



International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 8, Issue 4, April 2025



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Effect of Bamboo Bio char as A Stabilizer and Amendment Agent in Contaminated Soil

Seetha Pisharikkel

Assistant Professor, Dept. of Civil Engineering, Vidya Academy of Science & Technology, Thrissur, Kerala, India

Irene K B, Kavya V P, Lohith Manakkalath S, Saya Surendran

Undergraduate students, Dept. of Civil Engineering, Vidya Academy of Science & Technology, Thrissur, Kerala, India

ABSTRACT: The purpose of this paper is to examine bamboo biochar's potential as an amendment and stabilizing agent for contaminated soil. The objective is to evaluate the effects of bamboo biochar on soil stabilization, immobilization of contaminants, and general enhancement of soil health. To determine how well bamboo biochar reduces pollution mobility and improves soil fertility, tests in the lab and field are used here. The key objectives are to determine whether bamboo biochar can stabilize polluted soil. Examine how bamboo biochar affects the way pollutants in soil become immobilized. After applying bamboo biochar, evaluate the alterations in the chemical and physical characteristics of the soil. Investigate the effects of bamboo biochar on the general vegetation and plant growth in polluted soil. The methodology includes the laboratory testing of geotechnical properties like unconfined compressive strength, specific gravity and free swell index of raw soil, contaminated soil and remediated soil. And testing of chemical properties includes pH value test and electrical conductivity. Measurements of soil stability, contaminant levels, and other soil characteristics will be made after applying different concentrations of bamboo biochar to samples of contaminated soil. Assays for plant growth will also be carried out to determine the effect on vegetation. The results of this paper may provide important and new understandings into economical and ecologically acceptable techniques for cleaning up contaminated land. Using bamboo biochar has the potential to improve ecological restoration and sustainable farming methods, providing a feasible remedy for the problems with soil pollution.

KEYWORDS: Bamboo, Biochar, stabilizing agent, Amendment agent

I. INTRODUCTION

Heavy metal and organic pollutant contamination of soil affects ecosystems and human health, making it a major environmental problem. Conventional soil remediation techniques can entail pricy and non-sustainable procedures. The carbonrich substance known as biochar, which is obtained by the pyrolysis of biomass, has gained traction in the soil remediation field recently because of its high adsorption capability and capacity to enhance soil fertility and structure. Because of its high surface area and porous structure, bamboo biochar in particular has demonstrated considerable potential as a stabiliser and amendment agent in contaminated soil. The purpose of this study is to find out how well bamboo biochar works to improve soil quality and support sustainable remediation techniques by lowering the mobility and bioavailability of pollutants in the soil.

II. METHODOLOGY

The methodology adopted is :Collection of soil sample, Conducting basic tests on soil sample to determine the geotechnical and chemical properties, Pyrolysis based biochar preparation, Heavy metal contamination on soil sample and 30-day incubation period, Basic test on contaminated soil sample, Blending biochar with different proportions of 3, 6, and 9 in a portion of the contaminated soil to determine the optimum dosage.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

III. RESULT AND DISCUSSION

The soil sample is collected from a paddy field and conducted the basic test to determine the geotechnical and chemical properties.

Table 1 Determination of Properties of soil

Properties	Result	Remarks
Unconfined compressive strength	6.26 kN/cm ²	it indicates that it is of very soft consistency
Free swell index	30 %	Soil have moderate expansiveness
Specific gravity	2.27	Organic soil
pH	5.5	Acidic soil
Electrical conductivity	342 mS/m	Moderate salinity of soil

Properties of contaminated soil sample

A 3 kilograms soil sample is taken, and 2 grams of lead nitrate in 7 ml of water and 2 grams of cadmium chloride in 13 ml of water were added. After 30 days of incubation, the tests were carried out. There were certain differences between the properties and their original value; all of their quality was diminished.

Table 2 Determination of Properties of contaminated soil

Properties	Result	Remarks
Unconfined compressive strength	6.02 kN/cm ²	it indicates that it is of very soft consistency but the strength is reduced than the raw soil
Free swell index	35%	Soil have moderate expansiveness but expansiveness increased, stability decreased
Specific gravity	2.57	The soil composition is altered
pH	3.42	Became highly acidic
Electrical conductivity	463 mS/m	Elevated salinity of soil



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Properties of biochar blended soils

Bamboo biochar is incorporated into soil at different proportions, specifically 3%, 6%, 9%, to enhance its properties and improve soil health. This process involves the deliberate introduction of biochar at varying concentrations to optimize its benefits for agricultural or environmental purposes.

Table 3 Determination of Properties of biochar blended soil

% ob biochar	Properties	Result	Remarks
3%	Unconfined compressive strength	6.26 kN/cm ²	The strength is increased .Falls within the moderate to firm consistency level range
	Free swell index	27%	Soil have moderate expansiveness
	Specific gravity	2.46	Relatively dense compaction
	pH	4.3	acidity reduced
	Electrical conductivity	453 mS/m	Clay soil sample falls within this range
6%	Unconfined compressive strength	6.67kN/cm ²	Falls within the moderate to firm consistency level range
	Free swell index	24%	Moderate potential for soil expansion
	Specific gravity	2.39	Moderately dense soil
	pH	5.2	Moderatly acidic
	Electrical conductivity	389mS/m	Moderate soil salinity
9%	Unconfined compressive strength	7.19kN/cm ²	Firm to stiff consistency
	Free swell index	20%	Become more stable soil
	Specific gravity	2.3	Specific gravity is attained similar to raw soil

	pH	6.7	Acidity is reduced, more near to alkaline nature
	Electrical conductivity	354mS/m	Moderate soil salinity.

IV. CONCLUSION

In this study, conducted a series of experiments to assess the effectiveness of bamboo biochar in enhancing the properties of contaminated soil. Initially, tested the basic geotechnical and chemical properties of raw soil. Then contaminated the soil with cadmium chloride and lead nitrate, causing significant alterations and reductions in its quality. Subsequently the addition of bamboo biochar to the contaminated soil at concentrations of 3%, 6%, and 9% brought a notable improvement in the strength and quality of the soil. These results demonstrate bamboo biochar's potential in contaminated soil as an amendment and stabilising agent. Using biochar not only enhanced the soil's qualities but also lessened the pollutants' negative effects on the environment.

REFERENCES

- [1] Yi Wu, Yuhang Yan, Zongwei Wang, Zhongxin Tan, Tuo Zhou: Biochar application for the remediation of soil contaminated with potentially toxic elements: Current situation and challenges, Journal of Environmental Management, Volume 351 (2024)
- [2] Ehab A. Ibrahim, Mohamed A.A. El-Sherbini, El-Metwally M. Selim: Effects of biochar on soil properties, heavy metal availability and uptake, and growth of summer squash grown in metal-contaminated soil, Scientia Horticulturae, Volume 301 (2022)
- [3] AThanh-Binh Nguyen, Kamakshi Sherpa, Xuan-Thanh Bui, Van-Truc Nguyen, Thi-Dieu- Hien Vo, Hien-Thi-Thanh Ho, Chiu-Wen Chen, Cheng-Di Dong: Biochar for soil remediation: A comprehensive review of current research on pollutant removal, Environmental Pollution, Volume 337 (2023)
- [4] IS 2720 (Part 10): "Methods of Test for Soils: Determination of Unconfined Compressive Strength" (1991)



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com