wastewater (Dordio *et al.*, 2011; Dan *et al.*, 2013). For heavy metal removal, *Eleocharis acicularis* demonstrated strong accumulation capabilities for metals like Ag, Pb, Cu, Cd, and Zn (Ha *et al.*, 2011) and Yadav *et al.* (2012) found that metal accumulation was higher in below-ground biomass than above-ground biomass. Despite significant research efforts, this approach is still relatively new in Nigeria, indicating a need to examine the suitability of grey-water treated with common reed for irrigation purposes.

MATERIALS AND METHODS

The research was conducted behind Jadesola Akande female hostel on the Obanla campus of the Federal University of Technology (FUTA), Akure, Ondo State, Nigeria. Akure is located at Latitude 7°14' N and Longitude 5°08' E. The region experiences a tropical humid climate, marked by two distinct seasonal patterns (rainy and dry). Suffice it to say that all of the experiments, from wetland planting to water treatment, were carried out in the dry seasons of December to February of 2016, 2017 and 2018. Influent grey-water was sourced from a hostel, where water from showers, bathtubs, kitchens, and bathroom sinks was directed into a system designed for initial filtration and pretreatment. This water traveled through pipes with a diameter of 128 mm to reach a filtration tank, where a preliminary filtration process removed larger suspended particles as shown in Figure 1. Items such as food debris, hair, and lint were screened out using a layered filtration medium composed of various sizes of gravel specifically layers with particles smaller than 32 mm, 24 mm, and 16 mm and capped with a fine sand layer of 0.2 mm in diameter for finer filtration.

After this pre-filtration stage, the partially treated grey-water was conveyed through a narrower, 32 mm diameter pipe into the constructed wetland as illustrated in Figure 2. This wetland was set up with a similar combination of gravel and sand as the filtration tank, but included the addition of common reed (Phragmites australis), a plant selected for its effectiveness in aiding the treatment process as shown in Figure 3. In the wetland system, the grey-water was retained for a period of two days, allowing for further purification through the combined effects of microbial action, plant uptake, and sedimentation within the substrate. Following this retention time, the processed effluent, now treated grey-water, was collected and ready for potential reuse or safe discharge. Water samples were taken from two sources: raw grey-water and treated grey-water, both were collected in sterilized laboratory bottles from the study site for analysis. The parameters evaluated included physical factors (temperature and pH), chemical factors such as total suspended solids (TSS), biochemical oxygen demand (BOD), total nitrogen (TN), total phosphorus (TP), chemical oxygen demand (COD), electrical conductivity (EC), manganese, iron, and anions (sulfates, chlorides, and nitrates).

Additionally, microbial factors like fecal coliforms (FC) and Escherichia coli (E. coli) were also examined. On-site temperature readings were taken using a thermometer, while pH and electrical conductivity (EC) measurements were performed immediately after sample collection with a pH meter and EC meter, respectively, following the procedures outlined by Motsara and Roy (2008). The concentrations of calcium and magnesium were determined using titrimetric analysis based on the standard EDTA method (American Public Health Association, 2020). Analysis of heavy metals, such as nickel (Ni), cadmium (Cd), zinc (Zn), copper (Cu), and lead (Pb), was conducted at the Sustainable Laboratory in Akure, Nigeria. Levels of sodium (Na) and potassium (K) were assessed using a flame photometer, while chloride content was quantified through titration with silver nitrate ($AgNO_3$).

Figure 1: Raw Grey-water from Jadesola Akande Hostel to the Sedimentation tank at the Experimental Field

Figure 2: Constructed Wetland planted with Common reed at the Experimental Field

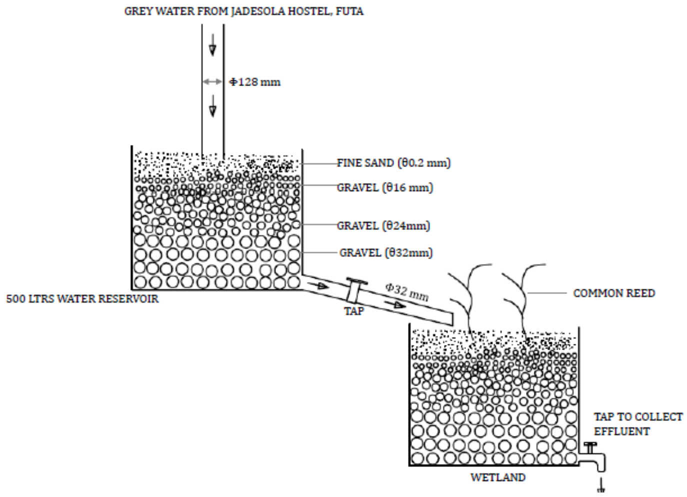

Figure 3: Grey-water Treatment Setup

Both biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were measured using the standard Open Method at the same laboratory to determine the levels of organic pollution. Total suspended solids (TSS) were assessed through the gravimetric method, specifically for "total suspended non-filterable solids," in accordance with APHA guidelines (2005).

RESULTS AND DISCUSSION

To evaluate the suitability of treated grey-water for irrigation, the following characteristics of irrigation water in the study area were analyzed:

pH of Treated Grey-water

The pH analysis revealed values of 7.08, 6.10, and 8.06 for treated grey-water during the dry seasons of 2016, 2017, and 2018, respectively (Table 2). According to Food and Agriculture Organization (2003) guidelines, an effluent pH range of 6.5 to 9.0 is desirable for irrigation, while the Environmental Protection Agency (EPA, 2004) and the World Health Organization (WHO, 1989) recommend a pH range of 6.5 to 8.5. The temperature and pH values observed in this study align with findings from previous research in similar areas (Kayombo *et al.*, 2000; Kaseva, 2004). These ranges support high microbial activity, as they fall within the optimal pH range of 6.0 to 9.0 and a temperature range of 25°C to 35°C (Metcalf and Eddy, 2003). Variations in pH and temperature can be attributed to different weather conditions on sampling days (such as sunny or cloudy weather) and the composition and volume of sewage released. The design of the wetland system, which incorporates both plants and gravel, influences these parameters by reducing direct sunlight exposure to the grey-water as it passes through the wetland. The lower pH levels observed in treated grey-water compared to raw grey-water inflows may be attributed to the inability of the plants to exude or absorb carbon dioxide during daylight hours, as both plants and microorganisms engage in photosynthetic activity (Kaseva, 2004; Kyambadde *et al.*, 2004).

Salinity Hazard of Treated Grey-water

The analysis of treated grey-water indicated that Total Dissolved Solids (TDS) were 1152 mg/L, 1226 mg/L, and 1300 mg/L during the dry seasons of 2016, 2017, and 2018, respectively. Furthermore, the Electrical Conductivity (EC) values measured were 2.43 dS/m, 2.26 dS/m, and 2.60 dS/m respectively for the same years (Table 2). Consequently, the treated grey-water presents a slight to moderate salinity issue for crops, as FAO (2003) suggests an acceptable EC range of 0 to 2.0 dS/m. Additionally, Pescod (1992) recommends a TDS range of 450 to 2000 mg/L for wastewater used in irrigation. Since the EC of the treated grey-water exceeds this range, it may lead to slight to moderate degradation of the soil's physical structure, potentially reducing plant growth, root and shoot lengths, and overall yield (Omami, 2005; Agarwai and Pandey, 2004). To mitigate salinity issues, applying additional freshwater beyond the plants' needs can help leach salts from the root zone (Plaut *et al.*, 2013).

Sodium (Na) Hazard of Treated Grey-water

The concentrations of sodium (Na) in treated grey-water were documented over three consecutive dry seasons, showing values of 41.20 ppm in 2016, 42.40 ppm in 2017, and 43.60 ppm in 2018. For the same years, raw grey-water samples had significantly higher Na concentrations, recorded at 57.50 ppm, 60.30 ppm, and 63.10 ppm, respectively, as detailed in Tables 1 and 2. According to Pescod (1992), sodium levels in all analyzed water samples fell within acceptable ranges for irrigation purposes, as they remain sufficiently low to prevent negative impacts on soil structure or plant health. The treatment process effectively reduced sodium levels, aligning with irrigation suitability standards. This reduction in sodium concentration contributes to maintaining soil permeability and preventing potential sodium-induced issues, which can be beneficial in long-term agricultural applications.

Chloride Contents of Treated Grey-water

Chloride concentrations are a key factor in evaluating the quality of irrigation water because high levels of chloride can be harmful to plants and also act as a measure of water salinity. In the treated grey-water samples, chloride concentrations measured were 18.82 mg/L, 19.43 mg/L, and 20.04 mg/L for the dry seasons of 2016, 2017, and 2018, respectively. These values suggest that the treated grey-water is appropriate for use with salt-tolerant crops, which can withstand mild salinity without adverse effects on growth or yield. The relatively modest chloride levels observed in the treated grey-water samples may reflect the efficiency of the treatment process in reducing salinity-related constituents. This reduction is crucial for minimizing potential negative impacts on plant health and soil structure over extended irrigation periods, as displayed in Table 2. The capacity to manage chloride concentration through effective grey-water treatment ensures that the water remains viable for agricultural use, supporting both crop growth and soil sustainability.

Microbial Parameters of Treated Grey-water

The evaluation of treated grey-water showed levels of Fecal Coliform (FC) bacteria measuring 390, 530, and 460 CFU/100 ml for the dry seasons of 2016, 2017, and 2018, respectively. These results suggest a lower risk of pathogen presence in the treated water, as detailed in Table 2. The observed decrease in FC levels can be attributed to the initial sedimentation phase, during which the grey-water was retained for several days. This retention period allows for natural purification processes to take place. Various mechanisms contribute to the reduction of bacterial populations, including sedimentation, chemical reactions, natural die-off, and the predation of bacteria by organisms such as zooplankton, nematodes, lytic bacteria, and bacteriophages, as discussed by Kadlec and Knight (1996). Additionally, plants play a vital role in the wastewater treatment process, primarily through their physical contributions. Macrophytes help stabilize the surfaces of treatment beds, enhance physical filtration capabilities, and create a substantial surface area that promotes microbial growth, thereby facilitating further purification (Brix, 2020). This multifaceted approach ensures the effective treatment of greywater, reducing pathogens and improving overall water quality.

Chemical Parameters (COD, BOD and TSS) of Treated Grey-water

The results indicated that the treated grey-water is suitable for irrigation based on the BOD values of 23.00 mg/L, 26.00 mg/L, and 24.50 mg/L, and COD values of 33.22 mg/L, 35.51 mg/L, and 37.80 mg/L for the dry seasons of 2016, 2017, and 2018, respectively (Table 2). These values fall within the FAO's acceptable limits of 60 mg/L for BOD and 200 mg/L for COD (Pescod, 1992). However, the TSS of the treated grey-water were 89.00 mg/L, 92.00 mg/L, and 95.00 mg/L for the same years, which exceed the FAO's acceptable limit of 50 mg/L. This could potentially lead to soil plugging in irrigation systems. The relatively low BOD and COD levels in the treated grey-water were likely due to purification processes occurring in the sedimentation tank, and these findings are consistent with earlier studies by Bilha (2006) and Seswoya and Zainal (2010). The lower values in this study compared with other reports may be attributed to the reduced levels of degradable organic matter entering the constructed wetland system, since most of it may

Table 1: Properties of the Raw Greywater at the Experimental Site

Year	Temp (°C)	pH	COD (mg /L)	BOD (mg/L)	TSS (mg/L)	EC (dS/m)	NO_3 (mg/L)	SO_4^{2-} (mg/L)	TDS (mg/L)	FC (CFU/100 ml)	Cl^- (mg/L)
2016	27.20	7.46	415.77	274.35	109.00	3.72	24.60	2542.50	1995.00	2570	17.02
2017	28.10	6.26	415.77	286.40	107.00	4.02	23.40	2551.30	2001.00	2440	15.53
2018	29.00	8.66	406.44	298.45	111.00	4.32	25.80	2560.10	1998.00	2700	18.51
Standard (Pesco, 1992)	Nill	6 - 9	200	60	50	0.7 – 3	50	2000	450 – 2000	1000	500

Table 2: Properties of the Treated Greywater at the Experimental Site

Year	Temp (°C)	pH	COD (mg /L)	BOD (mg /L)	TSS (mg /L)	EC (dS /m)	NO_3 (mg /L)	SO_4^{2-} (mg /L)	TDS (mg/L)	FC (CFU/100 ml)	Cl^- (mg/L)
2016	27.80	7.08	33.22	23.00	89.00	2.43	11.40	1546.50	1152.00	390	18.82
2017	28.10	6.10	35.51	26.00	92.00	2.26	12.40	1563.70	1226.00	530	19.43
2018	29.40	8.06	37.80	24.50	95.00	2.60	13.40	1580.90	1300.00	460	20.04
Standard (Pesco, 1992)	Nill	6 - 9	200	60	50	0.7 – 3	50	2000	450 – 2000	1000	500

have been removed during the sedimentation process.

Heavy Metals of Irrigation Water

The heavy metals analyzed included cadmium, copper, lead, zinc, nickel, and manganese (FAO, 1992). The results showed that the concentrations of heavy metals in the treated grey-water were within the acceptable limits set by WHO, indicating they are unlikely to pose risks to soil or crops (Table 4). The removal efficiencies for manganese (Mn) were 88%, 88.71%, and 72.72% for the dry seasons of 2016, 2017 and 2018, respectively. For iron (Fe), the removal efficiency was 85.71% across all three seasons. Lead (Pb) showed a removal efficiency of 98% for the three seasons, while nickel (Ni) achieved 100% removal efficiency throughout. The removal rates for zinc (Zn) were 3.90%, 14.45%, and 14.58% for 2016, 2017, and 2018, respectively, and for copper (Cu), the efficiencies were 58.33%, 79.17%, and 80.56% during the same periods. The removal efficiencies observed align with earlier studies conducted by Nakwanit *et al.* (2011), Akinbile *et al.* (2012), Tuheteru *et al.* (2016), Pongthornpruek (2017), Thathong *et al.* (2019), Prasetya *et al.* (2020), Ismail *et al.* (2024), and Zubair*et al.* (2021). Exceptional removal of heavy metals has been noted by Nguyen *et al.* (2021) and Ismail *et al.* (2024), which they attributed to the use of added rhizobacteria and adsorbents in constructed wetland systems. Overall, heavy metals were primarily eliminated through rhizofiltration, where the roots of the plants in the water absorb metals. Once absorbed through the root membranes, these metals can either be retained in the roots or transported to other parts of the plant for tissue localization (Prasetya *et al.*, 2020).

Table 3: Concentrations of Heavy Metals in Raw Grey-water used in the Experiment

Year	Mn (ppm)	Fe (ppm)	Pb (ppm)	Ni (ppm)	Cd (ppm)	Zn (ppm)	Cu (ppm)
2016	0.100	0.014	0.050	0.002	Nill	0.154	0.060
2017	0.105	0.014	0.050	0.002	Nill	0.173	0.120
2018	0.110	0.014	0.050	0.002	Nill	0.192	0.180
WHO Standard (1985)	0.400	0.300	0.010	0.020	0.003	3.000	2.000

Table 4: Concentrations of Heavy Metals in Treated Grey-water used in the Experiment

Year	Mn (ppm)	Fe (ppm)	Pb (ppm)	Ni (ppm)	Cd (ppm)	Zn (ppm)	Cu (ppm)
2016	0.012	0.002	0.001	Nill	Nill	0.148	0.025
2017	0.021	0.002	0.001	Nill	Nill	0.156	0.030
2018	0.030	0.002	0.001	Nill	Nill	0.164	0.035
WHO Standard (1985)	0.400	0.300	0.010	0.020	0.003	3.000	2.000

CONCLUSION

This study set out to examine the suitability of grey-water treated with common reed in constructed wetlands for irrigation purposes in Akure, Nigeria. Through detailed analyses, the findings revealed that the treatment process significantly improved the quality of the grey-water. Specifically, the treatment led to reductions in key physico-chemical and microbial parameters, reflecting a notable improvement in water quality. Additionally, the constructed wetland system, which utilized common reed, was effective in reducing concentrations of heavy metals, highlighting its role in enhancing the overall safety and usability of the treated water. The removal efficiencies for various heavy metals, such as manganese, iron, and lead, were particularly impressive, further supporting the treatment's effectiveness. Based on the results, it can be concluded that the treated grey-water met the required standards for irrigation water reuse, with all analyzed parameters falling within acceptable limits set by regulatory bodies. This suggests that common reed-treated grey-water can be a viable alternative for irrigation in agricultural settings, contributing to sustainable water management practices in areas like Akure. The findings underscore the potential of using constructed wetlands with macrophytes like common reed not only for improving grey-water quality but also for promoting environmentally sound irrigation practices. Consequently, the treated grey-water from this system is deemed safe and suitable for agricultural use, aligning with guidelines for wastewater reuse in irrigation.

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