



# IJRASET

International Journal For Research in  
Applied Science and Engineering Technology



---

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume:** 13      **Issue:** V      **Month of publication:** May 2025

**DOI:** <https://doi.org/10.22214/ijraset.2025.70346>

[www.ijraset.com](http://www.ijraset.com)

Call:  08813907089

E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)

# Design and Performance of Grey Water Treatment Plant

Mr. Santosh Sable<sup>1</sup>, Mahendra Shinde<sup>2</sup>, Pratik Fasate<sup>3</sup>, Siddhesh Zolekar<sup>4</sup>

<sup>1</sup>Assistant Professor, <sup>2,3,4</sup>UG Students, Department of Chemical Engineering, Pravara Rural Engineering College, Loni, Dist.: Ahmednagar- 413736.

**Abstract:** Advanced Oxidation Processes (AOPs), Moving Bed Biofilm Reactor (MBBR) systems, and Constructed Wetlands (CWs) to enhance efficiency of organic and inorganic pollutant removal. MBBR system consists of an aeration tank it is similar to a activated sludge tank with plastic media which surface biofilm can grow. Initially grey water feed to AOP system then MBBR and finally pass through wetland construction. AOP and MBBR is a recent and beneficial biofilm technology which has many properties which includes anti-load ability, High treatment efficiency. AOP and MBBR technology became more popular and widely utilized worldwide due to fact that need for clean water keeps to rapidly increase with increase in population of the world grows year by year. Greywater from Bathroom Water used in hand washing and bathing generates around 50-60% of total greywater and is considered to be the least contaminated type of greywater. Greywater is specifically washing water like bath, dish and laundry water excluding toilet wastes and free of garbage-grinder residues. Gray water shows the Initial characteristics TDS, pH and SS are 900 mg/l, 8.5 and 413 mg/l. After treating with AOP shows the TDS, pH and SS are 750 mg/l, 8.3 and 327 mg/l, after MBBR treatment TDS, pH and SS are 400 mg/l, 8.3 and 104 mg/l and Final wet land construction treatment TDS, pH and SS are 118 mg/l, 8.3 and 50 mg/l.

**Keywords:** Gray water, MBBR, SS, TDS reduction, Biofilm media.

## I. INTRODUCTION

Greywater is specifically wash water like bath, dish and laundry water excluding toilet wastes and free of garbage-grinder residues. Greywater can be a valuable resource which horticultural and agricultural growers as well as home gardeners can benefit from. It can be valuable to landscape planners, builders, developers and contractors because of design and landscaping advantages of on-site greywater treatment.

Greywater a source of pollution for lakes, rivers and ground water which are excellent nutrient sources for vegetation when wastewater is made available for irrigation. Moving bed bio film reactor (MBBR) is a treatment process of wastewater that was initially invented by Prof. Hallward at Norwegian University of Science and Technology in the late 1980s. There are over 700 wastewater treatment systems both municipal and industrial systems installed in more than 50 countries. Now a day, there are various suppliers of MBBR technology. The MBBR system consists of an aeration tank it is similar to a activated sludge tank with plastic media which surface.

## II. COMPOSITION OF GREYWATER

Greywater from Bathroom Water used in hand washing and bathing generates around 50-60% of total greywater and is considered to be the least contaminated type of greywater. Common chemical contaminants include soap, shampoo, hair dye, toothpaste and cleaning products. It also contains bacteria and viruses through body washing. Greywater from Cloth Washing Water used in cloth washing generates around 25-35% of total greywater.

## III. EXPERIMENTAL ANALYSIS

### A. Raw Materials and Chemicals

- 1) Fe reagent/H<sub>2</sub>O<sub>2</sub>
- 2) MBBR Media
- 3) Alkali/acid
- 4) Grey Water Sample

**B. Apparatus**

- 1) Measuring Cylinder
- 2) Beaker
- 3) Glass Ro
- 4) Aeration Pump
- 5) MBBR Setup
- 6) Aerobic and anaerobic tank

**C. Experiment Procedure**

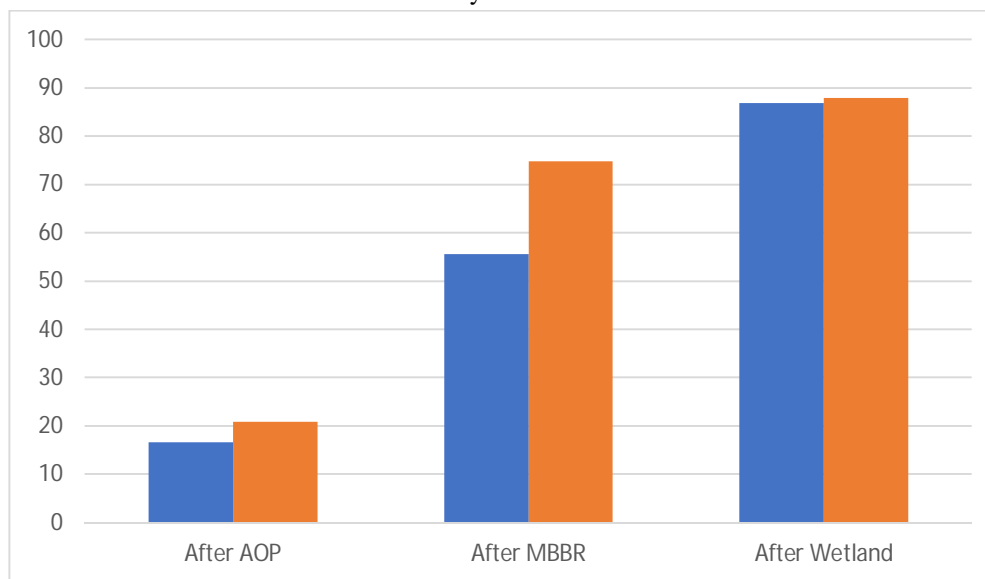
- 1) Take 5–10-liter grey water.
- 2) Check initial pollutant concentration unit or absorbance using spectrophotometers/ colorimeters.
- 3) Add grey water in AOP tank for treatment.
- 4) Pass through moving bed in bioreactor tank.
- 5) Start air blower and purge air in bioreactor.
- 6) Add biological culture in bio reactor chamber.
- 7) After biological treatment pass the grey water in wetland construction.
- 8) Take grey water sample for analysis and measures its absorbance.
- 9) After retention time of water get over flow into primary setting tank.
- 10) After setting of sludge, we can take sample for analysis.
- 11) Measure the % of removal of COD, BOD, TDS, pH etc. from the waste water.

**IV. RESULTS AND DISCUSSIONS**

The characteristics of gray water before and after treatment. The sample withdrawal after various time of intervals. Gray water shows the Initial characteristics TDS, pH and SS are 900 mg/l, 8.5 and 413 mg/l. After treating with AOP shows the TDS, pH and SS are 750 mg/l, 8.3 and 327 mg/l, after MBBR treatment TDS, pH and SS are 400 mg/l, 8.3 and 104 mg/l and Final wet land construction treatment TDS, pH and SS are 118 mg/l, 8.3 and 50 mg/l.

Treatment Method	TDS mg/l	pH	SS mg/l
Initial Value	900	8.5	413
After AOP	750	8.3	327
After MBBR	400	8	104
After Wetland	118	7.5	50

Table Characteristics of Gray Water before and after Treatment



% Reduction of TDS and SS

$$\% \text{ Reduction} = \frac{(\text{final value} - \text{initial value})}{\text{Final value}} * 100$$

% Reduction of TDS

1. After AOP treatment

$$\% \text{ Reduction of TDS} = \frac{(900 - 750)}{900} * 100 = 16.66$$

2. After MBBR Treatment

$$\% \text{ Reduction of TDS} = \frac{(900 - 400)}{900} * 100 = 55.55$$

3. After Treatment of wetland construction

$$\% \text{ Reduction of TDS} = \frac{(900 - 118)}{900} * 100 = 86.88$$

% Reduction of SS

1. After AOP treatment

$$\% \text{ Reduction of TDS} = \frac{(413 - 327)}{413} * 100 = 20.82$$

2. After MBBR Treatment

$$\% \text{ Reduction of TDS} = \frac{(413 - 104)}{413} * 100 = 74.81$$

3. After Treatment of wetland construction

$$\% \text{ Reduction of TDS} = \frac{(413 - 50)}{413} * 100 = 87.89$$

*A. Observation for % Reduction of TDS and SS*

The % reduction of TDS and SS from gray water using MBBR treatment for 3 hrs. time of intervals. % Reduction in TDS and SS for 3, 6 and 9hrs. time of interval are 16.66, 55.55, 86.66 and 20.82, 74.81, 87.89 resp. The ate of reduction increase with increase in contact time.

Treatment Process	% Reduction in TDS	% Reduction SS
After AOP	16.66	20.82
After MBBR	55.55	74.81
After Wetland	86.88	87.89

% Reduction of TDS and SS

*B. Graphical Representation for % Reduction of TDS and SS*

Fig. shows graphical representation of the % reduction of TDS and SS from gray water using AOP, MBBR and wetland construction treatment. Graph shows the % reduction in TDS and SS using AOP, MBBR and wetland construction treatment are 16.66, 55.55, 86.66 and 20.82, 74.81, 87.89 resp.

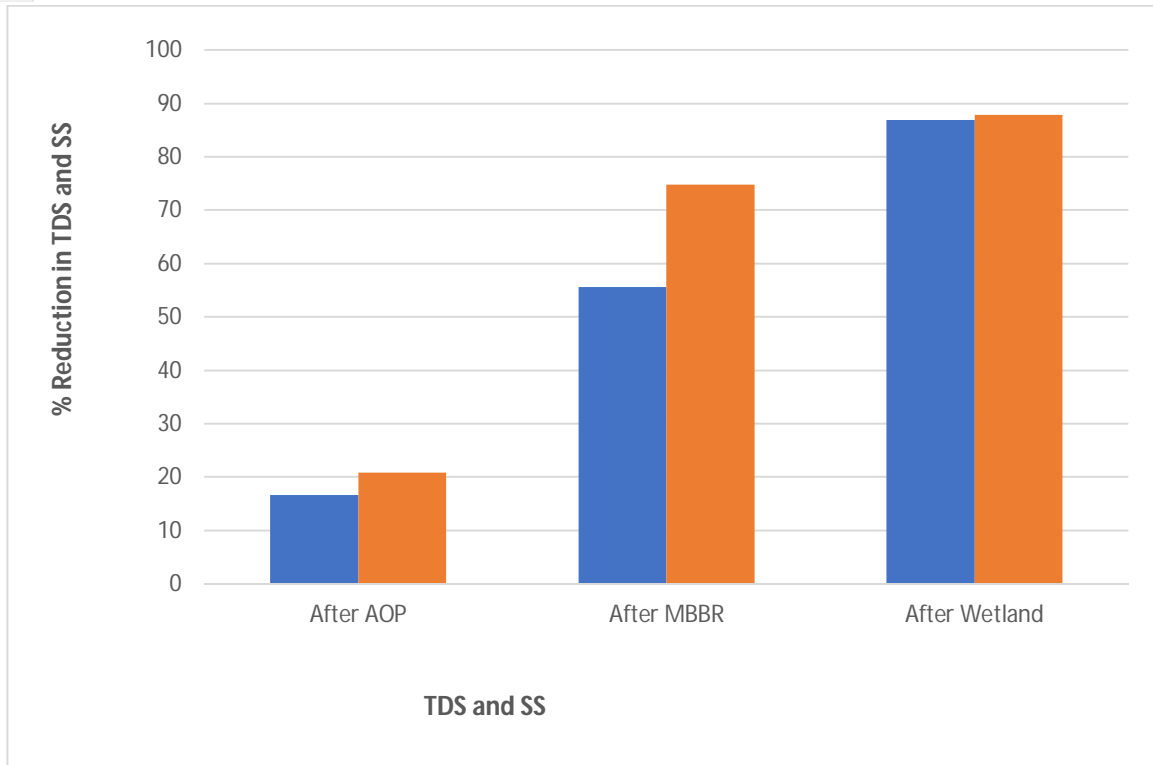


Fig. Graphical Representation

## V. CONCLUSION

Greywater is specifically wash water like bath, dish and laundry water excluding toilet wastes and free of garbage-grinder residues. MBBR technology became more popular and widely utilized worldwide due to fact that need for clean water keeps to rapidly increase with increase in population of the world grows year by year. the % reduction of TDS and SS from gray water using AOP, MBBR and wetland construction treatment. Graph shows the % reduction in TDS and SS using AOP, MBBR and wetland construction treatment are 16.66%, 55.55%, 86.66% and 20.82%, 74.81%, 87.89% resp.

## VI. FUTURE SCOPE AND BENEFITS

AOP, MBBR and wetland construction treatment one of the alternatives and efficient methods for treating wastewaters at a variety of conditions. AOP, MBBR and wetland construction treatment became more popular and widely utilized worldwide due to fact that need for clean water keeps to rapidly increase with increase in population of the world grows year by year. Due to the rapid urbanization grey wastewater has continuously and excessively released into environment causing significant impacts on human and wild life. Many organic compounds in grey wastewater are detected in different types of wastewaters, affecting water quality, human health and biodiversity in the ecosystems. Using greywater to irrigate landscape plants can conserve water and electricity and reduce water bills by recycling water otherwise destined for a wastewater treatment plant. Since an estimated 30 to 50% of home water use produces greywater, significant savings can be realized by reusing this source of nonportable water to irrigate landscape plants. Reduce strain on septic system or treatment plant. The quality of groundwater and surface waters are much better preserved by the natural purification processes the grey water undergoes in the top layers of the soil than by any engineered water treatment.

## REFERENCES

- [1] Akhin George, Ancy C J, Anupama Renjini K R, Jithin P Nair and Jency Nadayil, Characterization of Grey Water and Treatment using Moving Bed Biofilm Reactor (MBBR), International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06, Issue: 04, Apr 2019.
- [2] Ahmad Majid, Mehrazaran Mahna, Application of Lab-Scale MBBR to Treat Industrial Wastewater using K-3 Carriers: Effects of HRT, High COD Influent and Temperature, International Journal of Environmental Sciences & Natural Resources Volume 20 Issue 2 - June 2019.
- [3] Bavor Herbert John and Michael Waters, Pollutant transformation performance in a peri-urban African wetland system receiving point source effluent and diffuse source pollutant inputs, Ecohydrol. Hydrobiol, 7 (3-4), 201-206, 2007.

- [4] Gross A., O. Shmueli, Z. Ronen and E. Raveh, Recycled vertical flow constructed wetland (RVFCW)—a novel method of recycling greywater for irrigation in small communities and households, Elsevier, Chemosphere 66, 916–923, 2007.
- [5] Heenalisha K. and R. Prashanna Rangan, Grey-Water Treatment and Reuse: A Review, Asian Journal of Science and Applied Technology, ISSN: 2249-0698 Vol. 8 (1), pp. 5-9, 2019.
- [6] Hanna Porsgaard and Sofia Söderström, Removal of Nitrogen from Landfill Leachates with MBBR and SBR A Pilot Study at the Brudaremassen Landfill, Chalmers University of Technology, Gothenburg, Sweden 2015.
- [7] Mariana Chrispima, Marcelo Antunes Nolasco, André Santosc, Gabriel Inacio Silva-Netod, Neildes Souza Santana Water Resources Saving: A Possibly Contribution from a Greywater Collection, Treatment and Reuse, Conference on International Research on Food Security, Natural Resource Management and Rural Development, 2014.
- [8] Mr. Lambe J. S. and R. S. Chougule, Greywater Treatment and Reuse, Department of Civil Engineering, D.J. Magdum College of Engineering, Jaysingpur, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 20-26, 2018.
- [9] Mohammad Javad Amiri and Mehdi Bahrami, Clustering the Adsorbents of Horizontal Series Filtration in Greywater Treatment, Sustainability, 12, 3194, 2020.
- [10] Mohanty Bibhabasu & Zeel Patel, Use of Natural Materials for Low Cost and Effective Technology for Greywater Treatment, Science, Technology and Development, Volume VIII, Issue XI, November, ISSN: 0950-0707, 2019.
- [11] Mr. Kazi Faraz Ahmed Abdullah1, Prof. D. C. Poul, Prof. S. C. Vadane and Prof. P.A., Hangargekar MBBR Treatment for Purification of Grey Water in Venkateswara Greens Society, International Research Journal of Engineering and Technology (IRJET), ISSN: 2395-0056, Volume: 09, Issue: 04, Apr 2022.
- [12] M. Pidou, F. A. Memon and T. Stephenson, Greywater recycling: treatment options and applications, Proceedings of the Institution of Civil Engineers Engineering Sustainability 160, Issue ES3, September 2007.
- [13] Mr. Evalyne Cathy Arinaitwe, Suitable treatment of source separated greywater for discharge into an Urban Environment, Water and Environmental Engineering Department of Chemical Engineering Lund University May, 2018.
- [14] Meng Nan Chong, Kai Siang Oh and Janet Yip Cheng Leong, A review of greywater recycling related issues: Challenges and future prospects in Malaysia Kai, Journal of Cleaner Production, 171, 17-29, 2018.
- [15] N. R. Kulabakoa, N.K.M. Ssonkob and J. Kinobe, Greywater Characteristics and Reuse in Tower Gardens in Peri-Urban Areas – Experiences of Kawaala, Kampala, The Open Environmental Engineering Journal, 4, 147-154, 2011.
- [16] Narcis Barsan, Hanen Filali, Dalila Souguir, Valentin Nedeff, Claudia Tomozei and Mohamed Hachicha, Greywater as an Alternative Solution for a Sustainable Management of Water Resources A Review, Sustainability, 14, 665 2022.
- [17] Narayana J, Development of Cost-effective Waste Water Treatment Model for Sustainable Utilization of House Hold Waste Water, Acta Scientific Agriculture, 127-129, 2020.
- [18] Sukumar Devotta, Manual Greywater Reuse in Rural Schools Wise Water Management, National Environmental Engineering Research Institute Nehru Marg, Nagpur - 440 020, India, January 2007.
- [19] SS Rakesh, Dr. PT Ramesh, Dr. R Murugaragavan, Dr. S Avudainayagam and Dr. S Karthikeyan, Characterization and treatment of grey water: A review, International Journal of Chemical Studies 8(1): 34-40, 2020.
- [20] Snehal Joshi, Priti Palande, Dr. Suneeti Gore, Ms. Anuja Oke, Mrs. Gopika Manjunath, Dr. Chitra Naidu, Dr. Meenal Joshi, Purification of Grey water using the natural method, International Journal of Environment, Agriculture and Biotechnology Vol-7, Issue-2; Mar-Apr, 2022.



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)