



Evaluation of fungal permeated lignocellulosic filter for remediation of water pollutants

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ABSTRACT

The use of biological techniques to remove pollutants from the environment has been long advocated. In this study, we assessed the efficacy of a fungal permeated lignocellulosic filter (mycofilter) in the removal of water pollutants using surface water as the test sample. A wild macrofungus was collected from a field within Osun State University, Oke-Baale, Osogbo, and cultured on potato dextrose agar. Identification was achieved using morphological and PCR techniques. Mycofilters (FCCs) were developed from pure macrofungus mycelium and diced pasteurized corncob (CC). Collected surface water (RW) was passed through three mycofilters, each with flow rates of 0.2, 0.5, and 1.0 ml/min. Diced pasteurized corncob (CC) was used as the negative control. Physicochemical parameters including pH, temperature, turbidity, cadmium, copper, iron, zinc, and lead, and microbial parameters i.e. total bacterial count (TBC) and *Escherichia coli* counts (ECC) of RW, CC, and FCC treated waters were determined. Phenotypically, the fungus was identified as *Macrolepiota procera* and yielded 650 bp by PCR product assessment on gel electrophoresis. Remarkably, FCC reduced the levels of turbidity, chemical, and microbial contaminants significantly at $p = 0.001$, < 0.05 , and ≤ 0.002 respectively compared to CC. The flow rate of 0.2 ml/min was the most efficient in reducing contaminants in the RW. This study reveals the potential of the *Macrolepiota procera* permeated filter in reducing water contaminants.

Keywords: Mycofilter, *Macrolepiota procera*, Contaminants, Corncob, Water

INTRODUCTION

In the last few decades, the teeming human population and industrialization have continued to drive an increased need for freshwater which is mostly fulfilled by rivers (Gupta *et al.*, 2017). This occasions continuous pollution of surface waters with municipal, agricultural, and industrial wastes (Titilawo *et al.*, 2020). Usually, deterioration in water quality arises when organic and inorganic xenobiotics enter the waterways through the intended discharge of effluents from wastewater treatment plants or accidental spillage during various industrial activities (Akpaja and Olorunfemi, 2014). Additionally, microbial contamination occurs via storm events, sewage overflow, and run-offs from agricultural farms (Titilawo *et al.*, 2015). These activities render aquatic environments incapable of the desired primary and secondary usage (Agbaire and Obi, 2009).

Easy access to clean and safe water is a basic and fundamental right of every individual owing to its vital role in life sustenance and physical well-being, and water intended for human usage must be readily available in adequate quantity and free from potential hazardous chemicals and disease-causing microorganism (WHO, 2010; 2011). Unfortunately, limiting factors including the huge capital equipment, and high maintenance cost, amongst others hinder the proliferation of conventional

water treatment facilities. Furthermore, chemical disinfectants such as alum and chlorine, where available, are very expensive (Aho and Lagasi, 2012; Tunggolou and Payus, 2017).

Mycofiltration is a promising low-cost bioremediation technique for treating polluted waters. First mentioned in the literature in the early 90s, mycofiltration involves the deliberate use of fungal colonized lignocellulosic waste to filter poisonous substances and microbes from contaminated waterbodies (Stamets, 1993). Its application in improving water quality including the removal of dirt, pathogens, toxic elements, antibiotics, and even antimicrobial-resistant genes has been reported (Stamets, 2005; Akpaja and Olorunfemi, 2014; Taylor *et al.*, 2014; Olorunfemi *et al.*, 2015; Lucas *et al.*, 2016). White-rot fungi including *Pleurotus ostreatus*, *Irpex lacteus*, *Stropharia rugosoannulata*, *Pleurotus tuber-regium*, and *Trametes versicolor*, and wastes such as wood chips, wheat straw, and corncobs have been employed in this technology (Taylor *et al.*, 2015; Olorunfemi *et al.*, 2015; Lucas *et al.*, 2016; Pini and Geddes, 2020).

Globally, this technology is still at infancy, and the efficacy of a variety of fungi in remediating polluted water and the effect of flow rate is yet to be thoroughly investigated. Till date and to the best of our knowledge, few scientists including Akpaja and Olorunfemi (2014) and Olorunfemi *et al.* (2015) reported the effectiveness of *Pleurotus tuber-regium* mycelium colonized corncob in bioremediating waters from some parts of Delta State, Southsouth, Nigeria. Recently, Adeyemi *et al.* (2022) reported contamination of waterbodies in some regions in Osun State which limits their use for diverse domestic and agricultural purposes. Hence, there is a need to search for low-cost and sustainable techniques to improve the quality of the available aquatic milieu. It is in this light that the study aimed at evaluating the remediating potentiality of a fungal permeated lignocellulosic waste and the effect of flow rates in mycofiltration technique under laboratory conditions.

METHODOLOGY

Collection and phenotypic identification of the macrofungus

The macrofungus was obtained from a grassy lawn at Osun State University, Osogbo, Southwest Nigeria in June 2019 (N7°45'41.9292"E4°36'4.3812"). Macrofungus sample was carefully uprooted from the soil using a sterilized hand trowel, placed in a paper bag, and transported to the laboratory for further analysis. Morphological description of the cap, stipe, and gill features and presumptive identification were done

according to Odeyemi and Adeniyi (2015). The spore print was done by cutting off the cap and placing the gill directly on white paper overnight. The paper was viewed macroscopically and visual observation was recorded.

Tissue culture of the macrofungus fruiting body

This was done according to Adeniyi *et al.* (2018). The fruiting body was gently washed with sterile distilled water and the gills were chopped into 1 cm². The cut gills were dipped into 70% ethanol for 30 min for surface sterilization, removed, and carefully inoculated on potato dextrose agar (PDA) plates and then incubated at 28°C for 7–10 days. Fungal mycelium was subcultured until pure cultures were obtained and kept on a PDA slant at 4°C for further use.

Molecular identification of the fungal isolate

DNA extraction and PCR amplification

Genomic DNA extraction was done using fungal mycelium suspended in phosphate buffer and ZR Fungal/Bacterial DNA kit™ (Zymo Research, USA) following the standard protocol (Adeniyi *et al.* 2018). For PCR amplification, PCR mix comprising of 2.5 µl of 10× PCR buffer, 1 µl of 25 mM MgCl₂, 1 µl each of 5pMol forward and reverse primers, 1 µl of DMSO, 2 µl of 2.5 mM DNTPs, 0.1µl of Taq 5u/ul, 3 µl of 10 ng/µl DNA, 13.4 µl of H₂O. The oligonucleotide sequence of ITS1: 5'-TCCGTAGGTGAACCTGCGG-3' and ITS 4: TCCTCCGCTTATTGATATGC (White *et al.*, 1990) was used for the amplification. The PCR cycling conditions included initial denaturation at 94 °C for 5 min; 35 cycles of denaturation at 94 °C for 30 s; annealing at 54 °C for 30 s and extension at 72 °C for 45 s; followed by the final extension at 72 °C for 7 min. Five microlitres of HyperLadder™1 kb DNA ladder (BioLoin, London, UK) and the amplicon (5 µl) were placed into the well of 1.5% w/v agarose gel stained with ethidium bromide, left to run at 60 V for 2 h and visualized with a ChemiDoc™ MP System (Bio-Rad Laboratories, Hercules, CA, USA). According to Hussein *et al.* (2014), PCR product of *Macrolepiota procera* is 650 bp.

Mycofilter preparation

Mycofilter was made using fungal spawn and diced pasteurized corncob. Spawn was prepared by autoclaving freshly boiled white sorghum grain in glass bottles at 121°C for 15 minutes. After cooling, the grains were mixed with pure fungal mycelium discs and incubated at 28°C for colonization. Furthermore, diced corncob was washed several times with clean water, pasteurized at 63°C for 30 minutes, drained, and allowed to cool. Exactly 25g of spawn was mixed with 150g (dry weight)

pasteurized corncob and filled into a 75 cl capacity plastic tank (height = 25 cm; diameter = 6 cm) to a height of 20 cm and left for fungal ramification.

Collection of contaminated water sample

Water samples were collected from a free-flowing stream at Osun State University, Oke-Baale, Osogbo Campus, Osun State (N 7° 45'41.9292" E 4°36'4.3812") in a sterile plastic container and immediately transported on ice pack into the laboratory. In-situ field parameters including temperature and pH were determined using a hand-held probe (Jenway 550, UK).

Mycofiltration procedure

The mycofiltration unit consisted of a raw water tank (75 cl capacity), connecting pipe (length =150m; diameter = 12.1 cm), and the mycofilter tank. The water sample filled into the raw water tank was passed through the connecting pipe into the mycofilter at different rates, 0.2, 0.5, and 1ml/min. Filtrate was collected from the filter outlet into a sterile container. The experiment was performed in triplicates.

Physicochemical and microbial analyses of water samples

Raw water (RW) i.e. water collected from the surface water, and water samples filtered through corncob only (CC) and fungal permeated corncob (FCC) at flow rates of 0.2, 0.5, and 1.0 ml/min were used for the physicochemical and microbial analysis.

Determination of temperature, pH, and turbidity

Temperature and pH were determined using a portable hand-held probe (Jenway 550, UK). Turbidity was measured using the nephelometer (Labscience SGZ-200BS, England). First, the nephelometer was calibrated using distilled water (zero NTU) and a standard turbidity suspension of 40 NTU. Thereafter, the thoroughly mixed sample was placed into the nephelometric tube and the value recorded.

Determination of chemical properties of water sample

Exactly 200 ml of water sample was digested with 5 ml of 9:4 ratio v/v of di-acid mixture (nitric acid: perchloric acid) on a hot plate and filtered by Whatman No. 42 filter paper and made up to mark in a 50 ml volumetric flask by double distilled water for analysis of heavy metals including cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), iron (Fe) and zinc (Zn). Levels of the heavy metals in the water samples were determined using atomic absorption spectrophotometer (AAS) (Perkin

Elmer A Analyst 100).

Microbial analysis of water sample

Total bacterial count (TBC) and *E. coli* count (EEC) were assessed using the standard plate count technique (APHA 2012). One millilitre (1 ml) of water sample was serially diluted in sterile 9 ml physiological saline up to the 6th tube. One hundred microliter (100µl) of diluted sample was pipetted from the test tubes and spread on plate count agar and eosin methylene blue agar respectively, incubated at 37°C, and observed after 24 hours. Colonies observed on the plates were counted and recorded as colony-forming units per milliliter (CFU/ml) using the equation below.

$$\text{CFU/ml} = \frac{\text{Number of colonies} \times \text{Dilution factor}}{\text{Volume of culture plated (ml)}}$$

Statistical analysis

All experiments in this work, except PCR analysis, were done in triplicates. SPSS IBM version 23 software was employed for data analyses and values were expressed as mean ± standard deviation. The difference in means was estimated using one-way analysis of variance (ANOVA) and Duncan multiple tests employed to determine the significant difference in raw, CC, and FCC waters with respect to flow rate. Paired T-test was used to identify the difference between variable CC and FCC. Values with a probability level of <0.05 were considered statistically significant.

RESULTS

Presumptive identification of the macrofungus

The morphological description of the macrofungus is described in Table 1 and identified as *Macrolepiota procera*. Tissue culture yielded white mycelium on the PDA plate. The pictures of the macrofungus, spore print, and mycelium are shown in Plate 1.

Table 1: Morphological description of the macrofungus.

Mushroom presumptive identity	Cap	Stipe	Gill / Spore print
<i>Macrolepiota procera</i>	9 to 19 cm across, button spherical when young, flattened with a prominent umbo, grey-brown covered in shaggy scales	7 to 18 cm high with 0.8 to 1.5 cm diameter. White stipe, with grey-brown, felt covering and bulb at the base. Annulus also present	Free and white in colour. Turns dark brown after harvest. The spore print is yellow in colour



Plate 1: Picture showing the macrofungus. a – Young macrofungus growing on a grassy lawn; b – Matured macrofungus growing on a grassy lawn; c – Gill and stipe features of the macrofungus; d – Gill turned dark brown after harvest; e – Light yellow spore print; f – Macrofungus mycelium on PDA plate.

Molecular identification of the isolate

The mushroom culture produced enough fresh mycelia in Eppendorf tubes to extract genomic DNA. The protocol of DNA extraction was highly reproducible. The target

region of genomic DNA of the mushroom using ITS 1 and 4 primers generated fragments of approximately 650 bp (Plate 2).

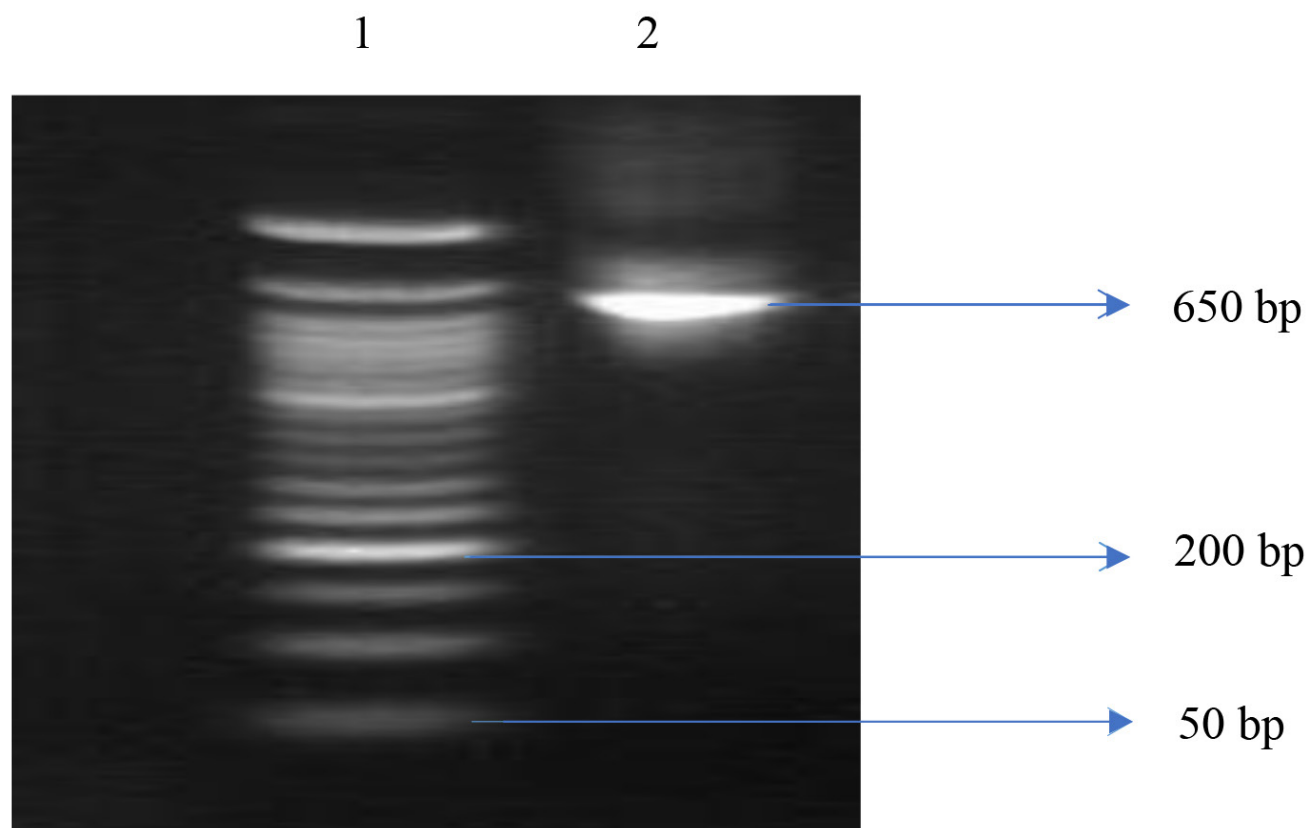


Plate 2: Gel picture of *Macrolepiota procera*. Lane 1 -DNA ladder; Lane 2 - Identified isolate

Turbidity and chemical quality of the water samples

The turbidity of RW (14.60 ± 0.10 NTU) was significantly lower ($p < 0.05$) than the CC-treated waters with values ranging from 61.57 ± 0.79 to 170.67 ± 0.15 NTU, but significantly higher than FCC filtrates (7.33 ± 0.40 to 10.43 ± 1.30 NTU). Flow rate 0.2 ml/min had the lowest turbidity (7.33 ± 0.40 NTU) and the value recorded was significantly different from 0.5 and 1 ml/min (Table 1). Generally, there was a significant difference ($p = 0.001$) between turbidity obtained in the CC and FCC water.

The cadmium, copper, iron, lead, and zinc content of the RW sample was 0.08 ± 0.01 , 1.23 ± 0.01 , 5.35 ± 0.01 , 0.91 ± 0.01 and 1.11 ± 0.01 mg/L respectively

(Table 2). These values reduced after passing through CC and FCC. Interestingly, there was more reduction in the metal levels in FCC treatments compared to the CC treatments, except for cadmium (0.5 ml/min) and lead (1ml/min) whose values were the same after CC and FCC treatment (Table 2). In the three flow rates, 0.2 ml/min had the highest concentration of the tested metals in CC treated water except zinc and the lowest level of metals after treatment with FCC (Table 2). One-way ANOVA reveals that the values obtained in the RW, CC and FCC waters were significantly different at $p \leq 0.002$. Likewise, paired T-test shows significant difference between CC and FCC at $p < 0.05$.

Table 2: Turbidity, cadmium, copper, lead, iron, and zinc levels of collected surface water, corncob and mycofilter treated water samples

Sample	Turbidity (NTU)		Cadmium (mg/L)		Copper (mg/L)		Iron (mg/L)		Lead (mg/L)		Zinc (mg/L)	
RW	6.42 ± 0.02		0.08 ± 0.01		1.23 ± 0.01		5.35 ± 0.01		0.91 ± 0.01		1.11 ± 0.01	
Flow rate (ml/min)	CC	FCC	CC	FCC	CC	FCC	CC	FCC	CC	FCC	CC	FCC
0.2	6.65 ± 0.03	6.80 ± 0.12	0.03 ± 0.02	0.00 ± 0.00	1.08 ± 0.04	0.07 ± 0.01	4.36 ± 0.55	0.30 ± 0.01	0.64 ± 0.12	0.03 ± 0.02	0.73 ± 0.56	0.10 ± 0.00
0.5	6.33 ± 0.02	6.78 ± 0.14	0.01 ± 0.00	0.01 ± 0.00	0.88 ± 0.01	0.76 ± 0.01	3.91 ± 0.01	3.07 ± 0.06	0.32 ± 0.01	0.08 ± 0.01	0.99 ± 0.01	0.85 ± 0.18
1	6.51 ± 0.01	6.86 ± 0.04	0.02 ± 0.01	0.01 ± 0.00	0.76 ± 0.01	0.45 ± 0.01	4.12 ± 0.02	1.56 ± 0.01	0.22 ± 0.03	0.22 ± 0.01	0.99 ± 0.01	0.49 ± 0.01

Legend: RW - Collected surface water; CC - Corncob only; FCC – Mycofilter

Microbial load of the water samples

The total bacterial count (TBC) and *E. coli* count (ECC) of the RW were 2179.67 ± 28.79 and 491.00 ± 28.79 cfu/ml respectively (Table 3). Generally, there was a reduction in the TBC and ECC of RW after filtering through CC and was in the order $0.2 < 0.5 < 1.0$ ml/min. FCC further reduced TBC and ECC compared to CC in the same

order. Percentage reduction in TBC and ECC was highest at 0.2 ml/min (40.67; 64.50%), followed by 0.5 ml/min (25.85; 49.79%) and lastly, 1.0 ml/min (7.63; 21.71%) (Table 3). There was a significant difference in values obtained in the RW and the three flow rates of CC and FCC-treated water at $p = 0.000$. Similarly, a statistically significant difference of $p \leq 0.002$ was observed in TBC and ECC of CC and FCC-treated waters.

Table 3: Total bacterial count and *Escherichia coli* count of collected surface water, corncob, and mycofilter treated water samples.

	Total bacterial count (cfu/ml)			<i>Escherichia coli</i> count (cfu/100ml)		
RW	2179.67 ± 28.79			491.00 ± 26.72		
Flow rate (ml/min)	CC	FCC	% Reduction	CC	FCC	% Reduction
0.2	1645.00 ± 55.06	976.00 ± 48.04	40.67	456.33 ± 12.22	162.00 ± 5.57	64.50
0.5	1887.67 ± 104.08	1399.67 ± 82.54	25.85	470.00 ± 7.94	236.00 ± 12.01	49.79
1.0	2030.00 ± 47.62	1877.00 ± 82.54	7.63	488.33 ± 10.50	262.00 ± 8.57	46.34

Legend: RW – Collected surface water; CC – Corncob only; FCC – Mycofilter

DISCUSSION

Surface waters are a vital natural endowment covering about 13,000 sq km of the total land area of Nigeria (CIA, 2020). However, rapid urbanization and industrialization, and overwhelming population growth continue to exert frightening pollutions and various burdens on the quality and quantity of water thus, limiting free access to the resource (Adesiyan *et al.*, 2018). In this study, the macrofungus used for presumptive water treatment was morphologically identified as *Macrolepiota procera* yielding 650 bp PCR product.

Mycofilter is a combination of lignocellulosic waste and networks of fungal mycelium developed to improve water quality (Stamets, 2005). This current investigation successfully constructed a mycofilter from corncob and *Macrolepiota procera* mycelium. Previous researchers developed mycofilters from wood chips and *Stropharia rugosoannulata* (Taylor *et al.*, 2014), maize cob, and *Pleurotus tuber-regium* (Akpaja and Olorunfemi, 2014; Olorunfemi *et al.*, 2015), wheat straw and *Pleurotus ostreatus* (Pini and Geddes, 2020).

A previous study reported the efficacy of fungi in the decontamination of polluted environmental samples (Akpaja *et al.*, 2014), with mushrooms possessing the capability for metal bioaccumulation and trapping and digestion of microorganisms in polluted water samples (Stamets, 2005). Usually, diverse physicochemical and microbiological parameters are employed to determine the quality of water for sundry purposes (Titilawo *et al.*, 2020).

Turbidity indicates the quantity of colloidal matter in the

suspended state when light is passed through a liquid. The increased turbidity noticed in CC-treated water (Table 1) may be due to the dissolvable organic matter present in the corncob used as a filter. Cloudiness appearance in water is associated with fine soil particles and organic matter, and invisible living organisms (Ezeribe *et al.*, 2012; Yasin *et al.*, 2015), and may possibly impact objectionable taste and odour, and reduce the action of disinfectants in water. In this current study, the turbidity was reduced in FCC treatments (Table 1). Possibly, the organic matter in the corncob was used for fungal mycelium growth during colonization of the substrate, and the fungal mat in and around the substrate absorbed dissolved organic matter and disallowed passage of particulate matter. This corroborated Frac *et al.* (2018) who stated that the branching and porous network of fungal hyphae penetrate the substrate, break down, absorb, and convert organic matter into biomass, and the fungal mat sieve out impurities from the water. Although FCC reduced the turbidity of RW, the values recorded still exceeded the 5 NTU WHO standards (WHO, 2008).

The presence of heavy metals in drinking water above stipulated limits can have detrimental effects on human health. In the present study, the levels of Cd, Cu, Fe, Pb, and Zn were determined in RW, CC, and FCC at 0.2, 0.5, and 1 ml/min flow rates (Table 1). In nature, Cd is found in rocks and soils, and may also be introduced into water through industrial, agricultural, and domestic waste disposal (Rahmanian *et al.*, 2015). In this study, the Cd content of the RW, CC, and FCC were above the safe limit recommended by WHO (0.003 mg/L), however, FCC at 0.2 ml/min completely removed the Cd from the water (0.00 mg/L). When Cd is excess in drinking water,

it can result in renal disease, arterial hypertension cramps, nausea, vomiting, and diarrhea (Boateng *et al.*, 2019).

Copper, an essential nutrient needed for producing red blood cells and strengthening immunity becomes a pollutant in water when its concentration exceeds the WHO threshold of 2 mg/L in water (WHO, 2011). Domestic wastes, metals, and mineral discharge are sources of Cu contaminants in surface water (Vetrimurugan *et al.*, 2017; Titilawo *et al.*, 2020). The concentration of Cu obtained in RW (1.23 ± 0.01 mg/L) is below the permissible limit (2 mg/L) of WHO (2011), albeit, FCC further reduced its level compared to CC. Higher concentrations of Cu can cause low red blood cell count, gastrointestinal disorders, and liver and kidney damage in humans (Dixit *et al.*, 2015).

Iron, the most abundant mineral in the earth's crust occurs as ores in rocks, soil, and minerals (Popoola *et al.*, 2019). In this study, the Fe level above the safe limit in RW (Table 1) could be due to the dissolving of minerals and rocks (mineralogical and piezometric features) along the water path. Although CC and FCC removed Fe, both treatments exceeded the safe level (0.3 mg/L) set by WHO (2011) except FCC 0.2 ml/min whose value was 0.30 ± 0.01 mg/L. Excessive intake of Fe results in liver damage, high blood sugar, arteries defect, and death of nerve cells. However, its deficit is associated with anemia (Brewer, 2009; Nagendrappa *et al.*, 2010; Popoola *et al.*, 2019).

Lead is extremely toxic at a very minute concentration (Gregoriadou *et al.*, 2001). High Pb in RW (0.09 ± 0.01 mg/L) could be linked to the disposal of wastes rich in lead into the water (Imam, 2012). The presence of Pb beyond the permissible concentration (0.01 mg/L) in RW, CC, and FCC (Table 1) could cause high blood pressure, delayed brain development in foetus and infants, and damage body tissues, organs, and systems (Titilawo *et al.*, 2018).

Zinc is a natural essential metal occurring at approximately 0.05 g/kg on the earth (Dohare *et al.*, 2014). RW, CC, and FCC for the three flow rates revealed zinc concentration below the tolerable limit of 15 mg/L set by WHO (2011). This could be adduced to the possibility that the zinc in its natural mineral form did not dissolve into the RW sample location (Broadly *et al.*, 2007). High dosages of Zn cause gastrointestinal disorders, kidney problems, ataxia, depression, impotence, kidney and liver failure, prostate cancer, and seizures (Popoola *et al.*, 2019). Overall, FCC and flow rate 0.2 ml/min reduced levels of heavy metals compared to CC and the two other flow rates assessed. This is most likely because the fungus or its enzymes transform and mineralize the pollutants (Robles-

Hernandez *et al.*, 2008), and the slow flow rate allowed long time interaction of the pollutants with the mycelium favouring improved transformation and mineralization. Microbial water pollution is a major health concern. In the current study, FCC lowered the level of microbial contaminants (TBC and ECC), with a flow rate of 0.2 ml/min being the most efficient rate (Table 2). Olorunfemi *et al.* (2015) reported the elimination of bacterial contamination after mycofiltration. In addition, slow percolation facilitates enough time for the interaction of pathogens with the fungal mycelium which predates the microbial contaminants (Maurya *et al.*, 2020). The TBC in our study has no discernable health effect, however, their presence makes water biologically unstable and unfit for drinking (USEPA, 2012; Maurya *et al.*, 2020). The ECC value in FCC at 0.2 ml/min (162.00 ± 5.57 cfu/100ml) exceeded the set safe level (≤ 10 cfu/100ml) by WHO (2011). Thus, the water is not safe for drinking. The detection of *E. coli* in water implies contamination with faecal material, and its ingestion is responsible for disease burdens among the human population (Titilawo *et al.*, 2018).

CONCLUSIONS

Aquatic environments are now endangered due to constant pollution and deterioration of water quality. Hence, there is an urgent need for measures to remediate water resources to ensure sustainability and equal access to improved water. The present study assessed the bioremediation potential of mycofilter (FCC) made from corncob and fungus mycelium in improving the physicochemical and microbial quality of surface water within Osun State University, Oke-Baale, Osun State, Nigeria. Corncob (CC) only served as negative control while three flow rates, 0.2, 0.5, and 1.0 ml/min were employed. Molecularly, the macrofungus yielded 650 bp PCR product. Overall, the FCC stabilized pH and reduced turbidity but had no effect on temperature. FCC efficiently reduced the concentrations of Cd, Cu, Fe, Pb, and Zn in the water when compared to CC. Similarly, TBC and ECC were significantly reduced in FCC in comparison with CC. This reveals the efficacy of FCC in remediating contaminated surface water, and its potential use as a low-cost mycofilter, combining waste materials and fungal mycelium. Among the three flow rates, 0.2 ml/min proved to be efficient in removing chemical and microbial contaminants in RW with some having levels above the stipulated WHO limits. Hence, further treatment techniques targeted towards regulating the quality of water from *Macrolepota procera* permeated filter to meet the set standards for drinking purposes are needed.

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