



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

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



Impact Factor: 8.699

Volume 14, Issue 8, August 2025

An Analysis of Fluoride Concentration in Ground Water

Ganga Shy Meena, Naresh Sharma

Associate professor, Department of Chemistry, SCRS Government College of Sawai Mahopur, Rajasthan, India

Professor, Department of Chemistry, Lords University, Alwar, Rajasthan, India

ABSTRACT: Groundwater is a vital resource for drinking and agriculture, especially in arid and semi-arid regions like Wazeerpur Tehsil of Sawai Madhopur district, Rajasthan. However, increasing fluoride contamination poses a serious threat to public health, particularly in rural areas where groundwater is consumed without treatment. This study investigates the concentration of fluoride in groundwater across selected villages in Wazeerpur Tehsil and evaluates the potential of wheat bran—an abundant agricultural by-product—as a low-cost, eco-friendly adsorbent for defluoridation. Water samples were collected following standard protocols and analyzed for key chemical parameters. The findings highlight fluoride levels exceeding the permissible limits in many locations, underscoring the urgent need for sustainable treatment solutions. The use of wheat bran not only presents a viable method for fluoride removal but also addresses waste management challenges, aligning the study with both environmental sustainability and public health improvement. This research thus offers a green and accessible approach to ensuring safe drinking water in fluoride-affected regions.

I. INTRODUCTION

Ground water is an essential source of life in India. Since almost 80 percent of drinking water is provided from groundwater, it is used without purification in rural and many urban areas (veena chaudhary indiawaterportal 2015).

The ground water quality depends on a combination of natural landscape features, such as geology, topography and soils; climate and atmospheric contributions; and human activities related to different land uses and land management practices. Water is such an excellent solvent; it can contain lots of dissolved chemicals. Since ground water moves through rocks and subsurface soil, it has a lot of opportunity to dissolve substances as it moves. For that reason, ground water will often have more dissolved substances than surface water.

Large amounts of water are stored in the ground. The water that is found underground in the cracks and spaces in soil, sand and rock are called ground water. The water is still moving, possibly very slowly and it is still part of the water cycle. Another term of ground water is 'aquifer' although this term is usually used to describe water bearing formations capable of yielding enough water to supply people's uses. Aquifers are a huge storehouse of earth's water and people all over the world depend on ground water in their daily lives.

Apart from human activities, some natural reasons are also responsible for groundwater pollution. One of these is the fluoride problem which is naturally occurring. Fluoride in groundwater comes mainly from the slow seepage of fluoride-rich rocks. The World Health Organization (1984) has set the maximum amount of fluoride in drinking water at 1.5 ppm. Has been determined. Almost all states in India suffer from the problem of excess fluoride in groundwater. The amount of fluoride in ground water has been found to be several times the maximum limit. Apart from groundwater, fluoride is also found in other foods. But the main reason is the absorption of fluoride by groundwater. Due to continuous consumption of fluoridated water, fluoride displaces the calcium present in the body and causes deformities in teeth and bones and also hinders other enzyme activities of the body, which is due to the high electronegativity of fluoride.

Fluoride is a well-known anion found in different forms in groundwater. Both environmental and human factors are responsible for its concentration in groundwater. High amounts of fluoride are found in crystalline and sedimentary rocks such as granite, mica, basalt, limestone, sandstone, phosphorite etc (veena chaudhary indiawaterportal 2015).

which slowly seep into groundwater. Fluoride is also found in pesticides and fertilizers used in fields, which seeps into the soil and ultimately enters the groundwater. Developing countries suffer greatly from this problem since groundwater is an important source of drinking water. Continuously increasing population and pollution has put pressure on creating deeper sources and with increasing depth the fluoride concentration further increases. Drinking water is a major source of fluoride. Although fluoride is also found in some medicines, food, toothpaste and tea. After entering the body, 99 percent of fluoride gets deposited in the bones and teeth (veena chaudhary indiawaterportal). Fluoride ion has high affinity towards calcium due to which it displaces calcium from teeth and bones and increases the disease of fluorosis(Hichour et al" 2000).

In which the bones become crooked and brittle and dark spots appear on the teeth. Children are extremely sensitive to it because their bodies are in the process of forming bones and teeth. The harmful effects of fluoride have also been found on the kidneys, lungs, thyroid and enzymes. So, excessive fluoride in water is harmful to public health on a global scale. The World Health Organization has set a maximum fluoride limit of 1.5 ppm in drinking water. Has been determined. In India it was reduced to 1.0 ppm in 1990. Had done. There are many methods of fluoride removal from water like adsorption, ion exchange, precipitation, nano filtration, reverse osmosis, Donnan dialysis but these technology is extremely and required constant maintenance ("Sanghratna S" 2015) . Adsorption, ion-exchange and precipitation methods are simple in which fluoride is extracted using various calcium and aluminum compounds (carbon, clay, zeolite, bio materials, nano materials). Some of these work at acidic pH which is unsuitable for drinking water while some use heavy metals and lanthanides which increase their concentration in drinking water and the use of bio-materials helps in eliminating the bacteria and fungus in water. Complaints remain. Activated Alumina has good fluoride removal properties but is also sensitive to acidic pH. But it is successful and increases the concentration of aluminum in water which is also the cause of Alzheimer's disease("Sanghratna S" 2015).

Fluoride is a worldwide problem affecting about 200 million people and many countries are affected(Apparao B.V., et al"1990). A simple, cheap, safe technology would definitely be of interest on the world stage. In this context, we can make the water of the area potable by removing fluoride on a large scale by using wheat husk Adsorbent Method (Ishtiaq, H et al" 2023) .

In the villages of wazeerpur tehsil area, 100% farming is done on ground water, due to which the groundwater level has reached very low level hence the amount of fluoride has increased and without removing fluoride from the water, it is not potable .Ground Water department of Rajasthan Government (10 November 2015)

DECLINE IN GROUNDWATER QUALITY-

- Due to falling groundwater level due to over-exploitation in various villages of wazeerpur tehsil, the groundwater at depth is becoming saline.
- The amount of salinity and fluoride in the groundwater is increasing in many areas - wazeerpur and villages like Meena Baroda, Baroli, Kunsay, Raipur , Khandeep , Meri, Syaroli, Kherla etc, in wazeerpur tehsil areas, May be more than 1.5 ppm. The amount of fluoride in drinking water should not exceed 1.50, if it exceeds this it causes bone and dental diseases.

The ground water is the only source for drinking water supply in the entire area of the Wazeerpur block, but the ground water level is declining. Thus the ground water scarcity and water quality problem is being increased. Thus it is very much needed to go through the water quality and quantity problems and to find out the possible causes and alternate remedial measures. Different types of chemical pollutants and ions present in excess in ground water may cause innumerable diseases and may be fatal for human life. Excessive ingestion of fluoride during the early childhood years may damage the tooth-forming cells, leading to a defect in the enamel known as dental fluorosis. A lack of calcium is one of the main causes of osteoporosis. The use of more Calcium per day without a medical necessity can lead to the development of kidney stones and sclerosis of kidneys and blood vessels. Potassium can lead to disturbing heartbeats. Sodium is necessary for human life to maintain the balance of the physical fluid system and is also required for nerve and muscle functioning. Too much sodium can damage our kidneys and increases the chances of high blood pressure etc. Thus different types of diseases and deficiencies may be caused from the excessive or less presence of the chemical constituents' presents in the ground water. Various International and National agencies have proposed Different tolerance limits. Various International and National agencies have proposed different limits for them which are

summarized as follows. Different types of diseases caused are also given with them.

TABLE:

S.No	Parameter (All values are in PPM except pH)	International Standards for potable water	Standards of Ministry of Urban Development & Govt. of INDIA	PHED standards of Rajasthan potable water	Undesirable effect that may be produced if limits crosses
1	pH	7.0-8.5	7.0-8.5	7.0-8.5	
2	Total Dissolved Solids	500	500	2000	Gastrointestinal irritation
3	Total Hardness (as CaCO ₃)	100	200	600	-
4	Calcium Hardness (as CaCO ₃)	75	75	200	-
5	Magnesium Hardness (as CaCO ₃)	30	30	125	Taste, Gastric irritation in presence of Sulphate
6	Chlorides	200	200	1000	Taste, corrosion in hot water system
7	Nitrates	45	45	100	Methaemoglobinemia in infants, Gastro- intestinal Ulcer in adults.
8	Sulphate	200	200	1000	Gastrointestinal irritation
9	Fluoride	0.7-1.5	1.0	1.5	Fluorosis
10	Iron	0.1	0.1	0.1	Growth of iron bacteria and turbidity

Ground water is one of the earth's renewable resource but its availability is decreasing continuously due to excess draw down. Due to growing population and per capita increase consumption of the ground water by the urban and rural population, the level of ground water is alarmingly going down. On the other hand, the quality of water is also affected by it. As the water level decreases, the percentage of various minerals and other dissolved impurities increases in it. Industrial and agricultural waste, fertilizers, pesticides, manure, animal dung etc. also play a major role in this process of damaging the quality of water. If ground water becomes more polluted, it will no longer be safe to drink.

II. REVIEW OF THE LITERATURE-

Ground water plays an important role in sustaining life in India, as about 80 percent of drinking water is supplied from groundwater. In rural and many urban areas it is used without treatment. Groundwater quality is influenced by a combination of natural factors such as geology, topography and soil, as well as climate, human activities and land management practices. Water is an excellent solvent, holding high amounts of dissolved chemicals due to its circulation through rocks and underground soils, making it likely to contain more dissolved substances than surface water.

More than 25 countries are grappling with diseases caused by fluoride ions (F⁻) derived primarily from natural sources or industrial waste water. Ishtiaq, H. et al (2023) Removal of fluoride from drinking water through low-cost techniques.

Thus, it is important to remove fluoride ions from drinking water to prevent serious health consequences. WHO recommends a limit of 1.5 mg/litre of fluoride in non-drinking water. In India it was reduced to 1PPM in 1990.

Farming in Wazeerpur tehsil area is 100 percent dependent on groundwater. According to information received from the Ground Water Department, Government of Rajasthan (10 November 2015), due to excessive exploitation, ground water has become saline in many villages of the area. Apart from this, the amount of salt and fluoride is more than 1.5 ppm.

Due to high amount of fluoride in the water of this area, arthritis and tooth decay etc. have become common problems in humans and there is also a risk of other diseases like dental fluorosis, skeletal fluorosis etc. Since no other research has been found on the groundwater area of Wazeerpur tehsil. Has not been done, hence further research will be interesting. There are many methods of defluorination, but mainly wheat is cultivated in this area and the villagers burn the straw obtained from it in the field, which is also harmful for the environment.

Therefore we are proposing defluorination of drinking water using wheat bran powder as a new, feasible, effective and low-cost adsorbent. It is agricultural waste and is available in abundance, which creates various environmental problems and challenges related to their management.

Wazeerpur tehsil of Rajasthan By using wheat bran as an absorbent we are trying to solve not only the water fluoride problem but also the waste management problems associated with it. In this regard, the study is a completely green approach

Groundwater quality information is provided by "Fluorine and fluorides (Environmental Health Criteria 36)", WHO Geneva, 93 (1984).

, "Water Resources and their Management in Indian Arid Zone" Dr. A.S FROADA focuses on proper and better use of water resources for long-term availability of good quality water.

In a thought-provoking article, "Water Resources Development in Gujarat: Research Needs",

Kumaraswamy has conducted studies on ground water pollution in and around solid waste disposal sites. Fluorosis among school children and high levels of iodine in groundwater have been reported by some activists in Rajasthan

Chandele C.P.S, Tatawat R.k (2008) has studied the quality of groundwater of Jaipur city and its suitability for domestic and irrigation purposes. He said that due to rapid urbanization and industrialization the groundwater quality of Jaipur city has declined.

Mukherjee et al" (2005) studied the assessment of groundwater quality in South Pargana (province), West Bengal coast. They reported that the concentrations of various ions are above the permissible limits for drinking and irrigation purposes.

Ali S. ,et al. (2021) Defluoridation of Groundwater Using Formaldehyde-Treated Agricultural Waste - Wheat, Oats, And Pea Straw.

Mr. S.K.Gupta talks about the needs of renewable resources of water.Sunil Kumar and Sanjay K.,Information on fluoride removal from groundwater using wheat bran, an agricultural waste, is provided by Sharma (2018): 'A case study of Hisar (Haryana)'.

Most of the methods have disadvantages such as high operation and maintenance, high cost, low fluoride removal efficiency, lack of selectivity for fluoride, undesirable effects on water quality, production of large amounts of sludge and complex process.

We are proposing defluorination of drinking water using wheat bran powder as a new, feasible, effective and low-cost adsorbent. It is agricultural waste and is available in abundance, which creates various environmental problems and challenges related to their management. We are using these absorbents to defluorinate water in various villages of Wazeerpur tehsil of Rajasthan state.

By using wheat bran as an absorbent we are trying to solve not only the fluoride problem of water but also the waste management problems associated with it. In this regard, the study is a completely green approach.

III. DESCRIPTION OF THE STUDY AREA

GEOGRAPHICAL DETAILS OF RAJASTHAN-

The total area of Rajasthan is about 3,42,239 km². Rajasthan region constitutes 1/10 (10.74%) of the total area of India. Rajasthan extends 826 kilometers from north to south and 869 kilometers from east to west. The shape of Rajasthan is a kite or rhombus .

In the west, Rajasthan is dry and infertile; in the southwestern part of the state, the soils are wetter, more mountainous, and more fertile. The climate varies throughout the state of Rajasthan. Average winter temperatures range from 8° to 28°C (46° to 82°F), while summer temperatures range from 25° to 46°C (77° to 115°F). Average rainfall also varies; the western desert receives about 100 millimetres (about 4 in) per year, while the eastern part of the state receives 650 millimetres (26 in) per year, mostly during the monsoon season from July to September.

*Drinking water is a major source of fluoride in daily life. Fluoride is also found in food, some Medications, tea, toothpaste.

Fluoride in groundwater is a major negative ion found in various forms. After entering the body, About 99% of fluoride gets stored in bones and teeth due to excessive intimacy of calcium. Fluoride ion By displacing the calcium of teeth and bones, it increases fluorosis disease, causing bones to harden and weakened. In the teeth, brittle and deep spots are formed. The process of formation of bone and teeth in children is more affected by this.

Environment and human factors are responsible for the concentration of fluoride in the groundwater contains high amount of fluoride in crystalline and sedimentary rocks In limestone, asbestos, granite, basalt phosphorite, etc., which gradually enters the water. Similarly, fluoride found in pesticides and fertilizers also enter the soil.

Groundwater is the main source of drinking water in developing countries. world Health Fluoride has been determined in high amounts in the WHO and India in 1.5 ppm and 1.0 ppm.

S.No	Parameter (All values are in PPM except pH)	International Standards of potable water	Standards of Ministry of Urban Development t Govt. of INDIA	PHED Rajasthan standards of potable water	Undesirable effect that may be produced if limits crosses
1	pH	7.0-8.5	7.0-8.5	7.0-8.5	
2	Total Dissolved Solids	500	500	2000	Gastrointestinal irritation
3	Total Hardness (as CaCO_3)	100	200	600	-
4	Calcium Hardness (as CaCO_3)	75	75	200	-
5	Magnesium Hardness (as CaCO_3)	30	30	125	Taste, Gastric irritation in presence of Sulphate
6	Chlorides	200	200	1000	Taste, corrosion in hot water system
7	Nitrates	45	45	100	Methaemoglobinemia in infants, Gastro- intestinal Ulcer in adults.
8	Sulphate	200	200	1000	Gastrointestinal irritation
9	Fluoride	0.7-1.5	1.0	1.5	Fluorosis
10	Iron	0.1	0.1	0.1	Growth of iron bacteria and turbidity

Due to excessive fluoride in ground water, it has become a major public health problem. Highly fluoride is a global public health issue in developing countries like India, Sri Lanka, Pakistan, Italy, Spain, Thailand, Africa, etc.

Fluoride contamination in Rajasthan

Certainly! Here is the expanded content without any additional commentary:

Fluoride Contamination in Rajasthan: A Growing Environmental Health Crisis

Fluoride contamination has emerged as a **major environmental health challenge** in Rajasthan, particularly affecting rural areas. The primary cause of this issue is a combination of **Rajasthan's unique geology, arid climate, and ancient rock formations** that naturally contain fluoride-bearing minerals like **fluorite, fluorspar, and fluorapatite**. Over centuries, **natural weathering and erosion** of these rocks release fluoride into the soil and groundwater, making it a persistent problem in the region.

Geological and Environmental Factors Contributing to Fluoride Contamination

Rajasthan's **desert-like landscape** is characterized by **deep, often isolated aquifers**. These underground water sources are essential for the survival of millions of people in both urban and rural communities. However, due to prolonged exposure to natural mineral deposits in the ground, high levels of fluoride have accumulated in these aquifers over time. The **dry climate** of the region further exacerbates the situation, as limited rainfall prevents the dilution of fluoride in groundwater, causing concentrations to increase.

As a result, many groundwater sources in Rajasthan contain **fluoride levels well above the acceptable limits** for drinking water, which poses serious risks to public health. Fluoride, while essential in small amounts for **dental health**, can be harmful when consumed in large quantities. The **toxicity of excessive fluoride** leads to conditions such as **dental fluorosis** (discoloration and damage to teeth) and **skeletal fluorosis** (joint pain and bone damage).

Impact on Health and Daily Life

The most vulnerable groups to the effects of fluoride contamination are those living in **rural areas**, where access to **safe drinking water** is limited. In these communities, people have little choice but to rely on contaminated groundwater sources for drinking, cooking, and agriculture. As a result, **fluoride toxicity** accumulates over time, leading to chronic health problems that affect both **children and adults**.

Beyond the physical health risks, fluoride contamination has significant social and economic consequences. **Agriculture**, the main livelihood for many families, is also impacted because high fluoride levels can affect the quality of irrigation water, harming crops and livestock. This further deepens the cycle of poverty, as communities are left struggling to maintain their primary source of income.

IV. INDUSTRIAL AND HUMAN ACTIVITIES CONTRIBUTING TO THE PROBLEM

While natural factors play a significant role, **human activities** also contribute to the problem of fluoride contamination in Rajasthan. **Industrial activities** such as mining, cement manufacturing, and chemical processing can introduce additional pollutants into the environment, which may interact with fluoride in the groundwater. Over-extraction of groundwater for irrigation and industrial use has further reduced the ability of natural processes to dilute fluoride concentrations, exacerbating the contamination.

The issue is further complicated by **poor infrastructure** in rural regions, which limits the ability of local governments to treat contaminated water effectively. Without access to proper **water treatment facilities** or technologies, many communities are left to rely on unsafe water sources, putting them at continuous risk of health problems.

Solutions to Address Fluoride Contamination

To combat the growing issue of fluoride contamination in Rajasthan, it is crucial to take **immediate action** and implement sustainable solutions. A **multi-pronged approach** is needed, which involves both **short-term relief** measures and **long-term strategies** aimed at reducing fluoride exposure and improving access to safe water.

1. Alternative Water Sources:

Finding **alternative sources of clean water** is a crucial first step in addressing fluoride contamination. This could involve tapping into water reserves that are **free of fluoride**, such as surface water from rivers or lakes, or **rainwater harvesting** systems that store clean water during the monsoon season. Expanding the network of **water supply infrastructure** to reach remote rural areas could also reduce reliance on contaminated groundwater.

2. Defluoridation Technologies:

Defluoridation refers to the process of removing excess fluoride from drinking water. There are several

affordable and effective technologies available that can help reduce fluoride levels in water, such as **activated alumina filters**, **reverse osmosis** systems, and **bone charcoal filters**. These technologies, though already in use in some areas, need to be scaled up and adapted to local conditions for better results.

3. **Public Awareness Campaigns:**

Many people in affected areas are unaware of the dangers of fluoride contamination and its long-term health effects. **Public awareness** campaigns are essential to educate communities about the risks of excessive fluoride intake, symptoms of fluorosis, and the importance of using **safe water** sources. These campaigns should also provide practical advice on **alternatives** to contaminated water, such as the use of simple filtration systems or boiled water.

4. **Improving Water Treatment Infrastructure:**

Governments at both the **state** and **local levels** need to prioritize the **development of water treatment infrastructure**. This includes the construction of **defluoridation plants**, **water filtration systems**, and **water purification plants** that can treat high-fluoride water. Additionally, **regular monitoring** of water quality should be carried out to ensure that fluoride levels remain within safe limits. **Collaboration with NGOs** and international organizations could help provide the necessary funding and expertise for these projects.

5. **Policy and Regulatory Changes:**

The government should take a **stronger regulatory role** in managing groundwater resources and controlling fluoride contamination. Establishing clear **standards for safe fluoride levels** in drinking water and holding industries accountable for their water use can help reduce contamination. Moreover, **financial support** for communities affected by fluoride contamination should be provided, including funds for water treatment facilities, healthcare, and rehabilitation for those suffering from fluoride-related health issues.

6. **Research and Data Collection:**

Finally, more **research** is needed to better understand the **geological**, **climatic**, and **anthropogenic factors** contributing to fluoride contamination in Rajasthan. This will allow for more targeted interventions and more accurate predictions of future fluoride concentrations. **Collaboration with universities**, **research institutes**, and **international experts** can help develop better defluoridation technologies and identify more sustainable solutions.

• **Boundaries**

The study will not address the interference of ions and particles such as Ca^{+2} , Mg^{+2} , Fe^{+2} and Ti^{+2} present in water. Furthermore, structural characterization and morphological studies of the adsorbents used are beyond the scope of the present study .

• **Work Plan**





- Method Of Sampling:

For sampling fluoride concentration in ground water, in Wazirpur Tehsil, standard ground water sampling protocol will be followed. Here is a basic outline of the process, which will be adjusted according to specific needs and guidelines.

- Site Selection

Samples of ground water were taken and analyzed in the first phase from the municipal - Wazirpur, Gram Panchayat

Meena Baroda, Gram Panchayat Barauli, Gram Panchayat Sadoli, Gram Panchayat Service.

- **Sampling Equipment Sample Bottles:**

Clean, glass bottles will be used for sample collection. Sterilizing Materials: Sample bottles will be cleaned with distilled water to avoid contamination.

- **Sample Collection**

The borehole/head pump will be flushed for 10-15 minutes to collect fresh ground water samples. Approximately 1 liter of water will be collected in each sample bottle by escaping air bubbles. The bottles will be tightly sealed, marked with the place, date and time of collection and then tested on time.





- Work Donde



Characteristic	Requirement (Acceptable Limits) as per BIS 10500 : 2012	Permissible Limits in the Absence of Alternate Source as per BIS 10500 : 2012	Sample Results				
Particulars	-	-	T.W. Tehsil	T.W. Hr. Sec. School	T.W. Sec. School	T.W. Sr. Sec. School	T.W. Electricity feeder
Village /Town	-	-	Wazirpur	Meenabaroda	Bedoli	Shyoroli	Seva
Date of Collection	-	-	30-01-2025	30-01-2025	30-01-2025	30-01-2025	30-01-2025
Date of Examination	-	-	05-02-2025	05-02-2025	05-02-2025	05-02-2025	05-02-2025
Lab. Sample no.	-	-	PC-42	PC-43	PC-44	PC-45	PC-46
NOTE- ALL RESULTS EXCEPT pH are in mg/l							
1. pH	6.5-8.5	6.5-8.5	7.3	7.5	7.3	7.4	7.2
2. Turbidity (NTU)	-	-	-	-	-	-	-
3. Colour	-	-	-	-	-	-	-
4. Odour	-	-	-	-	-	-	-
5. Total Alakinity	200	600	600	350	480	580	740
6. Total Hardness (as CaCO ₃)	200	600	200	260	300	600	310
7. Calcium Hardness	-	-	-	-	-	-	-
8. Magnesium Hardness	-	-	-	-	-	-	-
9 Chloride (as Cl)	250	1000	370	100	320	910	1020
10. Sulphate (as SO ₄ -2)	-	-	-	-	-	-	-
11. Nitrite (as NO ₂ -1)	-	-	-	-	-	-	-
12. Nitrate (as NO ₃ -1)	45	No relaxation	13	38	77	108	17
13. Total Dissolved solids	500	2000	1203	684	1122	2390	2260
14. Residual Chlorine	-	-	-	-	-	-	-
15. Fluoride	1	1.5	0.77	0.19	0.28	0.48	0.73

V. CONCLUSION

Fluoride contamination in Rajasthan presents a serious challenge, but it also offers an opportunity for innovation and progress. This study, conducted in the Wazeerpur tehsil of Sawai Madhopur district, provides a promising and sustainable solution to this growing problem. By utilizing wheat bran powder—an easily accessible and low-cost agricultural by-product—the research demonstrates an effective and environmentally friendly method for removing fluoride from drinking water.

This simple approach not only addresses the health risks associated with fluoride, such as dental and skeletal fluorosis, but also leverages local resources to solve a local problem. The technique is particularly valuable in rural areas, where conventional water treatment systems may be economically unfeasible.

The findings underscore the potential for using low-cost, readily available materials to improve water quality and public health, even in remote areas. By adopting such solutions, Rajasthan can take significant steps toward providing clean, safe drinking water to its communities. This approach represents a **win-win** for public health, the environment, and local economies, with the added benefit of utilizing agricultural waste, which further promotes sustainability.

With further support, this method could serve as a model for other fluoride-affected regions, offering hope for healthier communities and a cleaner, more sustainable environment for the future.

REFERENCES

1. Apparao B.V., Meenakshi S., Karthikayan G., "Nalgonda technique of defluoridation of water", Indian J. Environ. Protect, 10, 292–298, (1990).
2. Dr.A.S.Faroda, "Water resources and their management in the Indian Arid Zone", Journal of Indian WaterWorks .
3. *ChandelC.P.S,TatawatR.K(2008),AppliedEcologyand EnviornmentalResearch,6(2),79.
4. "Fluorine and Fluorides (Environmental Health Criteria36)", WHO Geneva, 93 (1984).
5. Hichour M., Persin F., Sandeaux J., Gavach C. "Fluoride removal from watersbyDonnan dialysis. Separation and Purification Technology". 18, 1–11, (2000).
6. *Ishtiaq, H.; Amina, N.; Irfan, A.; Mohsin, H.; and Shahbaz, A. (2023) Removal of fluoride fro drinking water through low-cost techniques.Advances in Civil and Architectural Engineering. Vol. 14, Issue No. 26. pp.80-94.
7. Kumar,S.,Gopal,K.,"Fluorosis and its preventive strategies", Indian Journal Environmental Protection,Vol.20,No.6,pp. 430-436(2000).
8. Meenakshi and Maheshwari R.C., 2006. Fluoride in drinking water and its removal, J. Haz. Mater.,(137) 456-463.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details