SUSTAINABLE APPROACH TO GREY WATER TREATMENT

[1] Nagendra
Student
department of civil engineering
Alva's institute of engineering and technology
Mangalore,Moodbidri,India
nagendrashetty2641@gmail.com

[2] Prakhyath
Student
department of civil engineering
Alva's institute of engineering and technology
Mangalore,Moodbidri,India
prakhyathkotian@gmail.com

[3] Pavan
Student
department of civil engineering
Alva's institute of engineering and technology
Mangalore,Moodbidri,India
pavandevadiga03@gmail.com

[4] Shailesh Kumar
Student
department of civil engineering
Alva's institute of engineering and technology
Mangalore,Moodbidri,India
shaileshacharya307@gmail.com

Abstract*— The use of natural materials in the coagulation-flocculation process for wastewater treatment offers a sustainable solution to urgent environmental challenges. Research has indicated that these materials can be developed into viable options for eco-friendly water treatment, responding to the growing demand for sustainable practices. However, while natural coagulants show potential, their effectiveness as primary agents often falls short, highlighting the need for innovative technologies to enhance their performance. This review examines various natural-based coagulants and their role in wastewater treatment, particularly in conjunction with traditional chemical coagulants. It emphasizes the critical need for sustainable methods amid increasing water scarcity and pollution. The study evaluates a range of materials, including natural biomaterials and advanced nano materials, focusing on their properties like adsorption capacity, selectivity, and regeneration potential. Additionally, the ecological impacts and long-term sustainability of these materials are discussed. Case studies illustrate the effective use of materials such as sugarcane bagasse, corn cobs, and activated charcoal from coconut shells, showcasing their potential as low-cost, environmentally friendly solutions for wastewater treatment.

Keywords— Natural coagulant, Natural adsorbent, Waste water treatment

INTRODUCTION

Water is one of the most vital resources for life on Earth, yet its quality is increasingly threatened by pollution from various sources. Among these, wastewater generated from households, industries, and commercial establishments poses significant environmental challenges, particularly effluents from restaurants and garages that often contain high levels of oil, grease, and Biochemical Oxygen Demand (BOD). If not properly treated, this wastewater can have detrimental effects on aquatic ecosystems and human health. The effective management and treatment of wastewater are critical for sustainable development, serving to reduce harmful contaminants, prevent waterborne diseases, and conserve fresh water resources. However, traditional wastewater treatment methods, such as chemical precipitation and biological treatment, can be costly and may not effectively remove certain contaminants, highlighting the need for innovative and cost-effective solutions. In recent years, natural adsorbents have emerged as a sustainable alternative, with materials like coconut shells, corn cobs, and sugarcane bagasse showing promise due to their abundant availability, low cost, and biodegradable nature. Coconut shells, in particular, are rich in lignin and cellulose, making them an excellent candidate for wastewater treatment. When processed into activated carbon, they possess enhanced surface area and porosity, allowing for effective adsorption of organic pollutants, oils, and greases. This study aims to evaluate the effectiveness of raw coconut shells in treating kitchen wastewater by focusing on key parameters such as the thickness of the adsorbent layer, the area of the treatment tray, and the volume of wastewater treated, employing Response Surface Methodology (RSM) and the Box-Behnken model to optimize these factors for maximum contaminant removal efficiency. The issue of water pollution extends beyond wastewater treatment, encompassing a range of pollutants that adversely affect aquatic life and human health. The consequences of water pollution are severe, leading to ecosystem degradation, loss of biodiversity, and increased health risks for communities reliant on contaminated water sources. Natural adsorbents not only address wastewater contamination but also promote sustainability by reducing agricultural waste and enhancing recycling practices. Moreover, the incorporation of these materials contributes to climate change mitigation through carbon sequestration, thereby reducing greenhouse gas emissions. As the world grapples with the challenges posed by climate change, integrating sustainable practices in water management becomes crucial for achieving resilience in water systems. Ultimately, the exploration of natural adsorbents, particularly coconut shells, offers a promising avenue for reducing contaminants in wastewater while promoting environmental stewardship. This study's focus on optimizing treatment parameters aims to demonstrate the efficacy of coconut shells as a low-cost, eco-friendly solution for wastewater treatment, contributing to global efforts to secure clean water for all and enhancing water quality while minimizing environmental impact. Through such initiatives, significant steps can be taken toward sustainable water management practices that benefit both people and the planet

LITERATURE SURVEY

1. Prof. Abeer Abalone's Research (2015) This study reviews grey water recycling for agricultural use, highlighting that treatment methods vary based on site conditions and grey water characteristics. It notes that water quality impacts consumption patterns, with specific conductivity, turbidity, and suspended solids ranges identified for dark and light grey water.
2. Prof. J. S. Lambe's Research (2017): This research discusses grey water treatment and reuse, indicating that bathing and hand washing produce the largest portion of grey water, which is less contaminated and supports microorganism growth. Kitchen grey water makes up about 10% of the total, with various treatment methods ranging from simple manual collection to primary screening techniques.
3. T Janani et al. (2019) This study addresses India's water crisis, advocating for the 3R formula (Reduce, Reuse, Recycle) to promote sustainable water management. It explores using agricultural waste for treating grey water, reporting a packed bed vertical reactor that achieves significant reductions in BOD, COD, TDS, suspended solids, and surfactants, with improved efficiency possible by extending detention time.
4. Nikita Katbarye et al. (2022): The researchers focus on activated charcoal, emphasizing its high surface area for adsorption. They detail the preparation process of coconut shells into activated carbon, which involves cleaning, drying, and heating to enhance its adsorptive properties, making it effective for water treatment.
5. Swapnil K. Gudadhe's Study (2022): This research highlights the effectiveness of fresh rice husk in treating grey water from household activities. The study reports satisfactory results in improving various physicochemical parameters, emphasizing rice husk's coarse structure, chemical resilience, and low cost as significant advantages for domestic applications.
6. Pathak et al. (2016): This study finds rice husk to be a highly effective adsorbent for dairy effluent treatment, achieving a removal efficiency of up to 92.5% under specific conditions. It highlights the cost-effectiveness of using rice husk as a raw material in wastewater treatment.
7. Sachin J. Mane et al. (2024): This research focuses on kitchen wastewater treatment, examining BOD, COD, and TSS removal using rice husk ash as an adsorbent. The study identifies optimal conditions for the treatment process, achieving high removal efficiencies for the pollutants, thereby demonstrating rice husk's effectiveness in wastewater management.

CONCLUSION

In conclusion, the reviewed studies highlight the importance of grey water recycling for agricultural use and wastewater treatment, with various methods employed depending on water source characteristics. The use of natural adsorbents, such as rice husk and corn cob, has proven effective in improving water quality by reducing key contaminants like BOD, COD, and suspended solids. These low-cost, sustainable materials offer significant potential for domestic and industrial wastewater management. Additionally, the effectiveness of activated carbon derived from agricultural waste, such as coconut shells, underscores the value of bio-based filtration technologies. As the global water crisis intensifies, these methods provide viable solutions for sustainable water reuse and conservation. Future research should focus on optimizing treatment processes for broader implementation.

ACKNOWLEDGMENTS

We would like to extend our sincere appreciation to the authors of the papers we reviewed in this study. Your research has been invaluable in shaping our understanding of the topic and has greatly contributed to this work. Thank you for your dedication to advancing knowledge in this field.

REFERENCES

[1] Jha, Stotram Gaur, Syed Shahabuddin, and Inderjeet Tyagi. "Biochar as sustainable alternative and green adsorbent for the remediation of noxious pollutants: a comprehensive review." Toxics 11, no. 2 (2023): 117.

[2] Kumar, Ajay, and Vineet Kumar. "A comprehensive review on application of lignocellulose derived nanomaterial in heavy metals removal from wastewater." Chemistry Africa 6, no. 1 (2023): 39-78.

[3]T.Janani, J. S. Sudarsan, and K. Prasanna, "Grey water recycling with corn cob as an adsorbent," AIP Conf. Proc., vol. 2112, no. June, 2019, doi: 10.1063/1.5112366.

Public Worksz , Faculty of Engineering , Ain Shams Uni," vol. 2, no. 1, pp. 59–66, 2014.

[6] A. D.B, S. Lukman, S. B.S, and Y. I, "Comparative Analysis of Filtration Using Corn Cob, Bone Char and Wood Chippings," Int. J. Appl. Sci. Technol., vol. 3, no. 3, pp. 146–152, 2013.

[7] N. Kaliyan and R. V. Morey, "Densification characteristics of corn cobs," Fuel Process. Technol., vol.91,no.5pp.S559,565,2010,doi:z10.1016/j.fuproc.2010.01.001.

[8] L. H D, M. C, V. A, and M. Manjula, "Defluoridation of Ground Water Using Corn Cobs Powder," Int. J. Eng. Sci., vol. 06, no. 06, pp. 78–81, 2017, doi: 10.9790/1813-0606027881.

[9] L. Abubakar and N. L. Tanko, "Evaluation of the Efficiency of Constructed Activated Carbon for the Treatment of Abattoir Wastewater," Sci. World J. Vol., vol. 16, no. 2, pp. 172–178, 2021.

[10] B. Priyadharshini, M. Abraham, and Parvathy, "Treatment of contaminated water using ecofriendly material," IOP Conf. Ser. Mater. Sci. Eng., vol. 993, no. 1, 2020, doi: 10.1088/1757-899X/993/1/012168.

[11] A. Y. D. Lestari et al., "Magnetically modified corn cob as a new low-cost biosorbent for removal of Cu (II) and Zn (II) from wastewater," J. Bahan Alam Terbarukan, vol. 9, no. 2, pp. 96–102, 2020, doi: 10.15294/jbat.v9i02.27136