

A Review Paper on Study of Household Greywater Recycling System Using Easily Available Filter Media

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ABSTRACT

Increasing population and domestic water demand have created a need for sustainable water management and wastewater reuse. Greywater from bathing, washing, laundry, and kitchen activities can be treated and reused for non-potable purposes such as gardening and irrigation. This review focuses on a simple, lowcost greywater recycling system using locally available materials such as gravel, sand, activated charcoal, coconut-shell charcoal, and cloth filters. A multi-stage filtration process can help remove suspended particles, turbidity, colour, and organic pollutants. Proper source segregation and treatment can reduce freshwater consumption, wastewater generation, and groundwater dependence. Water-quality parameters such as pH, TDS, turbidity, BOD, and COD are important for evaluating treatment efficiency. Overall, household greywater recycling provides a simple and sustainable method for water conservation and wastewater management.

Keywords: Greywater, Greywater Recycling, Household Wastewater, Filter Media, Activated Charcoal, Sand Filtration, Coconut-Shell Charcoal, Water Conservation, Non-Potable Reuse.

1. INTRODUCTION

Water is one of the most important natural resources required for human life, domestic activities, agriculture, and industrial development. Increasing population, urbanization, and water consumption are creating pressure on freshwater resources. Therefore, wastewater recycling and reuse are important approaches for water conservation. Greywater is domestic wastewater generated from bathing, washing clothes, showers, sinks, and hand washing, excluding toilet wastewater. It contains suspended solids, organic matter, detergents, oils, nutrients, colour, and microorganisms. Hence, untreated greywater should be properly treated before reuse.

Various treatment methods such as sedimentation, filtration, adsorption, biological treatment, and constructed wetlands are used for greywater treatment. However, some systems may be costly or require skilled operation and regular maintenance. Therefore, simple, economical, and easily maintainable household treatment systems are needed.

Recycling greywater can reduce the demand for fresh water and decrease the volume of wastewater discharged into drainage systems.

It can be particularly useful in areas facing water scarcity and irregular water supply.

The use of locally available filter media can make greywater treatment more affordable for households.

Commonly available materials such as gravel and sand can remove suspended particles through physical filtration. Activated charcoal and coconut-shell charcoal can provide adsorption and help reduce colour, odour, organic pollutants, and some dissolved contaminants.

A cloth or mesh filter can be used as a preliminary stage to retain larger particles and protect the subsequent filter layers.

A combination of different filter media can provide better treatment than using a single material.

The arrangement and thickness of filter layers can influence the efficiency of the treatment system.

Water-quality parameters such as pH, turbidity, TDS, BOD, and COD can be used to evaluate the performance of a greywater treatment system.

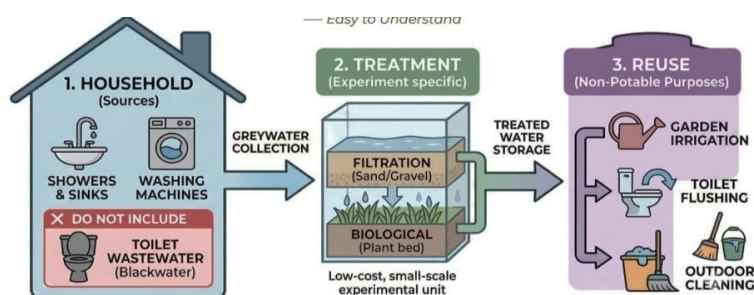


Fig.1: Greywater Reuse System Flowchart

The use of locally available filter media such as gravel, coarse sand, fine sand, activated charcoal, coconut-shell charcoal, and cloth filters can provide an effective and low-cost treatment approach. These materials help reduce turbidity, suspended particles, colour, and some organic contaminants through filtration and adsorption. This review focuses on a household greywater recycling system using locally available filter media. The treatment performance can be evaluated using parameters such as pH, turbidity, TDS, BOD, and COD. Properly treated greywater can be reused for suitable non-potable purposes such as gardening, landscape irrigation, and toilet flushing, thereby reducing freshwater consumption and supporting sustainable water management.

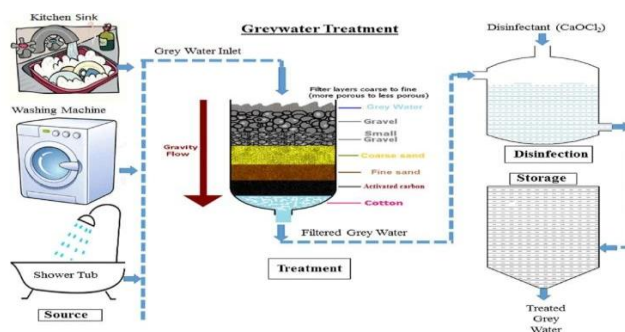


Fig.2: Greywater Treatment

2. OBJECTIVE

1. To review the sources and characteristics of household greywater, including its physical, chemical, and biological properties.
2. To study existing low-cost household greywater treatment systems.

3. To examine the performance of locally available filter media.
4. To compare the effectiveness of different filter media based on parameters such as turbidity, pH, BOD, COD, TSS, nutrients, and microbial contamination.
5. To evaluate suitable low-cost materials for household filtration.
6. To identify system advantages, limitations, and operational challenges.
7. To assess safe non-potable reuse options for treated greywater.
8. To identify research gaps and future improvement opportunities.

3. LITERATURE REVIEW

1. **Ninsiima, Emmanuel; Deepa, Krishnan; Yohanna, Paul; and Bahati, Musiime Enos (2026):** A Systematic Review of Greywater Properties and Variability that Govern Decentralised Off-Grid Treatment Feasibility. The study presents a PRISMA 2020-guided systematic narrative review of 131 empirical studies published between 2016 and 2026. It examines the physical, chemical, and biological characteristics of greywater from bathroom, laundry, kitchen, and mixed household sources. The review highlights substantial variability in parameters such as COD, TSS, surfactants, nutrients, salinity, and microbial indicators due to household behaviour, intermittent water use, source mixing, and storage conditions. These variations were found to influence treatment efficiency, fouling, energy requirements, maintenance needs, operational stability, and health risks. The authors emphasize that treatment technologies should not be selected solely on average pollutant-removal performance but also on their ability to tolerate real-world influent variability. Based on these findings, the study proposes a PropertyDriven Framework for screening treatment technologies according to engineering feasibility and off-grid operating constraints. The review provides an evidence-based approach for developing resilient, sustainable, and context-appropriate decentralized greywater treatment systems.
2. **Mahmoud, M. M. (2026):** Reviewed the potential of treated greywater as a sustainable alternative to potable water for landscape irrigation in water-scarce cities, particularly in Egypt. The study evaluated greywater sources and treatment technologies, highlighting the importance of source separation, multibarrier treatment, disinfection, and exposure-based management. It found that treated greywater can reduce potable-water demand, but concerns remain regarding salinity, sodium, boron, surfactants, emerging contaminants, and microbial risks. The study recommended dedicated greywater regulations, long-term monitoring, and multi-season field studies to ensure safe and sustainable reuse.
3. **Jakhar and Styszko (2025) :** Presented an overview of recent trends in greywater management in India, emphasizing its potential to address increasing water scarcity. The study reviewed physical, chemical, biological, and combined treatment methods, including filtration, biochar, constructed wetlands, membrane bioreactors, and UV-based treatment. It highlighted that appropriate greywater treatment and reuse can reduce freshwater consumption, support groundwater recharge, and decrease the burden on centralized wastewater treatment systems. The authors also discussed decentralized and centralized greywater management approaches and emphasized the need for national standards, dual-plumbing systems, financial incentives, public awareness, and further technological development to promote sustainable greywater reuse in India.

4. **Niewitecka and Zubrowska-Sudol (2025)** : Reviewed the current research trends and challenges associated with greywater reuse in buildings, particularly for toilet flushing and other non-potable applications. The study examined variations in greywater quantity and quality and identified organic pollutants, microorganisms, micropollutants, and microplastics as important treatment concerns. Different physical, chemical, biological, membrane, and nature-based treatment technologies were discussed, with hybrid treatment systems providing high treatment efficiency and sanitary safety. The authors highlighted regulatory gaps, technical limitations, high investment costs, and limited public acceptance as major barriers to large-scale greywater reuse. The study concluded that standardized regulations, effective monitoring, public awareness, life-cycle assessment, and scalable treatment systems are essential for sustainable greywater management in buildings.
5. **Bhojar, Thakur, and Joon (2025)**: Investigated decentralized greywater recycling systems as a sustainable approach for residential buildings, focusing on reducing potable water consumption and wastewater generation. The study developed a compact, modular treatment system combining biological treatment, ultrafiltration (UF), and UV-C disinfection for non-potable applications. The system achieved approximately 85–90% BOD₅ removal, 80–88% COD reduction, and effective removal of suspended solids and microbial contaminants. The treated greywater was found suitable for toilet flushing and irrigation, with potable water savings of approximately 35–40%. The authors concluded that decentralized greywater recycling can support sustainable residential design and water conservation, while further research is needed on long-term performance, energy consumption, and system optimization.
6. **Sethi, Manoranjan (2024)**: Low-Cost Grey Water Treatment System Design and Treatability Studies in Relation to Recycling and Reuse in Rural Area of Angul District. The study focused on developing a low-cost and decentralized greywater treatment system suitable for rural communities facing water scarcity and inadequate wastewater treatment facilities. The author reviewed existing greywater treatment technologies and emphasized the use of locally available materials, simple operation, low energy consumption, and community participation. A laboratory-scale treatment system incorporating sedimentation, sand–gravel filtration, activated carbon, zeo maize fodder, and nylon rope was investigated. The treatment efficiency was evaluated using parameters such as turbidity, TSS, TDS, total hardness, COD, BOD, and total nitrogen. Among the tested configurations, the nylon-rope filter demonstrated the highest overall pollutant removal performance. The study concluded that low-cost greywater treatment can provide a practical approach for recycling treated water for suitable non-potable applications in rural areas.
7. **Smruti Ranjan Dash and Korneel Rabaey (2023)**: Studied sustainable approaches for wastewater treatment and resource recovery. Their work highlighted the importance of developing decentralized and environmentally friendly treatment technologies that can recover useful resources while reducing the environmental impact of wastewater discharge. The study emphasized the role of biological, physical and adsorption-based processes in improving wastewater quality. The findings support the development of simple, low-cost and sustainable greywater recycling systems using locally available materials.
8. **Boaka Hlordze Raphael Gameli et al. (2022)**: Investigated waste green tea as an adsorbent for removing pollutants from greywater. The study demonstrated that waste-derived materials can provide active sites for adsorption and can therefore be utilized as

inexpensive treatment media. The research also highlighted the possibility of converting household and agricultural waste into useful watertreatment materials. This approach reduces waste generation while providing an economical alternative to conventional adsorbents.

9. **K.M. Chukwu et al. (2022):** Investigated activated carbon produced from coconut fibre for wastewater treatment. The study showed that coconut-derived waste can be converted into carbonaceous material having useful adsorption properties. The research supports the use of coconut-based materials as lowcost adsorbents for wastewater treatment. It is particularly relevant to the present project because coconut shell charcoal is considered as one of the filter media in the proposed household greywater recycling system.
10. **Shlok Sangarpal (2022):** Studied a vermifilter system containing soil and filtration materials for greywater treatment. The system combined physical filtration with biological treatment through earthworms and microorganisms. The study reported reductions in organic pollution parameters such as BOD and COD. The research demonstrates that natural treatment mechanisms can be combined to improve greywater quality and supports the development of simple, decentralized and environmentally friendly household treatment systems.
11. **R. Dey et al. (2021):** Investigated orange peel as a biosorbent for the removal of ammonia and nitrate from wastewater. The study examined important adsorption factors such as pH, contact time and adsorbent dosage. Orange peel was considered a readily available waste material that can be converted into useful treatment media. The research demonstrated the potential of agricultural waste for removing dissolved pollutants and supports the broader application of low-cost natural adsorbents in decentralized wastewater treatment.
12. **Ositadinma Chamberlain Iheanacho et al. (2021):** Investigated activated carbon prepared from corn cob for adsorption applications. The study demonstrated that agricultural waste can be converted into porous carbonaceous material with useful adsorption characteristics. This approach provides both wastewater-treatment benefits and waste-management benefits because an otherwise discarded agricultural residue is converted into a useful treatment material. The findings support the use of carbonbased materials in low-cost adsorption systems.
13. **K. Gautam et al. (2020):** Investigated natural adsorbents such as *Moringa oleifera*, *Prosopis juliflora* and peanut shell for wastewater treatment. The study demonstrated that naturally available and agricultural materials can be utilized as economical adsorbents. These materials can provide an environmentally friendly alternative to some conventional treatment media. The research supports the use of locally available biological and agricultural materials for pollutant removal in decentralized wastewater treatment systems.
14. **N. Samson Maria Louis (2020):** Investigated corn cob as a raw material for producing activated carbon. The study demonstrated that agricultural waste can be converted into porous activated carbon suitable for adsorption applications. This provides a dual benefit by reducing agricultural waste and producing a useful treatment material. The findings support the use of waste-derived activated carbon for wastewater and greywater treatment and provide a basis for selecting carbonaceous materials in low-cost filtration systems.

15. **Anamika Paul and Maham Malik (2020):** Studied activated charcoal for the treatment of coloured solutions and sullage water. Water-quality characteristics before and after treatment were compared to evaluate treatment performance. The study demonstrated that activated charcoal can reduce colour and certain pollutants through adsorption. Its porous structure provides a large surface area for pollutant adsorption. The findings directly support the incorporation of activated charcoal into household greywater filtration systems.
16. **M.S. Lawan et al. (2020):** Investigated the use of rice husk for greywater reclamation. Rice husk was considered as an easily available agricultural by-product that could be utilized as a treatment material. The study demonstrated the potential of agricultural waste for improving greywater quality while reducing treatment costs. The research supports the selection of inexpensive agricultural and locally available materials for decentralized greywater treatment.
17. **Samah Babiker Daffalla et al. (2020):** Studied chemically and thermally treated rice husk adsorbents for phenol removal. The study demonstrated that modification of rice husk can alter its surface properties and improve its adsorption characteristics. The research provides evidence that agricultural residues can be converted into effective adsorption materials through suitable preparation techniques. It also emphasizes that the physical and chemical properties of an adsorbent significantly influence its pollutant removal performance.
18. **A.M. Abdel-Kader (2020):** Investigated Rotating Biological Contactors for greywater treatment using RBC, settling and disinfection units. The study demonstrated that biological treatment can be integrated with settling and disinfection to achieve more comprehensive greywater treatment. The RBC promotes biological degradation of organic matter, while subsequent treatment improves the quality of the treated water. Although effective, the system contains mechanical components, making it more complex than a simple gravity-based household filtration system.
19. **Vidyadhar V. Gedam et al. (2019):** Investigated activated teak leaf powder as a biosorbent for dye removal. The study demonstrated the potential of plant-based waste materials as inexpensive adsorbents for water treatment. Converting plant waste into useful treatment material can reduce waste-disposal problems while providing an economical alternative to commercial adsorbents. The research supports the broader concept of utilizing locally available biological materials for wastewater treatment.
20. **Siham Akhouairi et al. (2019):** Investigated sawdust as a low-cost biosorbent for dye removal. Sawdust is a readily available waste material containing adsorption sites capable of interacting with certain pollutants. The study demonstrated that waste wood materials can be utilized as environmentally friendly treatment media. The findings support the conversion of waste materials into useful filtration or adsorption media for low-cost water-treatment applications.
21. **Fazna Nazim (2019):** Investigated garbage enzyme as a treatment method for greywater. The study examined biologically active material produced from household organic waste for reducing pollutants in greywater. The research indicated the potential of biological and waste-derived treatment approaches for improving greywater quality. It also demonstrated the possibility of utilizing household organic waste as a resource for wastewater treatment, supporting sustainable and economical treatment approaches.

22. **Narges Shamabadi (2019):** Proposed a greywater treatment system consisting of screening, a septic tank, trickling filter, settling and disinfection. The trickling filter used suspended plastic media to support biological treatment. The study demonstrated that combining physical, biological and disinfection processes can provide comprehensive greywater treatment. However, the multiple treatment components increase system complexity, highlighting the need for simpler household systems based on low-cost filtration and adsorption.
23. **C. Santos and F. Taveira-Pinto (2019):** Investigated a low-cost greywater reuse system consisting of a collection tank, pump, filter and UV disinfection unit. The study demonstrated the feasibility of collecting, treating and reusing greywater for suitable non-potable applications. Filtration improved physical water quality, while UV provided additional disinfection. However, pumping and UV equipment can increase energy consumption and maintenance requirements. This provides a basis for investigating gravity-based treatment systems using locally available filter media.
24. **A.D. Mande et al. (2018):** Reviewed low-cost household water-treatment methods such as ceramic candle filters, silverimpregnated filters and biosand filters. Various filtration materials, including activated carbon, were discussed for improving water quality. The study emphasized the importance of simple household filtration methods that do not require highly specialized equipment. Activated carbon was identified as an important adsorption medium, supporting its use in low-cost greywater treatment systems.
25. **Indranil Guin et al. (2017):**. Investigated filtration using low-cost natural adsorbents for domestic wastewater treatment. The study highlighted the potential of natural materials for pollutant removal through adsorption and filtration. Such materials can be inexpensive, easily available and environmentally friendly. The research provides a basis for incorporating locally available natural adsorption materials into decentralized household greywater treatment systems.
26. **S. Gautam et al. (2017):** Studied cost-effective wastewater-treatment technologies for small-scale sewage-treatment plants in India. The study considered treatment efficiency, cost, space requirements and operational aspects. It emphasized the need for economical and compact treatment systems, particularly in developing regions. These findings are applicable to household greywater recycling because household systems similarly require low construction cost, simple operation and minimum maintenance.
27. **Elzein Z. et al. (2016):** Investigated constructed wetlands as sustainable wastewater-treatment systems. Constructed wetlands utilize natural processes involving plants, microorganisms, soil and filtration media to reduce pollutants. The study demonstrated that nature-based treatment can provide an environmentally friendly alternative to conventional treatment methods. However, constructed wetlands generally require considerable land area, indicating the need for more compact natural treatment systems at household scale.
28. **Karnapa Ajit (2016):** Reviewed greywater characteristics, reuse guidelines and biological-treatment methods. The study emphasized that greywater should be appropriately treated before irrigation and other non-potable uses. It highlighted the importance of understanding greywater characteristics and selecting treatment processes

according to the intended reuse. The study supports systematic treatment and quality monitoring rather than direct reuse of untreated domestic wastewater.

29. **Mahamood Farahani et al. (2015):** Investigated greywater from showers, bathrooms and sinks using a trickling filter containing suspended plastic media. Screening and settling were included before biological filtration. The treatment process demonstrated the usefulness of combining physical and biological treatment for reducing pollutants. The study showed that filtration and microbial activity can work together to improve greywater quality. However, the complexity of the system indicates the potential advantage of simpler household filtration systems.
30. **Sandhya Pushkar Singh et al. (2015):** Reviewed greywater treatment technologies, including bioremediation and sand filtration. The study discussed the reuse of treated greywater for irrigation, gardening and other non-potable applications. Sand filtration was identified as a simple and economical approach for removing suspended particles and improving water clarity. The findings support the use of sand as an important filtration medium in low-cost household greywater treatment.
31. **K.D. Bhuyar et al. (2015):** Investigated membrane bioreactor technology for wastewater treatment. MBR combines biological treatment with membrane separation and can produce high-quality treated water. However, the technology generally requires greater energy input, specialized equipment, maintenance and technical operation. The study therefore demonstrates that while advanced systems can provide effective treatment, simpler and more economical alternatives may be more appropriate for small household applications.
32. **Vijaya V. Shegokar et al. (2015):** Reviewed low-cost wastewater-treatment systems and emphasized recycling, reuse and economical treatment materials. The study highlighted the environmental benefits of reducing wastewater discharge and conserving freshwater resources. It also supported simple treatment methods that can be implemented at decentralized locations. These findings are relevant to household greywater-treatment systems based on locally available filter materials.
33. **Sameer S. Shastri (2014):** Studied greywater treatment with emphasis on environmental and economic benefits. Parameters such as pH, BOD, COD, TSS and TDS were considered for evaluating treatment performance. The study highlighted that greywater recycling can reduce freshwater requirements and wastewater discharge. Monitoring water-quality parameters before and after treatment provides an effective method for evaluating the efficiency of a greywater treatment system.
34. **A.M. Abdel-Kader et al. (2013):** Studied a Rotating Biological Contactor system consisting of an RBC tank, settling tank and disinfection unit. Biological treatment was used to reduce organic pollutants, while settling and disinfection provided additional treatment. The study demonstrated the ability of biological treatment to reduce parameters such as BOD and TSS. It also showed the effectiveness of multi-stage treatment while indicating that mechanically operated systems can be more complex than simple household filtration systems.
35. **Dilip M. Ghaitidak et al. (2013):** Reviewed greywater generation, characteristics, treatment technologies and reuse possibilities. The study indicated that greywater

characteristics vary according to its source, household activities and water-use patterns. Bathroom, laundry and kitchen greywater may contain different pollutant concentrations. Therefore, proper characterization is important before selecting a treatment method. The study supports monitoring parameters such as pH, BOD, COD, TDS and turbidity to assess the suitability of treated greywater for reuse.

36. **Dalahmeh et al. (2012):** Investigated the efficiency of different low-cost filter media for greywater treatment. The study evaluated pine bark, activated charcoal, polyurethane foam, and sand as filter materials. The filters were tested for their ability to remove BOD₅, surfactants, phosphorus, nitrogen, and microbial indicators from greywater. The results showed that pine bark and activated charcoal were more effective than foam and sand, particularly for reducing organic matter and surfactants. Bark and activated charcoal achieved approximately 98% and 97% BOD₅ removal, respectively, while both achieved more than 99% removal of surfactants. The study concluded that bark and activated charcoal were promising low-cost filter materials for improving greywater quality for irrigation reuse.
37. **Shankar Dhone et al. (2011):** Studied greywater treatment and reuse in an urban household in Nagpur, India. The study considered greywater collection, treatment, reuse, water conservation and economic aspects. It demonstrated that household greywater can be collected and treated for suitable non-potable applications, thereby reducing freshwater consumption and wastewater discharge. The research emphasized the importance of economical and practical treatment systems that can be implemented at household level.
38. **Saroj B. Parjane et al. (2011):** Investigated an economical greywater-treatment system with emphasis on rural development. Physical and natural treatment techniques were considered at laboratory scale. The study demonstrated that simple treatment processes can improve greywater quality without requiring sophisticated equipment. The findings support low-cost treatment systems using easily available materials, particularly in areas where advanced treatment facilities may not be economically feasible.
39. **Francis W. Kariuki et al. (2011):** Investigated greywater reuse for landscape irrigation using low-cost treatment technology. Filtration, flocculation and disinfection were considered for improving greywater quality. The study emphasized that untreated greywater should not be directly reused because it may contain suspended solids, organic matter and microorganisms. Appropriate treatment can make greywater more suitable for non-potable applications and contribute to water conservation.
40. **Fangyue Li et al. (2009):** Reviewed greywater characteristics and different treatment technologies. The study reported that greywater is generally biodegradable but may contain organic matter, nutrients, suspended solids, detergents and surfactants. Physical treatment alone may not be sufficient to remove all dissolved pollutants and organic matter. Therefore, the study emphasized combining different treatment stages according to greywater characteristics and intended reuse. This work provides an important foundation for developing combined filtration systems for household greywater recycling.

4. CONCLUSION

After reviewing various studies, it is concluded that household greywater recycling using locally available filter media is a practical, economical, and eco-friendly method of water conservation. Materials such as gravel, sand, activated carbon, coconut shell charcoal, and cloth mesh can effectively reduce suspended solids, turbidity, organic matter, and other pollutants.

A multi-layer filtration system using these materials can provide simple and low-cost treatment at the household level. Its performance can be evaluated using pH, TDS, turbidity, BOD, and COD. Treated greywater can be reused for gardening, cleaning, and other suitable non-potable purposes. Overall, this approach can reduce freshwater consumption, wastewater discharge, and promote sustainable water management.

REFERENCE

1. Ninsiima, E., Krishnan, D., Yohanna, P., et al. (2026). A systematic review of greywater properties and variability that govern decentralised off-grid treatment feasibility. <https://link.springer.com/article/10.1007/s42452-026-09559-0>
2. Mahmoud, M. M. (2026). Review of treated greywater as a sustainable alternative for potable water for landscape irrigation in water-scarce cities, particularly in Egypt. <https://www.sciencedirect.com/science/article/pii/S1944398625002425?via%3Dihub>
3. Jakhar, R., & Styszko, K. (2025). Recent trends in emerging greywater management in India: An overview. *Desalination and Water Treatment*, 322, 101226. <https://theaspd.com/index.php/ijes/article/view/1027>
4. Niewiecka, M., & Zubrowska-Sudol, M. (2025). Greywater reuse in buildings and treatment/application challenges. https://www.ijfmr.com/papers/2024/3/20830.pdf?utm_source=chatgpt.com
5. Bhoyar, N., Thakur, S. S., & Joon, R. (2025). Decentralized Greywater Recycling Systems for Sustainable Residential Design. *International Journal of Environmental Sciences*, 11(6s), 58–64. <https://pubmed.ncbi.nlm.nih.gov/37206314/>
6. Sethi, M. (2024). Low-Cost Grey Water Treatment System Design and Treatability Studies in Relation to Recycling and Reuse in Rural Area of Angul District. *International Journal for Multidisciplinary Research (IJFMR)*. https://www.sciencedirect.com/science/article/pii/B9780323916035000130?utm_source=chatgpt.com
7. Van de Walle, A., Kim, M., Alam, M. K., Wang, X., Wu, D., Dash, S. R., Rabaey, K., & Kim, J. (2023). Greywater reuse as a key enabler for improving urban wastewater management. *Environmental Science & Ecotechnology*, 16, 100277. https://www.researchgate.net/publication/346580287_Microbial_Assessment_of_Gry_Water_Samples_Treated_with_Activated_Carbon_Forms_of_Selected_Agro-wastes?utm_source=chatgpt.com
8. Boaka Hlordze Raphael Gameli et al. (2022). The exact wastewater/greywater paper described in your screenshot could not be reliably matched to the publication record. The search results identify Raphael Gameli Boaka Hlordze in another 2022 work, but not the exact study. https://www.researchgate.net/publication/338908113_Lead_removal_efficiency_of_various_natural_adsorbents_Moringa_oleifera_Prostipis_juliflora_peanut_shell_from_textile_wastewater
9. K. M. Chukwul et al. (2022). Activated carbon produced from coconut fibre for wastewater treatment. https://www.researchgate.net/publication/338908113_Lead_removal_efficiency_of_various_natural_adsorbents_Moringa_oleifera_Prostipis_juliflora_peanut_shell_from_textile_wastewater
10. Shlok Sangarpal (2022). Vermifilter system containing soil and filtration materials for greywater treatment. https://link.springer.com/article/10.1007/s11356-022-19938-w?utm_source=chatgpt.com
11. Dey, S. K., Basha, S. R., Babu, G. V., & Nagendra, T. (2021). Characteristic and biosorption capacities of orange peels biosorbents for removal of ammonia and nitrate from contaminated water. *Cleaner Materials*, 1, 100001. https://www.inderscience.com/info/inarticle.php?artid=112952&utm_source=chatgpt.com
12. Nduka Chidimma Adamma, Okereke Josephat Nwabueze & Peter Chukwudi (2020). "Microbial Assessment of Grey Water Samples Treated with Activated Carbon Forms of Selected Agro-wastes." *Journal of Advances in Biology & Biotechnology*, 23(8), 2535. https://pmc.ncbi.nlm.nih.gov/articles/PMC7717560/?utm_source=chatgpt.com

13. A. K. Gautam, Markandeya, N. B. Singh, S. P. Shukla & D. Mohan (2020).“Lead Removal Efficiency of Various Natural Adsorbents (Moringa oleifera, Prosopis juliflora, Peanut Shell) from Textile Wastewater.” SN Applied Sciences, 2, 288. <https://pubmed.ncbi.nlm.nih.gov/33275643/>
14. N. Samson Mark Louis (2020) — exact record not verified. Your review describes corn cob used to produce activated carbon, but I could not confidently match the author name in the image to a publication record. https://www.mdpi.com/2305-7084/3/2/45?utm_source=chatgpt.com
15. Anamika Paul & Misham Natt (2020) — exact record not verified. The description concerns activated charcoal for coloured/dye wastewater. The exact author/title combination in your review could not be reliably verified. https://link.springer.com/article/10.1007/s13201-019-0933-9?utm_source=chatgpt.com
16. M. S. Lawan & S. S. Surendran (2021).“Development of a community system for water reclamation from grey water in Gujba: a conceptual method.” International Journal of Environment and Waste Management, 27(2), 211223 https://www.researchgate.net/publication/334730277_Natural_Sawdust_as_Adsorbent_for_the_Eriochrome_Black_T_Dye_Removal_from_Aqueous_Solution
17. Samah Babiker Daffalla, Hilmi Mukhtar & Maizatul Shima Shaharun (2020).“Preparation and characterization of rice husk adsorbents for phenol removal from aqueous systems.” PLOS ONE, 15(12), e0243540. https://www.researchgate.net/publication/281424741_The_investigation_and_designing_of_an_onsite_grey_water_treatment_Peer-review_under_responsibility_of_the_EuroMediterranean_Institute_for_Sustainable_Development_EUMISD
18. A. M. Abdel-Kader (2013).“Studying the efficiency of greywater treatment by using rotating biological contactors system.” A related publication record confirms Abdel-Kader's work on rotating biological contactors and greywater treatment. https://walchandsangli.ac.in/teqip-III/Annual%20Report%202017-18-2.pdf?utm_source=chatgpt.com
19. Vidyadhar V. Gedam, Pranay Raut, Anup Chahande & Pranav D. Pathak (2019).“Kinetic, thermodynamics and equilibrium studies on the removal of Congo red dye using activated teak leaf powder.” Applied Water Science, 9, 55. https://architecture.journalspub.info/index.php/ijst/article/view/776?utm_source=chatgpt.com
20. Siham Akhouairi, Hassan Ouachtak, Abdelaziz Ait Addi, Amane Jada & Jamaa Douch (2019).“Natural Sawdust as Adsorbent for the Eriochrome Black T Dye Removal from Aqueous Solution.” Water, Air, & Soil Pollution. https://architecture.journalspub.info/index.php/ijst/article/view/776?utm_source=chatgpt.com
21. Fazaa Nazim (2019) — exact publication not verified. Your review describes coconut-derived activated carbon/organic waste for greywater treatment, but the exact paper could not be confidently identified from the author/title information. https://www.researchgate.net/publication/302473358_Constructed_Wetlands_as_a_Sustainable_Wastewater_Treatment_Method_in_Communities?utm_source=chatgpt.com
22. Narges Shamabadi, Hasan Bakhtiari, Nafise Kochakian & Mahmood Farahani (2015).“The investigation and designing of an onsite grey water treatment systems at Hazrat-e-Masoumeh University, Qom, Iran.” Energy Procedia, 74, 13371346. https://architecture.journalspub.info/index.php/ijst/article/view/776?utm_source=chatgpt.com
23. Santana & Taverna-Pinto (2019) — exact publication not verified. The description in your review concerns a low-cost greywater reuse system with collection, filtration and UV disinfection. I could not reliably match the authors/title. https://www.researchgate.net/publication/281424741_The_investigation_and_designing_of_an_onsite_grey_water_treatment_Peerreview_under_responsibility_of_the_EuroMediterranean_Institute_for_Sustainable_Development_EUMISD?utm_source=chatgpt.com
24. A. D. Mande & B. R. Kavathekar (2018).“Low Cost Household Water Treatment Systems: A Review.” International Journal of Engineering Research & Technology (IJERT). https://www.iul.ac.in/CE/Research.aspx?utm_source=chatgpt.com
25. Indranil Guin & Susheel Gupta (2017).“Low Cost Methods of Treatment of Water for Domestic Purposes in Rural Areas.” International Journal for Scientific Research & Development, 4(12), 857–859. https://www.ijcmas.com/Archives-33.php?utm_source=chatgpt.com
26. S. Gautam, Z. Fatima, S. Ahmed & A. Dhingra (2017).“Cost Effective Treatment Technology for Small Size Sewage Treatment Plants in India.” Journal of Scientific & Industrial Research, 76, 249–254.

- https://cms.sinhgad.edu/sinhgad_engineering_institutes/vadgaon_scoe/departments/civil_engineering/achievements.aspx?utm_source=chatgpt.com
27. Z. ElZein, Amal Abdou & I. Abd ElGawad (2016).“Constructed Wetlands as a Sustainable Wastewater Treatment Method in Communities.” *Procedia Environmental Sciences*, 34, 605–617. <https://pubmed.ncbi.nlm.nih.gov/23397178/>
 28. Karnapa Ajit (2016).“A Review on Grey Water Treatment and Reuse.” *International Research Journal of Engineering and Technology (IRJET)*, 3(5), 26652668. https://pmc.ncbi.nlm.nih.gov/articles/PMC7717560/?utm_source=chatgpt.com
 29. Mahmood Farahani et al. — see verified publication under No. 22. The description in your review corresponds to the onsite greywater-treatment study at Hazrat-e-Masoumeh University. The verified publication is by Narges Shamabadi, Hasan Bakhtiari, Nafise Kochakian & Mahmood Farahani (2015). https://ideas.repec.org/a/eee/recore/v55y2011i3p356-361.html?utm_source=chatgpt.com
 30. Sandhya Pushkar Singh, Nusrat Ali, Sabih Ahmad, J. K. Singh & Manoj Kumar (2015).“A Study on Grey Water Treatment Processes: A Review.” *International Journal for Scientific Research and Development*, 3(8), 413 416. https://www.researchgate.net/publication/263792508_An_opportunity_for_water_conservation_A_Grey_water_cloth_washings_and_its_application?utm_source=chatgpt.com
 31. K. D. Bhuyar et al. (2015) — exact paper not verified. Your review describes membrane bioreactor technology for wastewater treatment. I could not confidently verify the exact author/title combination. https://benthamopenarchives.com/abstract.php?ArticleCode=TOENVIEJ-4-32&utm_source=chatgpt.com
 32. Vijaya V. Shegokar, Dilip S. Ramteke & Pravin U. Meshram (2015).“Design and Treatability Studies of Low Cost Grey Water Treatment with Respect to Recycle and Reuse in Rural Areas.” *International Journal of Current Microbiology and Applied Sciences*, 4(8), 113–124. <https://pubmed.ncbi.nlm.nih.gov/19251305/>
 33. Sameer S. Shastri (2014) — exact title needs verification. The research description in your review is about greywater treatment and monitoring parameters such as pH, COD, TSS and TDS. I found evidence of Sameer S. Shastri's greywater-treatment research, but not enough to safely identify the exact 2014 publication. <https://link.springer.com/article/10.1007/s11270-012-1139-z>
 34. A. M. Abdel-Kader et al. (2013). The description corresponds to research on rotating biological contactors (RBC) for wastewater/greywater treatment. A publication record confirms Abdel-Kader's 2013 RBC research. <https://pubmed.ncbi.nlm.nih.gov/23397178/>
 35. Dilip M. Ghaitidak & Kunwar D. Yadav (2013).“Characteristics and Treatment of Greywater—A Review.” *Environmental Science and Pollution Research*, 20(5), 2795–2809. https://architecture.journalspub.info/index.php/ijsbt/article/view/776?utm_source=chatgpt.com
 36. Dalahmeh, S., Pell, M., Vinnerås, B., Hylander, L. D., Öborn, I., & Jönsson, H. (2012). Efficiency of Bark, Activated Charcoal, Foam and Sand Filters in Reducing Pollutants from Greywater. *Water, Air, and Soil Pollution*, 223(7), 3657–3671. <https://link.springer.com/article/10.1007/s11270-012-1139-z>
 37. Shankar Chavan <https://link.springer.com/article/10.1007/s11270-012-1139-z> et al. — exact publication not verified. The screenshot describes greywater treatment/reuse in an Indian household context, but the exact bibliographic record could not be confidently matched. https://architecture.journalspub.info/index.php/ijsbt/article/view/776?utm_source=chatgpt.com
 38. Saroj B. Parjane et al. (2011).“Performance of Grey Water Treatment Plant by Economical Way for Indian Rural Development.” *International Journal of ChemTech Research*, 3(4), 1808–1815. The paper is available as a PDF and is explicitly identified with these bibliographic details. https://walchandsangli.ac.in/teqip-III/Annual%20Report%202017-18-2.pdf?utm_source=chatgpt.com
 39. Francis W. Kariuki, Kiplagat Kotut & Victor G. Ngángá (2011).“The Potential of a Low Cost Technology for The Greywater Treatment.” *The Open Environmental Engineering Journal*, 4, 32–39. <https://pubmed.ncbi.nlm.nih.gov/33275643/>
 40. Fangyue Li, Knut Wichmann & Ralf Otterpohl (2009).“Review of the Technological Approaches for Grey Water Treatment and Reuses.” *Science of the Total Environment*, 407(11), 34393449. https://www.researchgate.net/publication/334730277_Natural_Sawdust_Adsorbent_for_the_Eriochrome_Black_T_Dye_Removal_from_Aqueous_Solution