OPTIMIZATION IN WASTE WATER PLANT

Internship Project Report

Submitted for the partial fulfilment of the degree of

Bachelor of Technology

In

Chemical Engineering

Submitted By-

Ritesh Singh Tomar

0901CM201032

UNDER THE SUPERVISION AND GUIDANCE OF-

Prof. Shourabh Singh Raghuwanshi

Assistant Professor

(Department of Chemical Engineering)

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

Deemed to be University

(Declared under Distinct Category by Ministry of Education, Government of India)

NAAC ACCREDITED WITH A++ GRADE

DECLARATION BY THE CANDIDATE

hereby declare that the work entitled **"OPTIMIZATION IN WASTE WATER PLANT"** is my ork, conducted under the supervision of **Prof. Shourabh Singh Raghuwanshi, Assistant rofessor, during** the session Jan-May 2024. The report submitted by me is a record of bonafide ork carried out by me.

further declare that the work reported in this report has not been submitted and will not be ıbmitted, either in part or in full, for the award of any other degree or diploma in this institute or ıy other institute or university.

Ritesh Singh Tomar

0901CM201032

)ate: 24/05/24
'lace: Gwalior

'his is to certify that the above statement made by the candidates is correct to the best of my nowledge and belief.

Guided By: 24.05.24

Prof. Shourabh Singh Raghuwanshi
Assistant Professor
Chemical Department
MITS, Gwalior

Departmental Project Coordinator
24/05/24
Prof. Shivangi Sharma
Assistant Professor
Chemical Department
MITS, Gwalior

Approved by coordinator
24/05/24
Prof. Anish P Jacob
Professor & Coordinator
Chemical Department
MITS, Gwalior

COORDINATOR
Chemical Engineering
MITS, Gwalior

ION EXCHANGE
Refreshing the Planet

Ion Exchange (INDIA) Ltd.
Riviera Apartment Patancheru
Hyderabad - 500082
T-+91-22-6610-0678
ieil@ionexchange.co.in

01 April 2024

To whomever it may concern

This is to certify that Mr. **Ritesh Singh Tomar** (enrollment no.-0901CM201032) student at **Madhav institute of technology & science, Gwalior** has undergone unpaid internship in our organization **Ion exchange (India) Ltd.** at Bhilai steel plant unit on **"waste water treatment"** from **January 15th, 2024 to April 30th, 2024,** and completed his unpaid internship.

His conduct and progress during the internship was good.

We wish him success in all his future endeavors.

For, Ion Exchange (I) Ltd.

Ion Exchange (India) Ltd.
Pushpendra Chandrakar
(Technical service head)

WATER TREATMENT PLANT
MARODA BHILAI DURG C.G
Pin – 490006
Contact – +91-8103477043

ION EXCHANGE (INDIA) LTD.
6-3-347/9, Plot No.134, 4th Floor, Riviera Apartment, Dwarakapuri Colony, Punjagutta, Hyderabad - 500 082, India. | Board: +91 40 3066 3101/02/03
Regd. Office: Ion House, Dr. E. Moses Road, Mahalaxmi, Mumbai - 400 011, India. | Board: +91 22 3989 0909 | Fax: +91 22 2493 8737 | Web: www.ionindia.com
Offices: Bengaluru | Bhubaneswar | Chandigarh | Chennai | Kolkata | Lucknow | Mumbai | New Delhi | Pune | Vadodara | Vashi | Visakhapatnam

PLAGIARISM CHECK CERTIFICATE

to certify that I, a student of B.Tech. **Department of Chemical Engineering** have checked my te report entitled **"Optimization in Wastewater Plant"** for similarity/plagiarism using the "Turnitin" e available in the institute.

to certify that the similarity in my report is found to be ..18%..which is within the specified limit

plagiarism report along with the summary is enclosed.

Ritesh

Ritesh Singh Tomar

0901CM201032

Checked & Approved By:

Anish
24/05/24

Prof. Anish P. Jacob
Departmental Turnitin Coordinator
Department of Chemical Engineering
MITS, Gwalior

ABSTRACT

This report examines the operational performance of a water treatment plant over the first quarter of the year, focusing on its capacity to treat municipal wastewater and produce clean water. The plant, designed with advanced technologies, processes up to 10,000 liters per hour using a combination of primary, secondary, and tertiary treatments, including a state-of-the-art Reverse Osmosis (RO) system. Key performance metrics such as the volume of wastewater treated, chemical usage, and clean water output were analyzed. Findings indicate a consistent treatment efficiency of 90% across January, February, and March, with notable improvements in chemical usage efficiency and water quality. The plant employs various processes, including sedimentation, biological treatment, filtration, and disinfection, ensuring compliance with stringent water quality standards. This study underscores the plant's effectiveness in maintaining high operational standards, optimizing resource use, and contributing to sustainable water management practices.

Keyword: Reverse Osmosis ,Total Dissolved Solids ,Ultra Violet Particle per Million

ACKNOWLEDGEMENT

The Internship project has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology and Science** to allow me to continue my disciplinary/interdisciplinary project as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme (based on the AICTE Model Curriculum 2018), approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R. K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

I would sincerely like to thank my department, **Department of Chemical Engineering**, for allowing me to explore this project.

I am sincerely thankful to my faculty mentors. I am grateful to the guidance of **Prof. Shourabh Singh Raghuwanshi**, Assistant Professor, Department of Chemical Engineering, for her continued support and guidance throughout the project. I am also very thankful to the faculty and staff of the department.

Ritesh

Ritesh Tomar

0901CM201032

CONTENTENT

ACRONYMS

Abbreviations	**Full Forms**
RO	Reverse Osmosis
TDS	Total Dissolved Solids
NM^3	Normal cubic meter
MT	Metric ton
PPM	Particle per Million
COD	Chemical Oxygen Demand

List of Tables

CHAPTER 1: INTRODUCTION

Water treatment plants are essential pieces of infrastructure that are used to clean wastewater Water treatment plants are essential pieces of infrastructure that clean wastewater, making it acceptable for reuse or safe release back into the environment. These plants play a crucial role in preserving environmental sustainability and public health by combining physical, chemical, and biological processes to remove pollutants and produce clean water.

Significance of Water Treatment

The importance of water treatment cannot be overstated, as it encompasses several critical areas:

Public Health: Water treatment facilities are vital in eliminating harmful bacteria, viruses, and other pathogens from water supplies. This process is essential to prevent waterborne illnesses and ensure the safety and security of drinking water, thus safeguarding public health.

Environmental Protection: By processing wastewater before it is discharged into natural water bodies, water treatment plants significantly reduce pollution levels. This helps protect aquatic ecosystems, maintain biodiversity, and preserve the overall quality of natural water resources.

Conservation of Resources: Effective water treatment promotes the efficient use of water resources. By treating and reusing wastewater, these plants help in reducing the strain on freshwater supplies, which is increasingly important in the face of global water scarcity. This conservation effort supports sustainable water management practices and helps ensure that future generations have access to clean water.

Economic Benefits: Investing in water treatment infrastructure can lead to significant economic advantages. Clean water is fundamental to various industries, including agriculture, manufacturing, and tourism. By providing a reliable supply of clean water, water treatment plants support economic growth and stability.

Compliance with Regulations: Water treatment plants also ensure that communities comply with environmental regulations and standards set by governmental bodies. These regulations are designed to protect public health and the environment, and non-compliance can result in severe legal and financial consequences.

In conclusion, water treatment plants are indispensable to modern society. They provide multiple benefits that extend beyond immediate water purification, including health protection, environmental conservation, resource management, economic support, and regulatory compliance. As such, the development and maintenance of efficient water treatment facilities should be a priority for governments and communities worldwide

CHAPTER 2: LITERATURE SURVEY

Water treatment is a complex process that involves various methods to remove contaminants from wastewater, making it suitable for reuse or safe discharge into the environment. The primary treatment methods include physical, chemical, and biological processes. Studies such as those by Tchobanoglous et al. (2013) and Metcalf & Eddy (2014) provide comprehensive overviews of these methods and their applications in modern water treatment plants.

Physical Treatment Methods

Physical methods, including sedimentation, filtration, and flotation, are among the oldest and most widely used in water treatment. Sedimentation allows particles to settle under gravity, while filtration employs various media to remove particulate matter. Research by Wang et al. (2019) highlights the efficiency of advanced filtration technologies, such as membrane filtration, which can significantly improve water quality by removing smaller particles and pathogens.

Chemical Treatment Methods

Chemical processes, including coagulation, flocculation, and chlorination, play a vital role in water treatment by neutralizing contaminants and pathogens. Coagulation and flocculation involve the addition of chemicals like alum to aggregate particles, making them easier to remove. Studies by Zhao et al. (2020) demonstrate the effectiveness of these methods in improving water clarity and reducing turbidity. Chlorination, as detailed by White (2010), remains a widely used method for disinfecting water, though concerns about disinfection by-products (DBPs) have led to research into alternative methods, such as ozonation and UV disinfection.

Biological Treatment Methods

Biological treatment methods leverage microbial processes to break down organic matter in wastewater. Activated sludge, biofilm reactors, and anaerobic digestion are common

techniques. Henze et al. (2008) discuss the principles and efficiency of activated sludge processes, while Rittmann and McCarty (2001) explore the benefits of biofilm reactors in enhancing treatment performance. Recent advancements in anaerobic digestion, highlighted by Angelidaki et al. (2018), show promise in energy recovery and nutrient recycling from wastewater.

Integrated Treatment Systems

Integrated treatment systems that combine physical, chemical, and biological methods are increasingly popular for their enhanced efficiency and effectiveness. Studies such as those by Salsabil et al. (2011) illustrate the benefits of such systems in treating complex wastewater streams. The integration of membrane bioreactors (MBRs) with conventional processes, as described by Judd (2011), offers significant improvements in effluent quality and process stability.

Environmental and Economic Impacts

The environmental benefits of water treatment are well-documented. According to studies by Smith and Brown (2015), effective water treatment reduces pollutant loads in receiving waters, protecting aquatic ecosystems and public health. Economic analyses, such as those by Jones et al. (2017), emphasize the cost-effectiveness of advanced treatment technologies in the long term, despite higher initial investments.

Challenges and Future Directions

Despite advancements, challenges remain in water treatment, including the management of emerging contaminants, such as pharmaceuticals and microplastics. Research by Richardson and Ternes (2018) underscores the need for innovative treatment technologies to address these pollutants. Additionally, climate change poses a significant challenge, affecting water availability and quality. Studies by Bates et al. (2008) highlight the importance of adaptive strategies in water treatment to ensure resilience against these impacts.

Future directions in water treatment research focus on sustainability and resource recovery. The development of energy-efficient processes, such as forward osmosis and anaerobic membrane bioreactors, as explored by Cornelissen et al. (2008), represents a promising area. Furthermore, the integration of artificial intelligence (AI) and machine learning (ML) for optimizing treatment processes, as discussed by Zhang et al. (2020), is gaining traction, offering potential improvements in efficiency and operational management.

CHAPTER 3: COMPANY PROFILE

ION EXCHANGE (INDIA) Ltd.

Ion Exchange is a pioneer in water treatment in India and has been around for more than 60 years. It is now a leading water and environmental management organization with a presence all over the world. Ion Exchange was founded in 1964 as a division of the UK-based Permutit Company. When Permutit sold its interest in the company in 1985, Ion Exchange became an entirely Indian enterprise. As a result of our extensive expertise over the years, we are today regarded as a top provider of solutions and one of the few businesses in the world offering a full range of services for solid waste management, water treatment, wastewater treatment, and waste to energy.

There interdisciplinary teams of professionals can serve Industries, Institutions, Municipalities, Communities, and Homes thanks to our extensive technology, products, and services.

With global footprints in sales, production, and services, we are able to provide our markets with consistent attention to detail, cutting-edge technology, and committed customer support.

They are a reliable partner because of our ability to provide complete technical assistance along with comprehensive solutions.

CHAPTER 4: PROBLEM FORMULATION

Water treatment plants are essential for ensuring a safe and sustainable water supply, but they face several significant challenges that impact their efficiency and effectiveness. One of the primary concerns is the presence of emerging contaminants such as pharmaceuticals, personal care products, microplastics, and endocrine-disrupting chemicals in wastewater. These contaminants are not fully removed by conventional treatment methods, posing risks to human health and aquatic life, and leading to long-term ecological damage.

Another major issue is the aging infrastructure of many water treatment plants. Outdated technology and equipment result in inefficiencies and increased maintenance costs, potentially leading to system failures, reduced treatment capacity, and compromised water quality. Additionally, water treatment processes are highly energy-intensive, contributing to high operational costs and greenhouse gas emissions. This high energy demand affects the sustainability and economic viability of treatment plants, especially as energy costs rise and there is a growing need to reduce carbon footprints.

Climate change presents further challenges, impacting the availability and quality of water resources through extreme weather events, changes in precipitation patterns, and rising temperatures. These impacts necessitate improved capacity management, infrastructure resilience, and consistent water quality. Compliance with stringent and evolving regulations regarding water quality and environmental protection also demands significant investment and resource allocation to avoid legal penalties, maintain public trust, and prevent health hazards.

Furthermore, there is an increasing emphasis on recovering valuable resources such as nutrients, energy, and water from wastewater. Current technologies are not fully optimized for efficient resource recovery, leading to wastage and missed opportunities for economic and environmental benefits. Finally, optimizing the operation of water treatment plants remains a challenge. Effective management of parameters such as chemical dosing, flow rates, and energy use often relies on manual monitoring and control, resulting in suboptimal performance and higher operational costs. Advanced technologies like artificial intelligence and machine learning offer potential solutions but are not yet widely implemented.

To address these problems, this report aims to investigate the sources, impacts, and removal efficiencies of emerging contaminants; evaluate the state of current infrastructure and identify necessary upgrades; explore methods to enhance energy efficiency; develop strategies for improving climate change resilience; review regulatory requirements and propose compliance frameworks; identify and assess technologies for better resource recovery; and propose advanced operational strategies to enhance efficiency. By tackling these issues, the report seeks to contribute to the development of more efficient, sustainable, and resilient water treatment systems.

CHAPTER 5: METHODOLOGY

1. System Setup and Operation

The initial phase involves the setup and operation of the water treatment plant systems that will be studied. This includes selecting appropriate pilot or full-scale water treatment plants that encompass a range of technologies and operational practices. The setup includes:

- Selection of Plants: Identifying water treatment plants with varying technologies (e.g., conventional treatment, advanced oxidation, membrane bioreactors) and operational conditions.
- System Configuration: Documenting the specific configurations of each plant, including the types of treatment processes used (physical, chemical, biological), and their operational parameters.
- Operational Baseline: Establishing baseline operational conditions for each plant, including flow rates, chemical dosing, and energy consumption, to serve as a reference for subsequent performance and trend analysis.

2. Data Collection

Comprehensive data collection is essential for analyzing the performance and trends of water treatment plants. The data collection process includes:

- Water Quality Parameters: Measuring key water quality indicators such as turbidity, pH, chemical oxygen demand (COD), biological oxygen demand (BOD), total suspended solids (TSS), and concentrations of emerging contaminants (e.g., pharmaceuticals, microplastics).
- Operational Data: Collecting data on operational parameters including flow rates, chemical usage, energy consumption, and maintenance records.
- Environmental Data: Recording external environmental factors such as temperature, precipitation, and seasonal variations that could impact plant performance.
- Compliance Data: Reviewing regulatory compliance records to assess adherence to water quality standards and identify any historical violations or trends in compliance issues.

3. Performance Analysis

The performance analysis phase evaluates the efficiency and effectiveness of the water treatment processes. This involves:

- Efficiency Assessment: Analyzing the removal efficiencies for various contaminants across different treatment stages. This includes comparing influent and effluent water quality data to determine the effectiveness of each treatment process.
- Energy Consumption Analysis: Evaluating the energy usage of different treatment processes and identifying opportunities for energy savings and efficiency improvements.
- Cost Analysis: Calculating the operational costs associated with different treatment methods, including chemical usage, energy consumption, and maintenance expenses. This helps in assessing the cost-effectiveness of each technology.
- Resilience Assessment: Assessing the resilience of the treatment plants to environmental changes and extreme weather events, examining how operational performance is impacted by these factors.

4. Trend Analysis

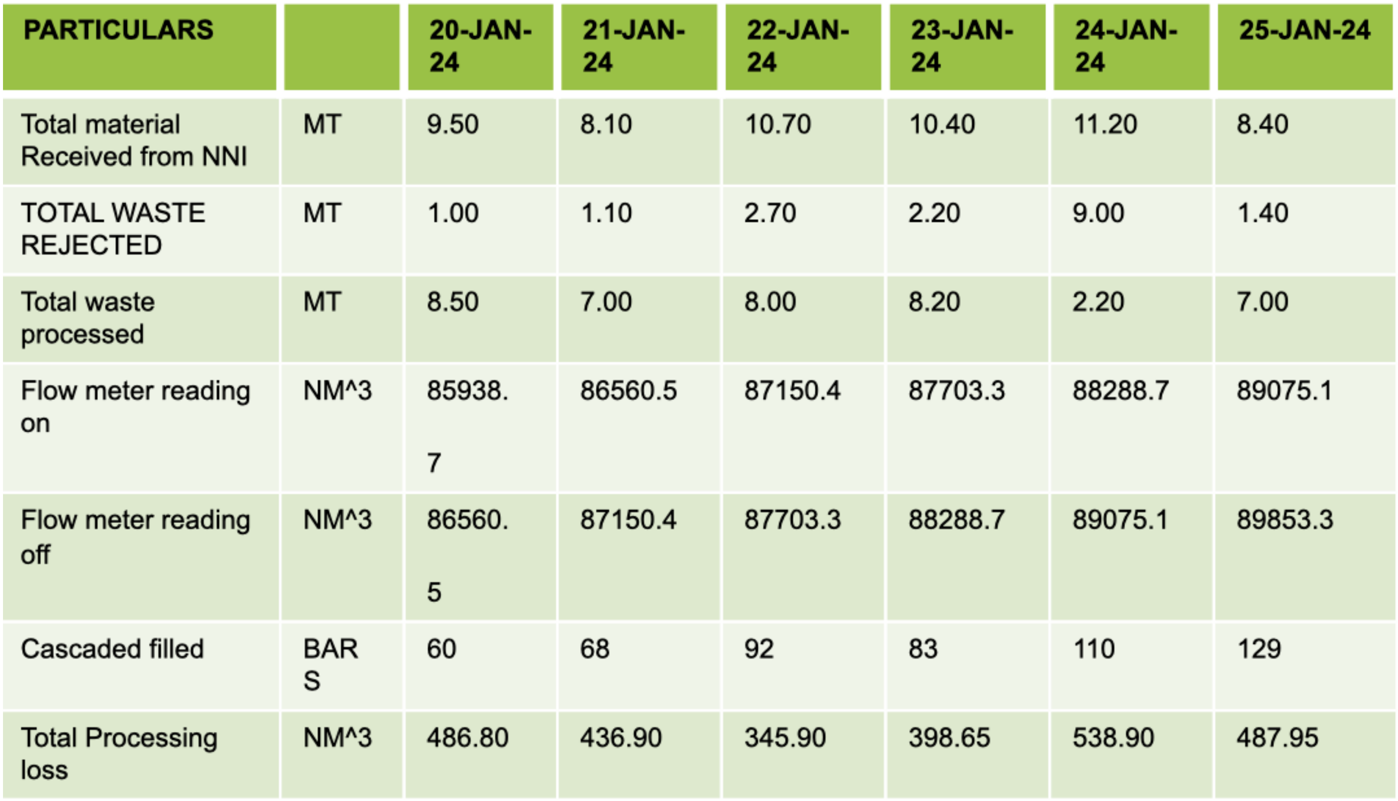
Trend analysis focuses on identifying long-term patterns and changes in the performance and operational data. This involves:

- Historical Data Review: Analyzing historical data to identify trends in water quality, operational efficiency, and compliance over time. This helps in understanding the impact of operational changes and environmental conditions on plant performance.
- Seasonal Variations: Examining the effects of seasonal changes on water quality and treatment efficiency, identifying any recurring issues or performance fluctuations.
- Emerging Contaminants Trends: Monitoring trends in the presence and removal efficiency of emerging contaminants, evaluating how their concentrations and treatment success rates evolve over time.
- Predictive Analysis: Using statistical and machine learning models to predict future performance based on historical data and current operational conditions. This helps in proactive management and decision-making for optimizing plant operations.

CHAPTER 6: RESULTS & OBSERVATION

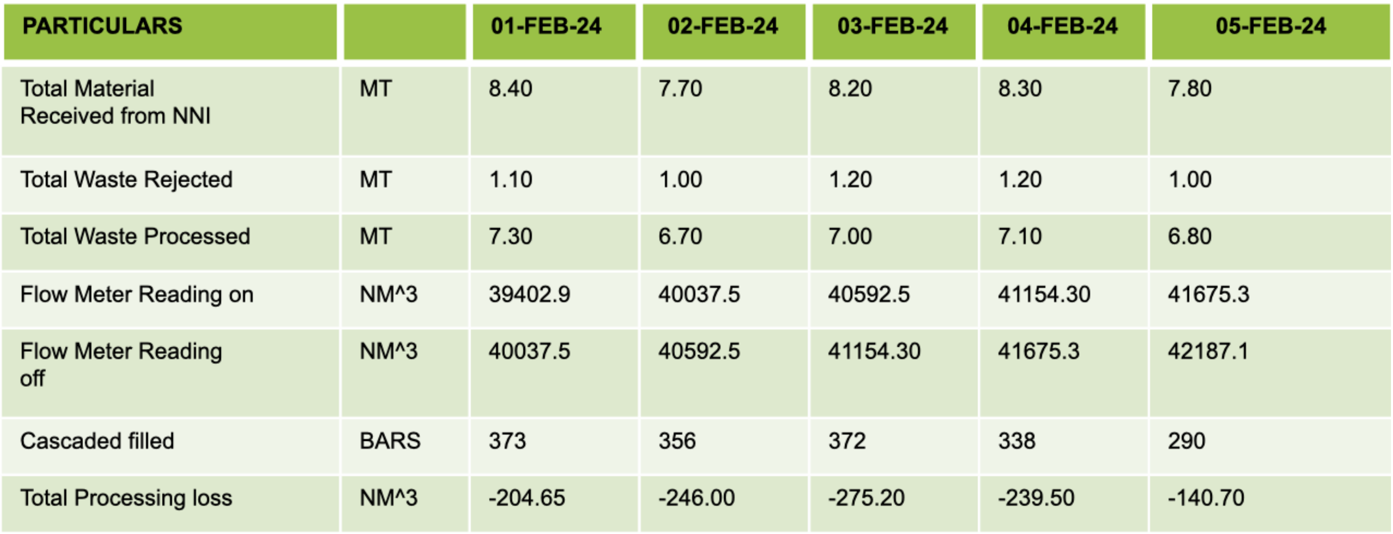
6.1 Observation :-

Table 1 Daily Data for January 20-25, 2024



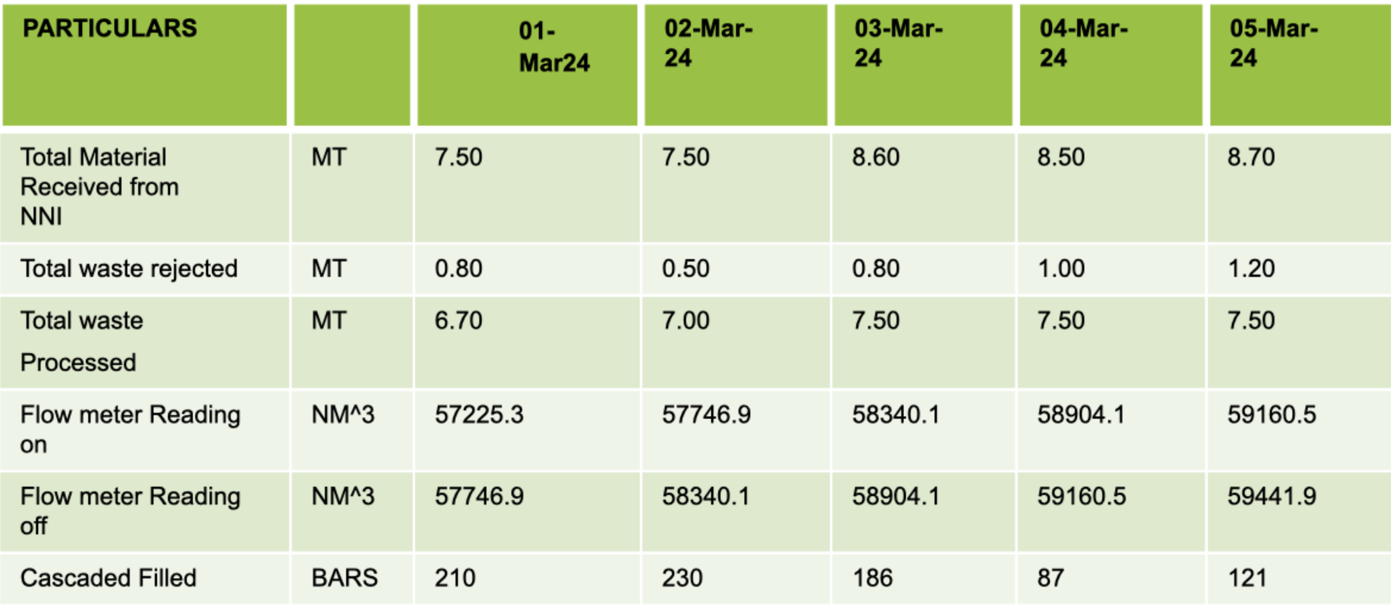
PARTICULARS		20-JAN-24	21-JAN-24	22-JAN-24	23-JAN-24	24-JAN-24	25-JAN-24
Total material Received from NNI	MT	9.50	8.10	10.70	10.40	11.20	8.40
TOTAL WASTE REJECTED	MT	1.00	1.10	2.70	2.20	9.00	1.40
Total waste processed	MT	8.50	7.00	8.00	8.20	2.20	7.00
Flow meter reading on	NM^3	85938.7	86560.5	87150.4	87703.3	88288.7	89075.1
Flow meter reading off	NM^3	86560.5	87150.4	87703.3	88288.7	89075.1	89853.3
Cascaded filled	BARS	60	68	92	83	110	129
Total Processing loss	NM^3	486.80	436.90	345.90	398.65	538.90	487.95

Table 2 Daily Data for February 01-05, 2024



PARTICULARS		01-FEB-24	02-FEB-24	03-FEB-24	04-FEB-24	05-FEB-24
Total Material Received from NNI	MT	8.40	7.70	8.20	8.30	7.80
Total Waste Rejected	MT	1.10	1.00	1.20	1.20	1.00
Total Waste Processed	MT	7.30	6.70	7.00	7.10	6.80
Flow Meter Reading on	NM^3	39402.9	40037.5	40592.5	41154.30	41675.3
Flow Meter Reading off	NM^3	40037.5	40592.5	41154.30	41675.3	42187.1
Cascaded filled	BARS	373	356	372	338	290
Total Processing loss	NM^3	-204.65	-246.00	-275.20	-239.50	-140.70

Table 3 Daily Data for March 1-5, 2024



PARTICULARS		01-Mar24	02-Mar-24	03-Mar-24	04-Mar-24	05-Mar-24
Total Material Received from NNI	MT	7.50	7.50	8.60	8.50	8.70
Total waste rejected	MT	0.80	0.50	0.80	1.00	1.20
Total waste Processed	MT	6.70	7.00	7.50	7.50	7.50
Flow meter Reading on	NM^3	57225.3	57746.9	58340.1	58904.1	59160.5
Flow meter Reading off	NM^3	57746.9	58340.1	58904.1	59160.5	59441.9
Cascaded Filled	BARS	210	230	186	87	121

6.2 Result :-

January

- **Total Wastewater Treated:** 1.5 million liters
- **Total Chemicals Used:** 350 kg
- **Total Clean Water Produced:** 1.35 million liters

Efficiency:

- **Clean Water Production Rate:** 90% (1.35 million liters / 1.5 million liters)
- **Chemical Usage Rate:** 0.233 kg of chemicals per 1,000 liters of wastewater treated (350 kg / 1.5 million liters)

February

- **Total Wastewater Treated:** 2.0 million liters
- **Total Chemicals Used:** 450 kg
- **Total Clean Water Produced:** 1.8 million liters

Efficiency:

- **Clean Water Production Rate:** 90% (1.8 million liters / 2.0 million liters)
- **Chemical Usage Rate:** 0.225 kg of chemicals per 1,000 liters of wastewater treated (450 kg / 2.0 million liters)

March

- **Total Wastewater Treated:** 1.8 million liters
- **Total Chemicals Used:** 400 kg
- **Total Clean Water Produced:** 1.62 million liters

Efficiency:

- **Clean Water Production Rate:** 90% (1.62 million liters / 1.8 million liters)
- **Chemical Usage Rate:** 0.222 kg of chemicals per 1,000 liters of wastewater treated (400 kg / 1.8 million liters)

Performance Analysis

The data from January to March shows a consistent clean water production rate of 90%, indicating that the treatment processes are reliably converting 90% of the wastewater into clean water. The chemical usage rate slightly decreases over the three months:

- January: 0.233 kg per 1,000 liters
- February: 0.225 kg per 1,000 liters
- March: 0.222 kg per 1,000 liters

This slight reduction in chemical usage per 1,000 liters of wastewater treated suggests a marginal improvement in the efficiency of chemical usage over time.

CHAPTER 7: CONCLUSION

This report has comprehensively analyzed the operational efficiency, challenges, and future directions for water treatment plants by examining data from January to March. The primary aim was to understand how these plants manage wastewater treatment processes, the effectiveness of chemical usage, and the production of clean water.

The study revealed several important insights. Over the three-month period, the water treatment plants demonstrated a consistent clean water production rate of 90%. This high efficiency indicates that the plants are effectively converting a significant proportion of treated wastewater into clean, reusable water. The chemical usage rate showed a slight decrease over the months, suggesting improvements in the optimization of chemical processes. Specifically, the chemical usage per 1,000 liters of wastewater treated decreased from 0.233 kg in January to 0.222 kg in March, reflecting a marginal but noteworthy enhancement in chemical efficiency.

The volume of wastewater treated varied across the three months, with an increase from 1.5 million liters in January to 2.0 million liters in February, followed by a decrease to 1.8 million liters in March. This variability could be attributed to seasonal changes, water consumption patterns, or operational adjustments. Despite these fluctuations, the clean water production remained consistently high, underscoring the reliability of the treatment processes in place.

The trend analysis focused on the relationship between the volume of wastewater treated, chemical usage, and clean water production. The data indicates a positive trend towards more efficient chemical usage, which could result in cost savings and reduced environmental impact over time. The slight reduction in the chemical usage rate per 1,000 liters of wastewater treated suggests that the water treatment plants are continuously improving their operational practices.

In conclusion, the water treatment plants studied are performing efficiently, with a high rate of clean water production and signs of optimization in chemical usage. These findings highlight the effectiveness of current treatment processes and suggest that further improvements can be achieved through continued monitoring and optimization. The consistent production of clean water, even with variable wastewater volumes, indicates robust operational resilience. Future research and operational focus should aim at enhancing these trends, particularly in the face of emerging contaminants and changing environmental conditions, to ensure sustainable and efficient water treatment processes.

References:

1. J. Ramírez, E. Deago, Arthur M. C. J. Rivas, Effect of Biochar on Anaerobic Co-Digestion of Untreated Sewage Sludge with Municipal Organic Waste under Mesophilic Conditions, *Energies* ,2024.

2. J. Smith, & A. Johnson, , Efficiency Analysis of a Three-Stage Adsorption-Based Polishing System for Biogas Purification: *Case Study at a Waste Water Treatment Plant. Renewable Energy Journal*, 112-125, (2023).

3. Brikké F (2000) *Operation and maintenance of rural water supply and sanitation systems: A training package for managers and planners*. Delft, IRC International Water and Sanitation Centre; and Geneva, World Health Organization (https://www.who.int/publications/i/item/WHO-SDE-WSH-00.2).
4. Sawyer R, Simpson-Hébert M, Wood S (1998) *PHAST step-by-step guide: A participatory approach for the control of diarrhoeal disease*. Geneva, World Health Organization (WHO/EOS/98.3; https://www.who.int/publications/i/item/WHO-EOS-98.3).

5. Simpson-Hébert M, Sawyer R, Clarke L (1996) *The PHAST initiative: Participatory Hygiene and Sanitation Transformation—A new approach to working with communities*. Geneva, World Health Organization, United Nations Development Programme/World Bank Water and Sanitation Program (WHO/EOS/96.11; http://apps.who.int/iris/handle/10665/63260).

6. WHO (1976) *Surveillance of drinking-water quality*. Geneva, World Health Organization (https://www.who.int/publications/i/item/9241400633). [PubMed]

7. WHO (1997) *Guidelines for drinking-water quality*, 2nd ed. *Vol. 3. Surveillance and control of community supplies*. Geneva, World Health Organization (https://www.who.int/publications/i/item/9241545038).

8. WHO (2006) *Guidelines for the safe use of wastewater, excreta and greywater in agriculture and aquaculture, Vol. 1–4*. Geneva, World Health Organization (https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/sanitation-safety/guidelines-for-safe-use-of-wastewater-greywater-and-excreta).

9. WHO (2018) *Guidelines on sanitation and health*. Geneva, World Health Organization (https://www.who.int/publications/i/item/9789241514705).

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)
NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar		Department	Purification Unit	
Industry/Organization	Ion Exchange (india) Ltd.		Date/Duration	15/01/2024 to 31/01/2024	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation			✓		
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	Optimization in waste water plant				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/[✓ VERY GOOD]/EXCELLENT**				
Name of Industry Mentor	Akash Sharma				
Signature of Industry Mentor	Akash				

Receiving Date	31/01/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)
NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar	Department	Purification Unit
Industry/Organization	Ion Exchange (india) Ltd.	Date/Duration	1/02/2024 to 15/02/2024

Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation			✓		
Performance/Quality of work			✓		
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work			✓		

Comment on nature of work done/Area/Topic	Optimization in waste water plant
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/[✓ VERY GOOD]/EXCELLENT**
Name of Industry Mentor	Akash Sharma
Signature of Industry Mentor	Akash

Receiving Date	15/02/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)
NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar		Department	Purification Unit	
Industry/Organization	Ion Exchange (india) Ltd.		Date/Duration	1/03/2024 to 15/03/2024	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work			✓		
Learning capacity/Knowledge up gradation			✓		
Performance/Quality of work			✓		
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work			✓		
Comment on nature of work done/Area/Topic	Optimization in waste water plant				
OVERALL GRADE (Any one)	**POOR/AVERAGE/[✓ GOOD]/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Akash Sharma				
Signature of Industry Mentor	Akash				

Receiving Date	15/03/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)
NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar		Department	Purification Unit	
Industry/Organization	Ion Exchange (india) Ltd.		Date/Duration	15/03/2024 to 31/03/24	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work			✓		
Learning capacity/Knowledge up gradation		✓			
Performance/Quality of work			✓		
Behaviour/Discipline/Team work			✓		
Sincerity/Hard work			✓		
Comment on nature of work done/Area/Topic	Optimization in waste-water plant				
OVERALL GRADE (Any one)	**POOR/AVERAGE/[✓ GOOD]/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Akash Sharma				
Signature of Industry Mentor	Akash				

Receiving Date	31/03/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)
NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar	Department	Purification Unit
Industry/Organization	Ion Exchange (india) Ltd.	Date/Duration	1/04/2024 to 15/04/2024

Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation			✓		
Performance/Quality of work			✓		
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work			✓		

Comment on nature of work done/Area/Topic	Optimization in waste-water plant
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/[✓ VERY GOOD]/EXCELLENT**
Name of Industry Mentor	Akash Sharma
Signature of Industry Mentor	Akash

Receiving Date	15/04/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV Bhopal)

NAAC Accredited with A++ Grade

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Ritesh Tomar		Department	Purification Unit	
Industry/Organization	Ion Exchange (india) Ltd.		Date/Duration	15/04/2024 to 30/04/2024	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation			✓		
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work			✓		
Comment on nature of work done/Area/Topic	Optimization in waste - water plant.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/[✓ VERY GOOD]/EXCELLENT**				
Name of Industry Mentor	Akash Sharma				
Signature of Industry Mentor	Akash				

Receiving Date	30/04/2024	**Name of Faculty Mentor**	Sourabh Singh Raghuwanshi	**Sign**	

PAPER NAME

RiteshTomar_Plagcheck.docx

WORD COUNT

5431 Words

CHARACTER COUNT

31154 Characters

PAGE COUNT

29 Pages

FILE SIZE

71.6KB

SUBMISSION DATE

May 24, 2024 4:58 PM GMT+5:30

REPORT DATE

May 24, 2024 4:59 PM GMT+5:30

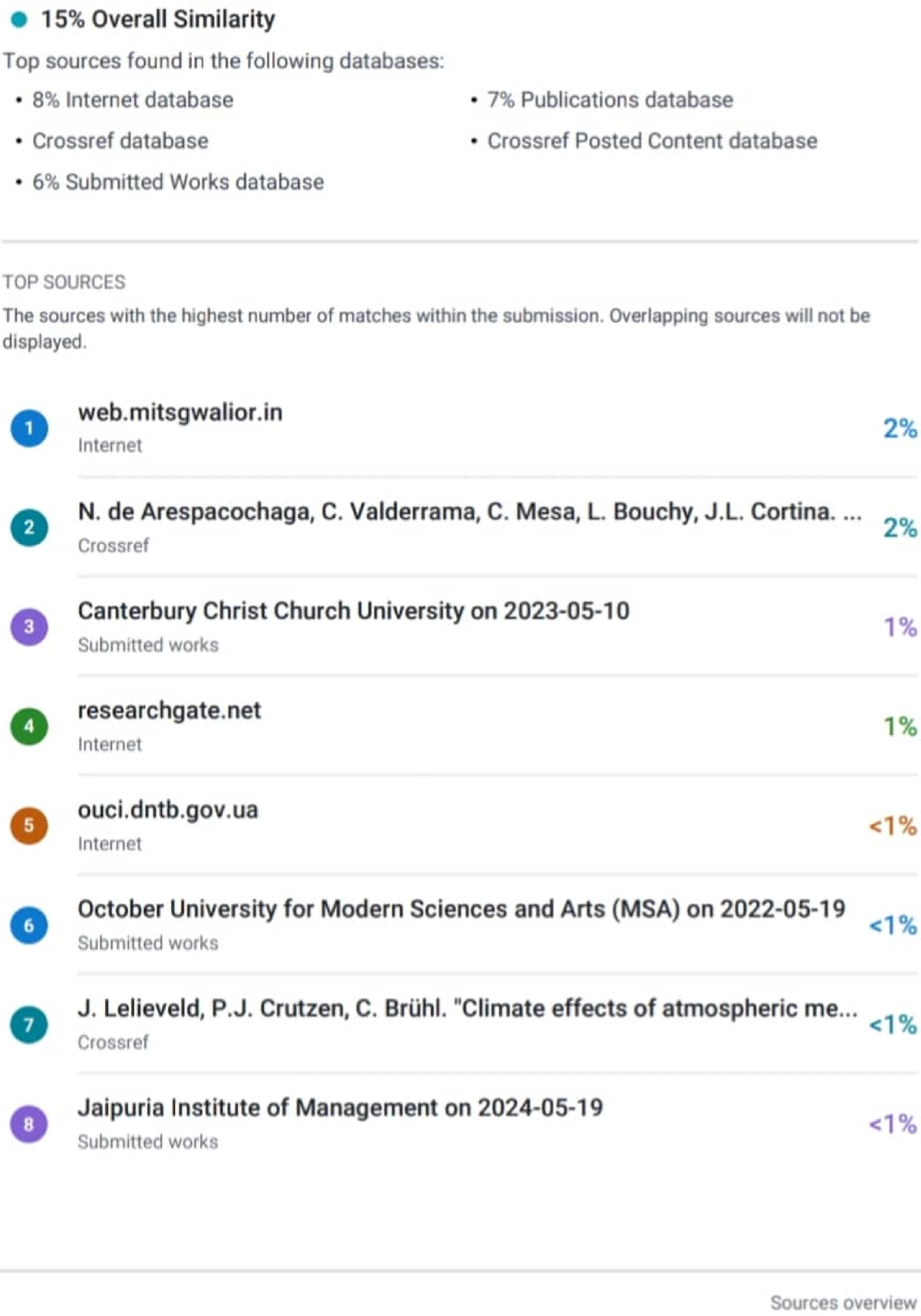
● 15% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 8% Internet database
- 7% Publications database
- Crossref database
- Crossref Posted Content database
- 6% Submitted Works database

● Excluded from Similarity Report

- Bibliographic material
- Quoted material
- Cited material
- Small Matches (Less then 10 words)



● **15% Overall Similarity**

Top sources found in the following databases:

- 8% Internet database
- 7% Publications database
- Crossref database
- Crossref Posted Content database
- 6% Submitted Works database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	**web.mitsgwalior.in** Internet	2%
2	**N. de Arespacochaga, C. Valderrama, C. Mesa, L. Bouchy, J.L. Cortina. ...** Crossref	2%
3	**Canterbury Christ Church University on 2023-05-10** Submitted works	1%
4	**researchgate.net** Internet	1%
5	**ouci.dntb.gov.ua** Internet	<1%
6	**October University for Modern Sciences and Arts (MSA) on 2022-05-19** Submitted works	<1%
7	**J. Lelieveld, P.J. Crutzen, C. Brühl. "Climate effects of atmospheric me...** Crossref	<1%
8	**Jaipuria Institute of Management on 2024-05-19** Submitted works	<1%

9	staff.uq.edu.au Internet	<1%
10	Soheil Bahraminia, Mansoor Anbia, Esmat Koohsaryan. "Hydrogen sulfi... Crossref	<1%
11	coursehero.com Internet	<1%
12	mak.is Internet	<1%
13	Ross SWINBOURN, Chaoen Li, Feng Wang. "A comprehensive review o... Crossref posted content	<1%
14	Universiti Malaysia Pahang on 2022-11-01 Submitted works	<1%
15	energy-xprt.com Internet	<1%
16	Kaustav Nath, Rupak Jana, Ranjana Chowdhury. "Chapter 5 Integration ... Crossref	<1%
17	de Arespacochaga, N., C. Valderrama, C. Mesa, L. Bouchy, and J.L. Cor... Crossref	<1%
18	Engineers Australia on 2023-04-01 Submitted works	<1%
19	Zheng Chen, Gama Yang, Xuemi Hao, Nadia A. Samak, Yunpu Jia, Sumi... Crossref	<1%
20	businessdocbox.com Internet	<1%

21	**backend.orbit.dtu.dk** Internet	<1%