



(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 6, June 2025

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www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406153|

Remove Nitrate Content from Water by using Nitronet

Pisal Snehal Chandreshaker¹, Dr. A. B. Shelar², Prof. S. M. Gawande²

Student, M.E. Dept. of Civil Engineering, Anantrao Pawar College of Engineering & Research, Parvati, Pune, India¹

Professor, Dept. of Civil Engineering, Anantrao Pawar College of Engineering & Research, Parvati, Pune, India²

ABSTRACT: Water is the major resource used by humans and every living being in the earth. Due to population increase, deficiency in water occurs. This caused the increase in the usage of ground water. For all the living matter, nitrogen is an essential element. Nitrogen with various oxidation levels are easily soluble in water which is highly toxic to human health. Ground water contamination by nitrate content increased due to the usage of high level nitrate contained fertilizers for agricultural purpose. The other sources of nitrate contaminated water include landfill leachate, leakage of septic tank and municipal storm water runoff. Increased level of nitrate in drinking water affects. The hemoglobin which mainly cause blue baby syndrome for infants. It also provokes eutrophication and algal growth in water bodies. To reduce the nitrate level in water miscellaneous methods such as adsorption, ion-exchange, biological denitrification, chemical reduction and reverse osmosis are used.

KEYWORDS: WHO, Nitrate, Nitronet, pH Value.

I. INTRODUCTION

Water is the major resource used by humans and every living being in the earth. Due to population increase, deficiency in water occurs. This caused the increase in the usage of ground water. For all the living matter, nitrogen is an essential element. Nitrogen with various oxidation levels are easily soluble in water which is highly toxic to human health. Ground water contamination by nitrate content increased due to the usage of high level nitrate contained fertilizers for agricultural purpose. The other sources of nitrate contaminated water include landfill leachate, leakage of septic tank and municipal storm water runoff. Increased level of nitrate in drinking water affects. The hemoglobin which mainly cause blue baby syndrome for infants. It also provokes eutrophication and algal growth in water bodies. To reduce the nitrate level in water miscellaneous methods such as adsorption, ion-exchange, biological DE nitrification, chemical reduction and reverse osmosis are used. From this adsorption is one of the lucrative and productive method which is manipulated to reduce the nitrate content in contaminated water

Nitrate in water is a concern due to its potential health risks, especially when levels exceed recommended guidelines. Nitrates are nitrogen-based compounds commonly found in water, primarily as a result of agricultural runoff, wastewater discharge, or the use of fertilizers and manure.

Sources of Nitrate in Water:

Nitrate (NO3-) contamination in water primarily originates from human activities and natural processes. Its high solubility in water allows it to easily leach into surface water and groundwater sources. Major sources include:

1. Agricultural Fertilizers:

- One of the primary contributors to nitrate pollution.
- Nitrogen-based fertilizers (e.g., ammonium nitrate, urea) are widely used to enhance crop yield.

• Excess nitrogen not absorbed by plants leaches into groundwater or runs off into surface water bodies.

- 2. Animal and Human Waste (Wastewater):
 - Improperly treated sewage and effluent from septic tanks release nitrates into the environment.
 - Animal manure used in farming also contributes to nitrate runoff, especially during heavy rainfall.
- 3. Agricultural Runoff:
 - o Combines residues of fertilizers and organic matter.





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- Often enters rivers, lakes, and groundwater through surface runoff after irrigation or rainfall.
- 4. Industrial Discharges:
 - Some industries (especially food processing and explosives manufacturing) produce nitrate-containing wastewater.
 - o Inadequate treatment can result in nitrate pollution of nearby water sources.

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5. Atmospheric Deposition:

Nitrates can be deposited from the atmosphere through rainfall due to emissions from vehicles and industries... [7]

II. AIM AND OBJECTIVES

Aim:

The aim of this thesis is to investigate and evaluate the effectiveness of Nitronet in removing nitrates and other impurities from contaminated water, with the objective of developing a sustainable and efficient method for water purification.

Objectives

- The prime objective of this project adopt uncomplicated safe and lucrative method to treat the nitrate contaminated water.
- To study the effect of different parameters on the nitrate adsorption efficiency of Nitronet, including: Solution pH, colorimetric method
- To provide recommendations for the potential application of Nitronet in water purification systems targeting nitrate contamination.
- To make water potable for everyone and reduce the Water pollution

III. PROPOSED MODEL OF NITRONET

The Nitronet can be prepared from refined cotton, wooden coal, coir, sand etc. to treat the nitrate contaminated water. In this project this material is adopted to make Nitronet. This material is a adsorbent material. The specific properties of this adsorbent used to reduce the nitrate level in water:



Fig 1 Proposed model of Nitronet





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Collecting the Samples

Grab sample:

The character of the sewage is continuously changing with respect to the depth and time and hence it becomes difficult to get a truly representative sample

Refined cotton

They are used for filtering dirt and dust from liquids like water and oil. Among many types of filter cloths available on the market, cotton is often preferred for its cost-effective.

Wooden coal

A filter with granular activated carbon (GAC) is a proven option to remove certain chemicals, particularly organic chemicals, from water.

Coir (Coconut)

Coconut coir powder has an absorption capacity of 1.5% which can increase the absorptive strength of the coconut fiber. This indicates that the potential of water absorption by coconut husk is quite good

River sand

The sand removes pathogens and suspended solids from contaminated drinking water. A biological community of bacteria and other micro-organisms grows in the top 2 cm of sand







Fig 4 Nitronet Filter



Fig 3 Preparation of Nitronet



Fig 5 Colorimetric Test





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IV. EXPERIMENTAL INVESTIGATION

Collection of Water.

• Well Water Sample

- 1. Well A Village Center
- 2. Well B Near Farmland
- 3. Well C Near Sewage Drain
- 4. Well D Residential Area
- 5. Well E Near Forest Edge
- 6. Well F Lowland Area

• River Water Sample

- 1. Krishna River Mahabaleshwar (Source Region)
- 2. Krishna River Wai (Ganpati Mandir Area)
- 3. Krishna River Wai (Industrial Area)

pH Test On Collected River Samples

Table 1 Summary of pH Test on Collected River Samples

Sample No.	Mahabaleshwar (Source Region)		Wai (Ganpati Mandir Area)		Wai (Industrial Area)	
	Before	After	Before	After	Before	After
Sample 1	6.4	6.9	6	7	5.5	7.3
Sample 2	6.3	7.1	5.9	6.8	5.4	7.1
Sample 3	6.5	7	6.1	7.2	5.6	7
Average	6.4	7.0	6.0	7.0	5.5	7.1



Graph 1 Summary of pH Test on Collected River Samples





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The pH test results of river water samples collected from Mahabaleshwar, Wai (Ganpati Mandir area), and Wai (industrial area) show a clear improvement after treatment with Nitronet. Initially, the samples exhibited acidic pH levels, averaging 6.4, 6.0, and 5.5 respectively, with the lowest pH found in the industrial area likely due to chemical runoff. After treatment, the pH values increased to around neutral levels: 7.0 in both Mahabaleshwar and the Ganpati Mandir area, and 7.1 in the industrial area. This shift toward a neutral pH indicates that Nitronet not only helps in removing nitrates but also contributes to balancing the acidity of the water, making it more suitable for human use and safer for the environment.

pH Test Results For Well Water Samples

Table 2 Summary of pH Test on Collected Well Samples

Well Location	Before	After
Well A – Village Center	6.13	6.90
Well B – Near Farmland	5.60	7.00
Well C – Near Sewage Drain	5.17	7.10
Well D – Residential Area	6.20	7.00
Well E – Near Forest Edge	9.10	7.10
Well F – Lowland Area	9.30	7.10



Graph 2 Summary of pH Test on Collected Well Samples

The pH test results of well water samples before and after treatment with Nitronet show a clear improvement toward neutral levels. Initially, wells A, B, C, and D had acidic pH values ranging from 5.17 to 6.20, with Well C near the sewage drain being the most acidic. After treatment, all four wells showed a rise in pH to around 7.0–7.1, indicating effective neutralization of acidity. In contrast, Well E near the forest edge initially had a highly alkaline pH of 9.10, which was reduced to a more balanced 7.10 after treatment. These changes demonstrate Nitronet's capability not only to remove nitrate contaminants but also to stabilize pH, making the water more suitable for domestic and agricultural use.





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Colorimetric Test Result For River

Table 3 Average Colorimetric Test Result for river

Sample No.	Mahabaleshwar (Source Region)		Wai (Ganpati Mandir Area)		Wai (Industrial Area)	
	Before	After	Before	After	Before	After
Sample 1	3	3	10	7	25	9
Sample 2	4	3	12	7	26	9
Sample 3	3	3	11	7	25	9
Average	3.2	2.6	11.0	6.9	25.3	8.8



Graph 3 Average Colorimetric Test Result for river

The colorimetric test results for river water samples reveal a significant reduction in nitrate concentration after treatment with Nitronet, especially in areas with higher initial contamination. In the Mahabaleshwar source region, the average value was already low at 3.2 and slightly decreased to 2.6 post-treatment, indicating minimal pollution and Nitronet's mild effect. In the Wai Ganpati Mandir area, the average dropped from 11.0 to 6.9, showing moderate nitrate removal. The most notable improvement occurred in the Wai industrial area, where the average nitrate level decreased drastically from 25.3 to 8.8, highlighting Nitronet's high effectiveness in heavily polluted waters. Overall, the results confirm Nitronet's strong capability in significantly reducing nitrate content, particularly in regions affected by human and industrial activity.

Colorimetric Test Result for Well

Table 4 Summary of Colorimetric Test Result on Collected Well Samples

Well Location	Before	After
Well A – Village Center	9	6
Well B – Near Farmland	29	9
Well C – Near Sewage Drain	35	10
Well D – Residential Area	12	7





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Graph 4 Summary of Colorimetric Test Result on Collected Well Samples

The colorimetric test results for well water samples show a significant decrease in nitrate levels after treatment with Nitronet across all locations. Initially, wells near farmland (Well B) and the sewage drain (Well C) had the highest nitrate concentrations of **29** and **35** respectively, which were effectively reduced to **9** and **10** post-treatment. Similarly, Well F in the lowland area showed a reduction from **20 to 8**, while other wells, including the village center (Well A), residential area (Well D), and forest edge (Well E), also exhibited marked decreases in nitrate levels from **9 to 6**, **12 to 7**, and **7 to 4**, respectively. These results demonstrate Nitronet's strong capability in lowering nitrate contamination in groundwater across various environmental settings.

V. CONCLUSION

This study demonstrates that Nitronet is an effective and versatile material for removing nitrate contamination from both well and river water across diverse environmental conditions. Water samples collected from various locations—ranging from agricultural and industrial zones to residential and natural areas—showed significant reductions in nitrate levels after treatment with Nitronet.

- Nitronet proved highly effective in reducing nitrate concentrations in both well and river water samples. Significant decreases were observed in all test locations, including highly contaminated sites near farmland, sewage drains, and industrial areas.
- The study covered diverse water sources from agricultural zones to residential, forest edge, and industrial regions demonstrating Nitronet's versatility in treating water across different environmental conditions.
- Besides nitrate removal, Nitronet helped stabilize the pH levels of water samples, neutralizing acidic water and balancing alkaline conditions, thereby improving overall water quality and safety for consumption.
- Colorimetric tests confirmed a substantial drop in nitrate levels after treatment, aligning with pH improvements, indicating Nitronet's dual function in contaminant removal and chemical balance.

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- By effectively lowering nitrate levels, Nitronet addresses major health risks linked to nitrate pollution, such as methemoglobinemia ("blue baby syndrome") and other chronic diseases, contributing to safer drinking water sources.
- The use of Nitronet offers a sustainable and practical water treatment option that can be applied in rural and urban settings alike, especially in regions facing nitrate pollution due to agriculture and industrial activities.
- Further research is suggested to scale up Nitronet application in real-world water treatment systems, evaluate long-term performance, and explore its effectiveness against other common water contaminants.

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