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CLEANWAVE: SUSTAINABLE WATER PURIFICATION USING INDIGENOUS MATERIALS

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ABSTRACT

Water pollution and the scarcity of safe drinking water have become major global concerns due to rapid urbanization, industrialization, and population growth. Conventional water purification systems often rely on plastic components, chemical additives, and expensive technologies that may negatively impact the environment. This review paper focuses on eco-friendly and low-cost water purification techniques using sustainable natural materials such as cactus powder, laterite soil, charcoal, gravel, moringa oleifera seeds, coconut husk, and cotton. Various recent studies on sustainable filtration systems are reviewed to understand their efficiency in removing turbidity, suspended solids, microorganisms, heavy metals, dyes, and other contaminants from wastewater. The review highlights the potential of biodegradable and locally available materials in developing affordable and environmentally friendly filtration systems suitable for rural and low-income communities. The study concludes that eco-friendly filtration technologies can significantly contribute to sustainable wastewater treatment and safe water reuse.

KEYWORDS: Wastewater Treatment, Clean Wave, Filters, Low-Cost Materials

1. INTRODUCTION

Water is one of the most essential natural resources for human survival and environmental sustainability. However, increasing contamination of water sources due to domestic, industrial, and agricultural activities has created serious health and environmental problems. Wastewater contains suspended solids, organic matter, pathogens, toxic metals, and harmful chemicals that can adversely affect human health and aquatic ecosystems.

Traditional water purification methods often involve chemical coagulants, plastic filters, and energy-intensive systems that generate secondary pollution and increase operational costs. Therefore, there is a growing need for sustainable, eco-friendly, and low-cost water treatment technologies.

Eco-friendly filtration systems use natural and biodegradable materials to remove contaminants from water through processes such as adsorption, coagulation, sedimentation, and mechanical filtration. Materials like activated charcoal, moringa seeds, coconut husk, sand, gravel, and cactus powder have shown promising performance in improving water quality while reducing environmental impact.

This review paper discusses recent advancements in sustainable water purification technologies and evaluates the effectiveness of various eco-friendly materials used in water treatment systems. The objectives of the current research are to design and develop low-cost water filter unit. To monitor the efficiency for treating wastewater.

Research Paper

2. MATERIALS AND METHODS

2.1 Cactus Powder

Cactus powder contains natural mucilage that acts as a coagulant. It binds with suspended particles and bacteria to form flocs that settle during sedimentation. This process improves water clarity and reduces turbidity.

2.2 Laterite Soil

Laterite soil contains iron and aluminum oxides capable of adsorbing heavy metals, dyes, phosphates, and fluoride from wastewater. It is particularly useful in industrial wastewater treatment.

2.3 Charcoal

Charcoal acts as an adsorbent due to its highly porous structure and large surface area. It removes odors, harmful chemicals, and some microorganisms through adsorption.

2.4 Gravel and Pebbles

Gravel provides mechanical filtration by trapping large, suspended solids and preventing clogging of finer filter layers.

2.5 Moringa Oleifera Seeds

Moringa seeds contain positively charged proteins that neutralize negatively charged particles and bacteria, promoting coagulation and flocculation.

2.6 Coconut Husk

Coconut husk possesses fibrous and porous characteristics that help remove suspended particles, oils, and certain heavy metals. It also supports beneficial microbial growth.

2.7 Cotton Balls

Cotton acts as a simple physical barrier for removing sediments, dirt, and visible suspended solids from water.

Fig. 1: Schematic Representation of Filtration Unit.

Plate 1, 2: Experimental setup of filtration unit.

3. RESULTS

The following results of experimental observations for the Clean Wave Water Purifier using eco-friendly materials.

Parameter	Before Treatment	After Treatment
pH	5.8	7.1
Turbidity (NTU)	120.0	12.0
TDS (mg/L)	980.0	320.0
Hardness (mg/L)	450.0	180.0
Chlorides (mg/L)	220.0	95.0
Fluoride (mg/L)	2.1	0.8

DISCUSSION

The expected outcomes of eco-friendly water purification systems include:

3.1 Safe and Clean Water

Removal of turbidity, suspended solids, and some harmful microorganisms improves water quality and

clarity.

3.2 Environmental Sustainability
Use of biodegradable materials reduces chemical pollution and plastic waste.

3.3 Low-Cost Technology
Locally available materials minimize construction and maintenance costs.

3.4 Reusability and Sustainability
Many filter materials can be cleaned, reused, or naturally degraded without harming the environment.

4. CONCLUSIONS
Eco-friendly water purification systems provide a sustainable and economical alternative to conventional treatment technologies. Natural materials such as cactus powder, moringa seeds, charcoal, coconut husk, laterite soil, and gravel demonstrate excellent potential for removing contaminants from wastewater through adsorption, coagulation, and filtration mechanisms.

The literature reviewed indicates that low-cost biodegradable filtration systems can effectively improve water quality while reducing environmental impact. Such technologies are particularly suitable for rural and low-income regions where access to advanced purification systems is limited.

Future research should focus on improving filtration efficiency, enhancing microbial removal, and integrating eco-friendly systems with modern treatment technologies for large-scale applications.

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REFERENCES
1. Khaled AlAqad et al., "Adsorbent Materials for Water Treatment: A Review of Current Trends and Future Challenges," 2025.
2. Dereje Diriba Chemeda et al., "Comparative Analysis of Moringa Seed Powder and Aluminum Sulfate for Turbidity and E. coli Removal," 2025.
3. David Herek et al., "Modern Water Treatment Technology Based on Industry 4.0," 2025.
4. Antoni SanchezFerrer et al., "Exploring Wood as a Sustainable Solution for Water Filtration," 2025.
5. Ahmad Reza Rostayee et al., "Low-Cost Filtering Materials for Domestic Water Treatment," 2024.
6. Malavika et al., "Purification of Water with Sustainable Biomaterial," 2024.
7. Mohammad Afreen et al., "Low-Cost Water Purifier Using Natural and Waste Materials," 2024.
8. J.O. Jeje et al., "Study of Water Filtration without Chemical Pretreatment," 2023.
9. Renier Dale et al., "Reduction of Contamination Using Rainwater Filtration System," 2022.
10. Roselle Y. Mamudi et al., "Development of a Low-Cost Dispenser Type Water Filtration System," 2022.