International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 03 | March - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

Filtration of Grey Water Using Herbs in a Columnar Evaluation

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ABSTRACT:

The management and reuse of domestic waste water, which refers to wastewater generated from non-toilet domestic activities, are becoming increasingly important in the context of water resource management. A well-organized waste water management system offers a valuable tool for addressing water scarcity concerns while simultaneously reducing pollution entering the hydrological cycle. The primary objective of such systems is to treat domestic waste water and utilize it in applications that do not necessitate drinking water quality. Examples of non-potable reuse applications include industrial processes, irrigation, toilet flushing, and laundry washing, depending on the treatment technologies employed. This thesis focuses on the development of a laboratory-scale domestic waste water treatment system and examines the water flow within the system. The overall aim is to construct the system and evaluate its efficiency in removing impurities from domestic waste water using herbal filters. The thesis encompasses a comprehensive description of the setup process and the subsequent testing of the domestic waste water treatment system. The present study investigates the effectiveness of herbal filters in eliminating impurities from greywater. The results demonstrate that the herbal filter proves to be highly efficient in removing impurities, thereby improving the quality of treated waste water. By implementing such a treatment system, the potential for reusing waste water in various non-potable applications is significantly enhanced. In conclusion, this thesis provides a thorough account of the construction and evaluation of a laboratory-scale domestic waste water treatment system. The focus on utilizing herbal filters highlights their efficacy in removing impurities from domestic waste water. The findings contribute to the broader understanding of waste water management, offering valuable insights for the development of larger-scale domestic waste water treatment systems aimed at addressing water scarcity and minimizing pollution in the hydrological cycle.

Domestic waste water management and reuse have gained significant importance in water resource management due to their potential to address water scarcity and reduce pollution in the hydrological cycle. Domestic waste water, which consists of wastewater from non-toilet domestic activities, can be effectively treated and utilized in various non-potable applications such as industrial processes, irrigation, toilet flushing, and laundry washing. This thesis focuses on the development of a open field waste water treatment system and investigates the efficiency of herbal filters in removing impurities from domestic waste water. The objective is to construct the system and test the water flow within it. The study aims to provide insights into the impurity removal and effectiveness of herbal filters in enhancing the quality of treated domestic waste water. Water is an essential resource for life, and its distribution varies across locations. To meet our daily needs and various purposes like washing, cooking, and cultivation, we rely on different water sources and

collection methods such as rainwater harvesting, groundwater and surface water collection, and springs. However, the water we utilize eventually becomes wastewater, which can contain pollutants due to its ability to dissolve various substances. Therefore, it is crucial to clean wastewater before its discharge to ensure a sustainable supply of clean water for the future use. Waste water management plays a crucial role in addressing water scarcity, ensuring water quality, and mitigating environmental degradation. By properly treating and reusing domestic waste water, pollution of freshwater resources can be minimized. Domestic waste water, excluding toilet wastewater, contains fewer contaminants, making it suitable for recycling. The thesis aims to describe the process of building a open field domestic waste water treatment system to contribute to the understanding and implementation of effective domestic waste water management practices. Water scarcity, poor water quality, and water-related disasters pose significant challenges for current and future water resources. Domestic waste water management offers a promising solution by reducing pollution in freshwater resources through the reuse of treated domestic water. This approach not only minimizes environmental impacts but also improves the overall water quality. Domestic waste water, originating from various sources such as baths, showers, hand basins, washing machines, dishwashers, laundries, and kitchen sinks, contains microorganisms, oil spills and chemical contaminants that need to be effectively addressed through appropriate treatment methods. The principles of domestic waste water management revolve around the efficient use of water by minimizing waste and exploring alternative water sources. Reusing treated domestic waste water for non-potable applications ensures sustainable water use, reduces freshwater consumption, decreases wastewater production, and ultimately leads to cost savings on water bills. Even in areas with abundant water resources, water recycling through domestic waste water management remains crucial for achieving sustainable living practices. In the literature review, Lucy Allen, a research associate at the Pacific Institute's Water Program, is mentioned. Her research interests encompass water quality, drinking water regulation, and the interconnectedness of water, energy, and climate change. With her background in conservation and resource studies, she has contributed to research projects on soil organic carbon cycling and the impact of earthworm invasion on soil organic carbon turnover and stability.

KEYWORDS:

Domestic waste water management, Water scarcity, Impurity removal, non-potable reuse, Herbal filters (Salvinia molesta, Ocimum Sanctum, Withania somnifera, Cattail, In additional with pubbles and sands).

INTRODUCTION:

Grey water can be defined as any domestic waste water produced, excluding sewage. In other word we can say that residential grey water is a mixture of all water discharges from the household including bathroom sinks, bathtubs, kitchen sinks, and laundry wash-water sources. Kitchen waste water can contain food particles, grease, oils and fats and its use is not recommended (particularly without treatment). The main differences between grey water and sewage (or black water) is the organic loading, sewage has a much large organic loading compared to grey water. Some people also classified kitchen waste water as black water because it has quit a high organic loading relative to other sources of waste water such as bath water. Due to rapid industrialization and development, there is an increased opportunity for Grey water reuse in developing countries such as India [10]. The quality of grey water can be highly variable due to factors such as number of household occupants, their age, lifestyle, health, water source and products used (such as soaps, shampoos, detergents).

Grey water may contain:

1) Disease causing organisms (bacteria, viruses, protozoa) from nappies and other soiled clothing

2) Chemicals from soaps, shampoos, dyes, mouthwash, toothpaste, detergents, bleaches, disinfectants and other products (such as boron, phosphorus, sodium, ammonia and other nitrogen based compounds).

3) Dirt, lint, food, hair, body cells and fats.

The potential risks to public health and the environmental impact of grey water that can be caused through improperly designed, installed, and maintained systems. Grey water may contain significant levels of disease causing organisms particularly where household members are suffering from a gastrointestinal illness. Domestic waste water management and reuse have gained significant importance in water resource management due to their potential to address water scarcity and reduce pollution in the hydrological cycle. Domestic waste water, which consists of wastewater from non-toilet domestic activities, can be effectively treated and utilized in various non-potable applications such as industrial processes, irrigation, toilet flushing, and laundry washing. This thesis focuses on the development of a open field waste water treatment system and investigates the efficiency of herbal filters in removing impurities from domestic waste water. The objective is to construct the system and test the water flow within it. The study aims to provide insights into the impurity removal and effectiveness of herbal filters in enhancing the quality of treated domestic waste water. Water is an essential resource for life, and its distribution varies across locations. To meet our daily needs and various purposes like washing, cooking, and cultivation, we rely on different water sources and collection methods such as rainwater harvesting, groundwater and surface water collection, and springs. However, the water we utilize eventually becomes wastewater, which can contain pollutants due to its ability to dissolve various substances. Therefore, it is crucial to clean wastewater before its discharge to ensure a sustainable supply of clean water for the future use. Waste water management plays a crucial role in addressing water scarcity, ensuring water quality, and mitigating environmental degradation. By properly treating and reusing domestic waste water, pollution of freshwater resources can be minimized. Domestic waste water, excluding toilet wastewater, contains fewer contaminants, making it suitable for recycling. The thesis aims to

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LITERATURE REVIEW:

A.Krishna Kumar O, K Adithya, Abhilash R and Arvind T

This research paper discussed grey water treatment by the process of BIO-REMEDIATION. Grey water taken from bathroom and sink (basin) are treated using effective microOrganisms solution and the filtered by the use of sand filter. The major technique involves bio-remediation which includes the use of EM solution for Deodorization and treatment of harmful micro-organism present in dirt water and use of sand filter for filtering purpose. This technique is very simple and economical, thus saving money, water and eco-friendly to the environment. [6]

B. Tiyasha, Shakibala Suraj kr Bhagat

This paper discussed the sand filtration technique is the oldest techniques which are natural filters used for huge wastewater purification. Simultaneously another method of removal of toxic substances from soil and water was developed which is known as physto-remediation. Phytoremediation technique has a large gap of application and research is only in its infancy. The purpose of the paper is to bring these two techniques together and make a design which can be used in small scale like house hold as well as for a whole colony to preserve, treat and reuse wastewater. [11]

C. Rajarshi Kar, Oindrila Gupta

In this research paper, study on the analysis of removal of dye and color pigments (such as ethanaminium) from grey water on synthetic activated carbon. The present work generally focus on the recycle of grey water that is produced from the bathroom, laundry, shower, basin, kitchen (dish washing), which can be recycled on site for uses such as Irrigation, constructed wetland, toilet flushing etc. [10]

D. Kamal Rana, Mitali Shah, Amita Upadhay

A review of those processes has been done to identify the best suitable method at household and community level. Septic tank, constructed wet land and intermittent sand filter are used for treating the grey water. These three steps are best suited decentralized or small scale treatment system discussed in this study. The present studies reviews and suggests the concept of using grey water in various purposes and solves the water scarce problem and reduce the sewage generation. [5]

E. Lucia Hernandez leal, Hardy temmink, Grietje Zeeman and Cees.J.N Buisman.

This research paper presents the study based on the comparison between three systems for Biological grey water treatment at similar hydraulic retention time (approximately 12-13 hr). These three systems are, first is the aerobic treatment in a sequencing batch reactor and second one is the anaerobic treatment in an up flow anaerobic blanket reactor and third is combined anaerobic- aerobic treatment.[7]

F. Francis W. Kariuki, Kiplagat Kotut and Victor G. Ngángá

This study investigated the low cost technology for the treatment of grey water. . The system comprises of discrete units of barrels that allows for filtration, flocculation, sedimentation and disinfection. GWT system produced water with both pH and electrical conductivity suitable for irrigation according to WHO guidelines. The study concludes that the GWT system can be a sustainable and promising low cost low technology treatment system that can be run and maintained by unskilled operators. [2]

Role of Typha (Cattail) and Phragmites australes (Reed Plant) in Domestic Wastewater Treatment-The study showedsignificant BOD and COD reduction in the treated wastewater as compared to the raw effluent. The concentration of trace elements such as cu and fe decreased, but zn and mn increased both under typh and phragmites australes. Similarly, NH4 and PO4 decreased but NO3 increased appreciably as compared to the control (raw effluent) treatment. The concentration of all the investigated trace elements was above the maximum allowable limits except NH4, NO3 and PO4 which was within acceptable limits for irrigation purpose.

Role of Typha (Cattail) and Phragmites australes (Reed Plant) in Domestic Wastewater Treatment (scialert.net)

Tulsi and ashwagandha to purify Hyderabad LAKE-Micro-organisms growing on the FTW and plant root systems break down and consume the organic matter in the water through microbial decomposition. The root systems filter out sediments and pollutants. The NGO claims that FTW is strong and can hold the weight of as many as four people. Compared to sewage treatment plants, this method is much cheaper.

G.Tulsi and ashwagandha to purify Hyderabad lake - The Hindu

How to treat wastewater at HOME-Baffle filter comprises a filter and multiple baffle chambers through which water flows. While flowing through the baffle chambers, water is treated by anaerobic decomposition, that helps to remove solid matter and scum. Reed bed is a tank filled with gravel, in which wetland plants are rooted. Here water gets purified by-plants absorbs nutrients, including synthetic compounds like soap, in the water. This also aids plant growth as wetland plants grow hydroponically, i.E., Only using water and the nutrients in it .Athogens in water are destroyed by natural die-off, antibiotic released by plant roots, UV exposition, sedimentation, and upon sticking to the gravel bed. For every 1000 litres of greywater, a reed bed of 5-7 sq m bed area and 1-1.5 m depth is recommended.

How to treat wastewater at home | Urban Waters, Bengaluru

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MATERIAL METHOD'S:

The study was conducted in a open field pond like setting, and the dimensions of the herbal filter surface flow, sand filter downflow systems were kept the same. The operating conditions of the investigated systems were determined. Domestic wastewater samples were collected from five families in a neighbourhood house, and the systems were continuously supplied with effluent from a primary sedimentation tank. Sampling was conducted once a week over a one-month period. The hydraulic retention time (HRT) for the sedimentation tank was fixed at 1.5 hour. The sand used in the study had a diameter of 2-3 mm. Composite samples of raw sewage and effluents from different treatment units were collected and analysed for pH, COD, BOD5, TKN, ammonia, and nitrite using analytical methods. Quantifying the generation and flow rate of domestic wastewater is crucial for designing an effective wastewater collection, treatment, and reuse system. Accurate data on current and projected flow rates are necessary for cost-effective system design. Factors such as budget, existing plumbing, and available garden area may influence the choice of wastewater reuse application. Domestic wastewater recycling offers numerous benefits, including reduced extraction of freshwater from rivers and aquifers, decreased strain on septic systems or treatment plants, indoor use such as toilet flushing, utilization of otherwise unsuitable real estate, groundwater recharge, irrigation and plant growth, maintenance of soil fertility, and improved water quality. However, the implementation and storage of wastewater systems are restricted by various by-laws in the United States, posing constraints to widespread adoption, unlike in many European countries where domestic wastewater recycling has been embraced. When planning a domestic wastewater recycling project, it is essential to consider design parameters such as water supply, soil characteristics, cost, intended use of recycled water, and accurate quantification of wastewater flow rates. In summary, this section provides information on the sampling sites, methods used for sample collection and conservation, analytical techniques employed, quantification of domestic wastewater, benefits and constraints of wastewater recycling, and key design parameters to be considered in domestic wastewater recycling projects.

DISCUSSION:

The study described a open field experiment comparing the performance of different wastewater treatment systems. The only difference between the systems was the direction of wastewater flow and the components used for the operation. Domestic wastewater samples were collected from five families over a one-month period and analysed for various parameters. Quantifying domestic wastewater flow rates is crucial for effective system design, considering factors such as budget, plumbing, and available space. Domestic wastewater recycling offers multiple benefits like reducing freshwater extraction, strain on septic systems, and improved water quality. However, implementation is restricted in the US due to by-laws, unlike in Europe. Design parameters such as water supply, soil characteristics, cost, and intended use of recycled water should be considered in domestic wastewater recycling projects.

RESULT:

The open field study compared different wastewater treatment systems with varying wastewater flow directions. Domestic wastewater samples were collected and analysed over a one-month period, providing valuable data on pH, COD, BOD5, TKN, ammonia, and nitrite levels. Accurate quantification of domestic wastewater flow rates is crucial for cost-effective system design, considering factors such as budget, plumbing infrastructure, and available space. Domestic wastewater recycling offers numerous benefits, including reduced freshwater extraction, improved water quality, and the ability to utilize otherwise unsuitable areas. However, the implementation of domestic wastewater systems in the United States is restricted by laws, unlike in Europe where it has been widely adopted. When planning a wastewater recycling project, it is important to consider design parameters such as water supply, soil characteristics, cost, and the intended use of recycled water.

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