Remove Nitrate Content from Water by Using Nitronet

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***Abstract*—Nitrate contamination in water has emerged as a major environmental and public health concern worldwide, particularly in agricultural and industrial regions. Excess nitrate in drinking water is associated with serious health problems such as methemoglobinemia, thyroid disorders, and potential carcinogenic effects. Conventional nitrate removal methods such as reverse osmosis, ion exchange, and biological denitrification are effective but often expensive and maintenance- intensive. This paper presents an in-depth study on the removal of nitrate from water using Nitronet, an advanced anion-exchange-based filtration medium. The study explains the chemistry of nitrate contamination, health impacts, design principles of Nitronet, experimental methodology, performance evaluation, advantages, limitations, regeneration process, cost analysis, and future scope. The results indicate that Nitronet is a cost-effective, efficient, and sustainable solution for nitrate removal, especially suitable for rural and decentralized water treatment systems.**

***Index Terms*—Nitronet , Nitrate, Environmental**

I. INTRODUCTION

Groundwater is one of the major resources for drinking and agricultural usage. Excessive use of nitrogen fertilizers in agricultural activities have increased the nitrate level in groundwater, which severely affects the health of human beings and this cause methemoglobinemia (MetHb), commonly called as “blue baby syndrome”. 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 is 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 leakage, leakage of septic tank and municipal storm water runoff. Increased level of nitrate in drinking water affects the haemoglobin 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. From this adsorption is one of the lucrative and productive method which is manipulated to reduce the nitrate content in contaminated water.

A. Nitrate

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:

- Agricultural runoff: Fertilizers containing nitrogen can leach into groundwater and surface water, particularly after heavy rainfall.

- Wastewater: Improperly treated sewage or animal waste can contribute nitrates to water sources.
- Industrial processes: Some industrial activities also release nitrates into water bodies.

B. Problem Statement

Nitrate contamination in water sources has become a serious environmental and public health concern due to excessive use of fertilizers, industrial discharge, and improper waste management. High nitrate concentration in drinking water can lead to health problems such as methemoglobinemia (blue baby syndrome) and other water-borne diseases. Conventional water treatment methods are often costly, complex, or inefficient in removing nitrates effectively. Therefore, there is a need to develop a simple, safe, and cost-effective method for removing nitrates and other impurities from contaminated water. In this context, the use of Nitronet as an adsorbent material is investigated to evaluate its efficiency in nitrate removal and to explore its potential application in sustainable water purification systems to make water safe and potable

II. STATE OF DEVELOPMENT

Claudio Della Rocca,Vincenzo Belgiorno, Sureyya Meric (2006)

Overview of in-situ applicable nitrate removal processes - Nitrate contamination of groundwater has became an environmental and health problem in developed and developing countries. Nitrate pollution is caused by the intensive use of nitrogen fertilizers, crop irrigation with domestic wastewater and use of manure, therefore, it is concern of diffuse pollution. The non-point sources of nitrate contamination make really difficult to apply the ex-situ approach to groundwater remediation. Nevertheless, best available technologies to treat nitrate-contaminated water such as reverse osmosis, ion exchange and electrodialysis developed for drinking water production cannot be used in in-situ application, which cause their technological complexity.

Archna, Surinder K. Sharma, And Ranbir Chander Sobti (2011)

Nitrate Removal from Ground Water: A Review - Nitrate contamination of ground water resources has increased in Asia, Europe, United States, and various other parts of the world. This trend has raised concern as nitrates cause methemoglobinemia and cancer. Several treatment processes can remove nitrates from water with varying degrees of efficiency, cost, and ease of operation. Available technical data, experience, and economics indicate that biological denitrification is more acceptable for nitrate removal than reverse osmosis and ion exchange. This paper reviews the developments in the field of nitrate removal processes which can be effectively used for denitrifying ground water as well as industrial water.

N.Sudha, P.Priyadharshini, J.S. Subaranjani, K.Pradeepa (2019)

Removal of nitrate from water by using activated coconut shell charcoal - Groundwater is one of the major resources for drinking and agricultural usage. Excessive use of nitrogen fertilizers in agricultural activities have increased the nitrate level in groundwater, which severely affects the health of human beings and this cause methemoglobinemia (MetHb) commonly called as “blue baby syndrome”. The main aim of this experiment is to develop a cost-effective process, efficient removal of nitrate and eco-friendly

III. PROPOSED MODEL

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.

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

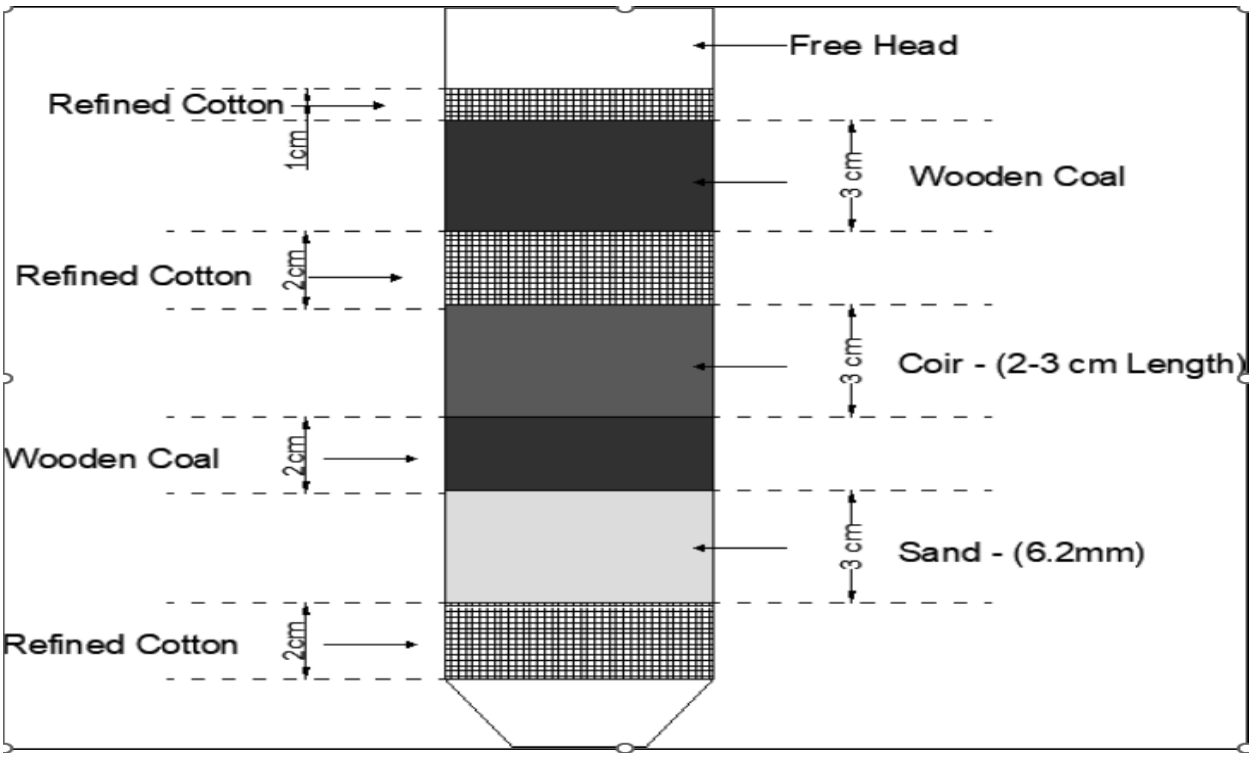


Fig 1 Proposed model of Nitronet

Fig 2 Actual model of Nitronet

Fig 3 Sample Collection

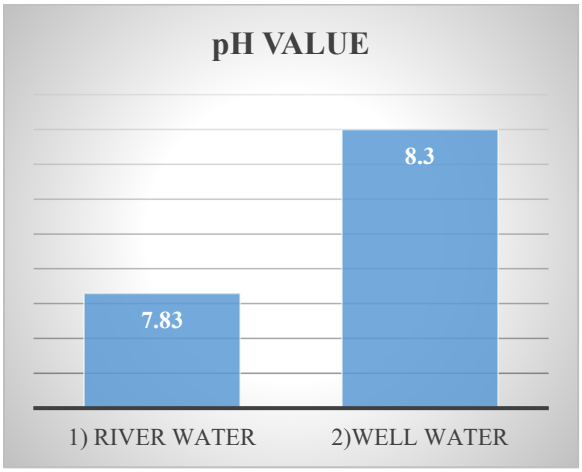
III. EXPERIMENTAL INVESTIGATION

A. pH Test (IS 10500:2012)

Fig 4 pH Meter

Table 1 Result for pH Test

Samples	Test	Actual Value
1) River Water	pH	7.83
2)Well Water	pH	8.3



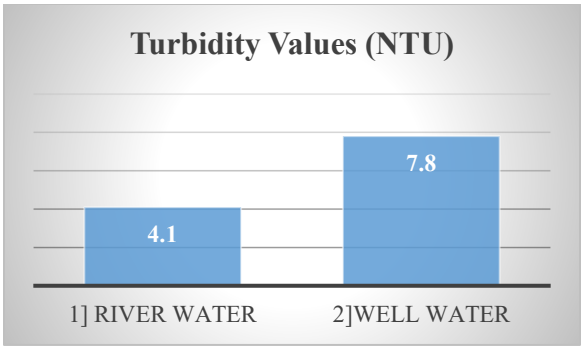
Graph 1 Result for pH Test

pH values of the collected water samples, namely river water and well water. The pH test is an important parameter used to determine the acidity or alkalinity of water. From the results, the pH value of the river water sample is 7.83, while the well water sample shows a pH value of 8.3. Both values indicate that the water samples are slightly alkaline in nature, as they are greater than the neutral pH value of 7.

B. Turbidity Test

Table 2 Result for Turbidity Test

Samples	Test	Turbidity Values (NTU)
1] River water	Turbidity	4.1
2]Well Water	Turbidity	7.8



Graph 2 Result for Turbidity Test

From the results, the turbidity value of the river water sample is 4.1 NTU, while the well water sample shows a higher turbidity value of 7.8 NTU. This indicates that well water contains a greater amount of suspended particles compared to river water.

IV. CONCLUSION

- This study confirms that Nitronet is an effective and reliable material for removing nitrate contamination from both well and river water. Significant reductions in nitrate levels were observed across all sampling locations, demonstrating its strong performance even in highly polluted conditions. Nitronet also contributed to stabilizing pH levels, thereby improving overall water quality.
- Its applicability across diverse environmental settings highlights its versatility and suitability for both rural and urban water treatment. Additionally, by reducing nitrate content, Nitronet helps mitigate serious health risks associated with contaminated water.
- Nitronet presents a sustainable and practical solution for water purification, with potential for large-scale application. Further studies are recommended to assess its long-term performance and broader treatment capabilities.

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APPENDIX – TEST REPORT

saenco

CIN : U74900PN2011PTC140226

TEST REPORT

Customer Information		Sample Details	
M/s. Rajgad Technical Campus A/P. Dhangwadi, Tal.Bhor, Dist Pune.		Sample Type : Sample Location: Sample Drawn by: Sample Quantity: Sample Condition:	River Water River Water After Filte Customer 2 Ltr Properly packed & labelled
Analysis Information		**Report Information**	
Analysis carried out at: Date of Sample Receipt: Analysis Start Date: Analysis End Date:	SAEN Lab 04.03.2026 04.03.2026 06.03.2026	Sample Inward No : Date of Sample collecfion : Report No. : Date of Report :	SAEN/25-26/481-1 04.03.2026 SAEN/TR/25-26/46-55 06.03.2026

Sr.No	Parameters	Result	Unit	Standard Limits	Analysis Method
1	Chemical Oxygen Demand (COD)	12.0	Mg/l	Not applicable	JS 3025 (PART58)2017
2	Nitrate	28.87	Mg/l	Not applicable	APHA 4500 NO3-B

Remarks (If Any): Not Applicable.

Note:

1. Test Report is based on above parameters.
2. Test Results pertain only to the sample tested.
3. The content of Test Report shall not be reproduced / used for advertising or legal use, in pan or full, without wfitten permission.
4. The instruments & equipments used for sampling and analysis are calibrated from NABL Acer. Calibration Laboratory, to maintain NIST Traceability.
5. Laboratory Accredited by NABL with Certificate ID : TC-17318, Valid till dt. 25.12.2029.
6. Laboratory Recognised by MoEF-CC with F. No. LB/99/7/2021-INST LAB-HO-CPCB-HO/PVT/557 dt. 12.06.2025, valid till dt. 30.05.2028.

S A Encon Private

Anantrao Nandaw

For S A Eric Private Limited

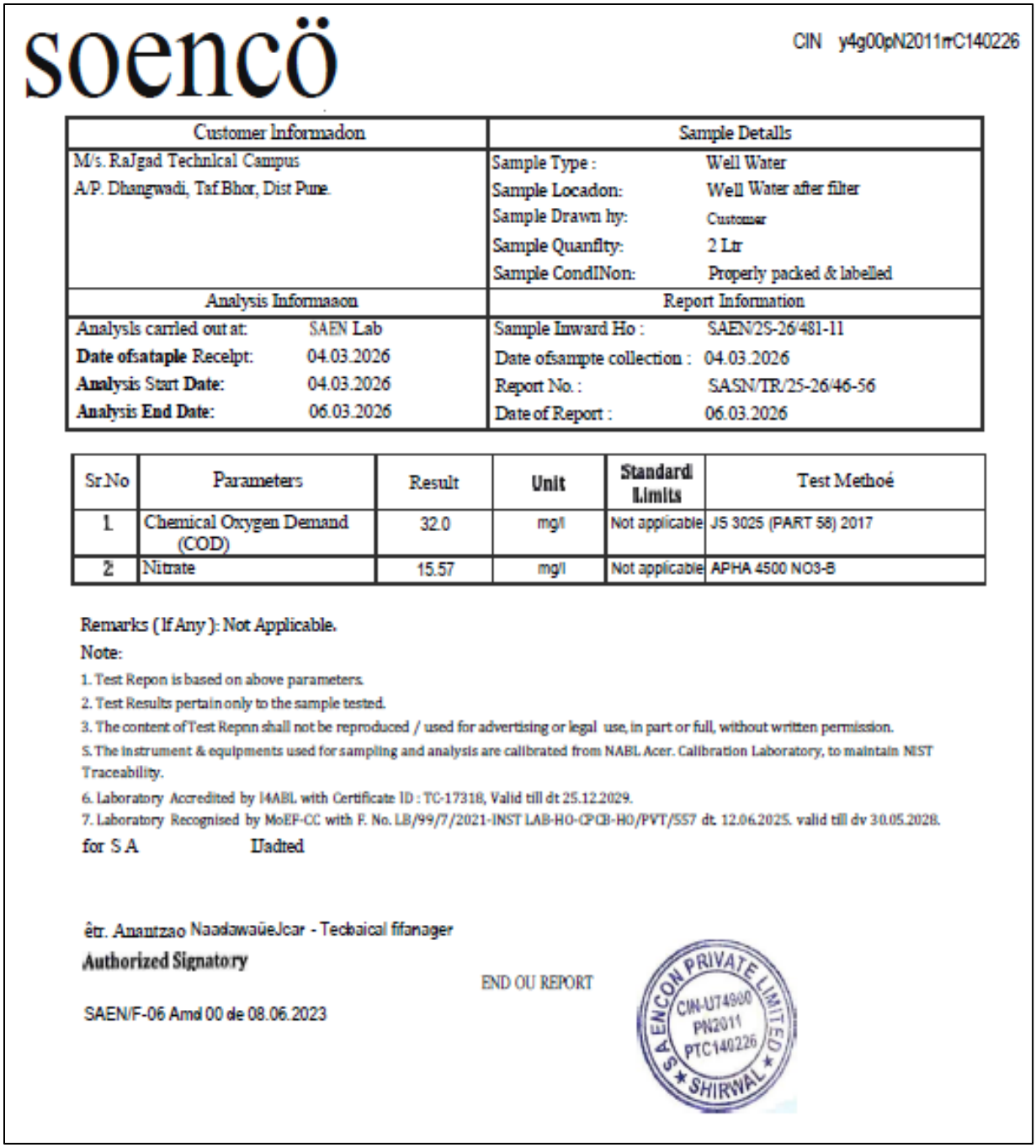
Mr. mo Nandawadekar - Technical Manager
Authorized Signatory

END OF REPORT

SAENCON PRIVATE LIMITED CIN-U74900 PN2011 PTC140226 SHIRWAL

SAEN/F-06 Amd 00 dr 08.06.2023

Fig 5 Test Report 1



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CIN y4g00pN2011rrC140226

Customer Inlormadon	Sample Detalls
M/s. RaJgad Technlcal Campus A/P. Dhangwadi, Taf.Bhor, Dist Pune.	Sample Type : Well Water Sample Locadon: Well Water after filter Sample Drawn hy: Customar Sample Quanflty: 2 Ltr Sample CondlNon: Properly packed & labelled
Analysis Informaaon	**Report Information**
Analysls carrled out at: SAEN Lab **Date ofsataple** Recelpt: 04.03.2026 **Analysis Start Date:** 04.03.2026 **Analysis End Date:** 06.03.2026	Sample Inward Ho : SAEN/2S-26/481-11 Date ofsampte collection : 04.03.2026 Report No. : SASN/TR/25-26/46-56 Date of Report : 06.03.2026

Sr.No	Parameters	Result	Unit	Standard Limits	Test Methoé
1.	Chemical Oxygen Demand (COD)	32.0	mg/l	Not applicable	JS 3025 (PART 58) 2017
2	Nitrate	15.57	mg/l	Not applicable	APHA 4500 NO3-B

Remarks (lf Any): Not Applicable.

Note:

1. Test Repon is based on above parameters.
2. Test Results pertain only to the sample tested.
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Authorized Signatory

END OU REPORT

SAEN/F-06 Amd 00 de 08.06.2023

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Fig 6 Test Report 2