

Holistic Solutions for Overcoming Fluoride Contamination Challenges in West Bengal, India: A Socio-economic Study on Water Quality, Infrastructure, and Community Engagement

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Abstract : Access to safe drinking water is a fundamental human right; however, regions like Purulia, Bankura, Birbhum, Malda, Dinajpur in West Bengal, India, face formidable challenges due to heightened fluoride levels. This paper delves into the hurdles of fresh drinking water production, presenting comprehensive solutions derived from literature reviews, field surveys, and scientific analyses. Encompassing fluoride-affected areas in Purulia, Bankura, Birbhum, Malda, North-South Dinajpur, and South 24 Parganas, the study emphasizes an integrated and sustainable approach. Employing a multidisciplinary methodology, combining scientific analysis and community engagement, the study identifies key factors influencing water quality and proposes sustainable strategies. Elevated fluoride concentrations exceeding international health standards (Purulia: 0.126 - 8.16 mg/L, Bankura: 0.1 - 12.2 mg/L, Malda: 0.1 - 4.54 mg/L, Birbhum: 0.023 - 18 mg/L) necessitate urgent intervention. Infrastructure deficiencies impede water treatment and distribution, while limited awareness obstructs community participation. The proposed solutions embrace advanced water treatment technologies, infrastructure development, community education, and sustainable water management practices. This comprehensive effort aims to provide clean drinking water, safeguarding the health of affected populations. Building on these foundations, the study explores the potential of rooftop rainwater harvesting as an effective and sustainable strategy to mitigate challenges in fresh drinking water production. By addressing fluoride contamination concerns and promoting community involvement, this approach presents a holistic solution to water quality issues in affected regions. The findings underscore the importance of integrating sustainable practices with community engagement to achieve long-term water security in Purulia, Bankura, Birbhum, Malda, North-South Dinajpur, and South 24 Parganas. This study serves as a cornerstone for further research and policy development, addressing fluoride contamination's impact on public health in affected areas. Recommendations include the establishment of long-term monitoring programs to assess the effectiveness of implemented solutions and conducting health impact studies to understand the long-term effects of fluoride contamination on the local population.

Keywords : fluoride mitigation, rainwater harvesting, water quality, sustainable water management, community engagement

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