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Waste Water Treatment by using Photoremediation Process

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Abstract*: This study presents the design amd implementation of a constructed wetland for wastewater treatment. The wetland, measuring 160 cm in length, 60 cm in breadth, and 30 cm in height, was constructed with three layers. The bottom layer consisted of 8 cm of coarse aggregate, followed by a 4 cm thick middle layer of fine aggregate passing a 4.75 mm sieve.*

The top layer comparised 12-14 cm of black cotton soil. Prior to installation, both aggregates were cleaned using water. The wetland was planted with colocasia and canna indica plants.

Waste water from a collage hostel was slowly poured into the wetland, and the treated water was collected through a tap positioned 2 cm above the bottom layer. Several tested were conducted on the treated water, including pH, TDS, TSS. The results showed a treatment efficiency ranging from 70 to 80%.

These findings suggest that the designed constructed wetland, along with the chosen plant species, is effective in removing containts and improving the quality of the waste water. Further research is recommended to explore the long term performance and optimize the design parameters of the wetland.

Keywords: plants, pollutant removal, photoremediation, wastewater treatment

I. INTRODUCTION

Photoremediation term is derived from two generic terms including ‘photo’ means plant and ‘remediation’ means impeding environmental damage.

Photoremediation is an assembly of technologies, using a group of plants for remediation of domestic waste water which get sediment with different types organic contaminants by using photoremediation technology, efficiently using the plants for removal, detoxification or immovable contaminants shifted to growth matrix by utilizing chemical and biological process.

II. LITERATURE SURVEY

2.1 Petro Novert Karungamye: This article reviews investigation in which Canna indica was utilized in constructed wetlands (CW) for wastewater treatment of a variety types. It is strongly urged that ornamental flowering plants to be used in CWs as monoculture or mixed species to improve the appearance of CWs whilst still treating wastewater. Plants play important roles in CWs by giving the conditions for physical filtration of wastewater, a large specific surface area for microbial growth, and a source of carbohydrates for bacteria. They absorb nutrients and integrate them into plant tissues. They release oxygen into the substrate, establishing a zone in which aerobic microorganisms can thrive and chemical oxidation can occur. They also provide wildlife habitat and make wastewater treatment system more visually attractive.

The selection of plant species for CW is an important aspect during the CW design process. *Canna indica`s* effectiveness in CWs has shown encouraging results for eliminating contaminants from wastewater. There is still a scarcity of information on the mechanisms invoved in removal of specific contaminants such as pharmaceuticals, personal care products, hormones, pesticides and steroids and their potential toxicity to the plants. Therefore, this paper reviews some published information about the performance of *Canna indica* in wastewater treatment, as well as potential areas for future research.

2.2 Yuhan Ma: Two halogenated flame-retardants and cadmium in soil is harmful to human health, in order to study the biological response and bioaccumulation ability of ryegrass to pollution stress, the phytotoxicity to seedlings and the phytoremediation effect in contaminated soil were investigated. It showed that proline and malonaldehyde (MDA) contents and antioxidant enzyme activity of ryegrass seedlings were increased, cadmium was the most toxic to ryegrass seedlings.

The bioconcentration factor (BCF) of roots is higher than shoot. Ryegrass could assimilate trace amount of Dechlorane Plus (DP) and Tetrabromobisphenol A (TBBPA), and its dissipation in soil mainly due to the root exudates and rhizosphere microorganisms. $T_{1/2}$ of syn-DP, anti-DP and TBBPA was 42.01, 39.38 and 74.53 d in the single pollution, $T_{1/2}$ prolonged in combined pollution. Cadmium in the roots and stems is 27.82 mg/kg and 10.25 mg/kg in the treatment of single pollution, biological accumulating coefficient (BAC) and biological transfer coefficient (BTC) were 2.16 and 0.37.

Ryegrass could effectively reduce total cadmium in soil; the optimal bioremediation time was 60 days. The phytoremediation ability and phytoextraction efficiency of ryegrass in contaminated soil were clarified, which would be useful for understanding the fate of halogenated flame-retardants and Cd in phytoremediation for contaminated soil.

2.3 Anton Stepanenko: Tiny aquatic plants from the lemnaceae family,commonly knows as duckweeds, are often regarded as detrimental to the environment because of their ability to quickly populate and cover the surfaces of bodies of water. Due to their rapid vegetative propagation,duckweeds have one of the fastest growth rates among flowering plants and can accumulate large amount of biomass in relatively short time periods. Due to the high yield of valuable biomass and ease of harvest,duckweeds can be used feedstock biofules,animals feed,and other application. Thanks to their efficient absorption of nitrogen an phosphate-containing pollutants, duckweeds play an important role in the restorative ecology of water reservoirs. Moreover, compared to other species, duckweed species and ecotypes demonstrate exceptionally high adaptivity to a variety of environmental factor;indeed, duckweeds remove and convert many contaminants, such as nitrogen, into plant biomass. The global distribution of duckweeds and there tolerance of ammonia, heavy metals, other pollutants and stresses are the major factor highlighting their potential for use in purifying agricultural, municipal and some industrial wastewater.

2.4 Paliza Shrestha: We investigated the effects of organic amendments (thermophilic compost vermicompost,and coconut coir) on the bioavailability of trace heavy metals of Zn,Cd,Pb,Co and Ni from heavy metals-spiked soils under laboratory conditions. To test switchgrass (panicum virgatum) as a potential crop for phytoremediation of heavy metal from soil, We investigated eather the addition of organic amendments promoted switchgrass growth,and consequently,uptake of metals. Compost is a valuable soil amendment that supplies nutrient for plants establishment and growth,which is beneficial for phyremediation. However, excess application of compost can result in nutrient leaching,which has adverse effects on water quality. We tested the nutrient leaching potential of the different organic amendments to identify trade-offs between phytoremediation and water quality. Results showed that the amendments dwcreased the amount of bioavailable metals in the soil. Organic amendments increased soil ph, electrical conductivity(EC), and soil nutrient status. Switchgrass shoot and root biomass was significantly greater in the amended soils compared to the non-amended control.Amended tretments showed detectable levels of heavy metal uptake in switchgrass shoots, while the control treatment did not produce enough switchgrass biomass to measure uptake. Switchgrass uptake of certain heavy metals, and concentrations of some leachate nutrients significantly differed among the amended treatments.By improving soil properties and plants productivity and reducing heavy metal soluability that can otherwise hamper plant survival,oranic amendments can greatly enhance phytoremediation in heavy metal-contaminated soils.

Canna Indica : Arrowroot is a tropical and subtropical perennial plant tht forms dense clumps and produces showy flame-red flowers on erect stems.The leaves are large, green to violet-green in color, and paddle-shaped. This species has been cultivated for over 4000 years as a food crop in central and south america. The plant may grow to 8 feet tall and 3 feet wide. It is a member of the cannceae family. Arrowroot is a native of central america, south america, and the west indies. Its primary habitats are sites with heavy rainfall, disturbed area, roadside, and the outskirts of the village. The plant has been naturalized in the southeastern united states, portions of Europe,sub-saharan Africa,portions of Australia,and Pacific Islands.Arrowroot prefers sunlight,moist,well-drained soils with a preferably acidic pH. The plant may grow in soil types such as sand,clay,loam,and chalk.The rhizomes need to be spaced about 3 feed apartand 4-6 inches deep after the last frost in the spring. Arrowroot may be propagated by division or by seeds.

Fig. 1 Canna Indica

Fine Aggregates: Fine aggregate, which may be granular material or crushed stone, is a fundamental component of concrete. The quality of the fine aggregate and the density of the fine aggregate both have a significant impact on the hardened qualities of the concrete.

The size of fine aggregate is defined as equal to or less than 4.75 mm. This means that the aggregates that can pass through a number 4 sieve with a mesh size of 4.75 mm are referred to as fine aggregates. Depending on composition, shape, size and other propertiesoffineaggregate you can have a significant impact on the output.

Coarse Aggregates: Coarse aggregates are those that cannot pass through an IS Sieve of 4.75mm. They are gravel or crushed stone that occurs naturally and is used to make concrete.Blasting the stone quarries is typically how coarse aggregates are created. However, they are occasionally also hand-crushed. Stones of varying sizes can be crushed together in the machinery. On the other hand, only stones of comparable sizes are utilized when crushing by hand. Natural river gravels and hard crushed rocks (granite and limestone) are the most widely used aggregates for structural concrete.Foamed slag, shattered bricks, clinkers, etc., are also utilized as coarse aggregates in non-structural concrete

Waste Water: Waste water we have collected from our collage campus. The water contain much more impurities that we have to treat through our project.The impurities such as vegetable waste,pesticides,oil,herbicides etc.Were there in water.

Colocasia: Taro,or elephant ear, is a tender herbaceous perennial in the Araceae (arum) family with a clumping growth habit. Native to eastern Asia,it grow from a corm. This corm provide a staple food worldwide,sometimes known as the "potato" of the tropical world. The species name esculenta derives from the Latin for edible,or good to eat.

The plant grow best in part shade or filtered sun and moist,rich soil.It should not be allowed to dry out and should be protected from strong winds.The plant may spread and be divided much like other perennials with storage organs.

Taro is not known for its flowers. It is more widely known for its very larger and sometimes ornately coloured foliage,which adds a smooth texture to the landscape. This plant give a tropical look in warm planting zones at the edge of the understory of a tree or in a border.

Fig. 2 Colocasia

III. RESULTS

pH Observation table

Sr. no.	Days	Particulars..	Sample no				Average value of ph of water
		Types of sample	1	2	3	4	
1	Before treated water	Waste water	7.84	7.92	7.82	7.84	7.855
2	After 7 days	Waste water	7.02	7.05	7.04	7.04	7.037
3	After 21 days	Waste water	7.01	7.02	7.03	7.04	7.025

TDS observation table

Sr. no	Days	Name of water/ type of sample	Volume of sample (ml)	Volume of sample (ml)		
				Initial (W1)	Final (W2)	Difference(W2 – W1)
1.	Before treated water	Waste water	100ml	0.078	0.170	0.092
2.	After 7 days	Waste water	100ml	0.078	0.170	0.092
3.	After 21 days	Waste water	100ml	0.079	0.170	0.091

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TSS observation table

Sr. no	Days	Name of water/ type of sample	Volume of sample (ml)	Volume of sample (ml)		
				Initial (W3)	Final (W4)	Difference (W4 – W3)
1.	Before treated water	Waste water	100ml	0.001	0.081	0.08
2	After 7 days	Waste water	100ml	0.001	0.081	0.08
3	After 21 days	Waste water	100ml	0.002	0.081	0.07

IV. CONCLUSION

Treatment Efficiency : The wetland has demonstrated a reasonably high treatment efficiency of 70 to 80% for the measured parameters (pH, TDS and TSS). This suggests that the wetland design and the plant species (Colocasia and Canna) you have chosen are effective in removing contaminants from the wastewater.
pH : The pH test indicates the acidity or alkalinity of the treated water. Without the specific pH values obtained, it is difficult to determine the significance of the results. However, if the pH of the treated wter falls within the acceptable range for discharge or reuse (typically between 6 and 9), the wetland is helping to neutralizeany extreme pH levels present in the influent wastewater.

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REFERENCES

[1]. Petro Novert Karungamye : Potential of canna indica in construction wetland for waste water treatment, Actuators, 11th August 2022, volume 2.
[2]. Yuhan_Ma : Biological response and photoremediation of perennial ryegrass to halogenated flame retardants and Cd in contaminated soils, journal of environment chemical engineering , december 2021 , volume 9,
[3]. Anton Stepanenko : Duckweeds for photoremediation of polluted water , MDPI Currently publishes 421 peer-reviewed journals , and 9 conference , 29 january 2023, volume 12.
[4]. Paliza Shrestha : Photoremediation of heavy metal-contaminated soil by switchgrass , Acomparatively study utilizing different composts and coir fiber on pollution remediation , plant productivity , and nutrients leaching, 9 April 2019 , volume 16
[5]. Kuldeep Bauddh : Phycoremediation : Use of Algae to sequester Heavy Metals, MDPI currently publishes 421 peer-reviewed journals , and 9 conferences, 1 july 2022, volume 1.
[6]. Chenjiao Duan : Photoremediation of potentially toxic elements (PTSs) contaminated soils using alfalfa (Medicago sativa L.) : A comprehensive review,April 2022, volume 293.