GURU GHASI DAS VISHWAVIDYALAYA BILASPUR (C.G)

Review of Zeolite– Iron Composite Materials for Wastewater Treatment with a Case Study on Water Quality Challenges in Sirgitti Bilaspur Chhattisgarh,India

A Mini Project Report

In Partial Fulfilment of the Requirement for Award of Degree of Bachelor of Technology of the 2nd Year in Chemical Engineering

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CERTIFICATE

Certifie that the Mini Project Report entitle ***"Review of Zeolite Iron Composite Materials for Waste water Treatment with a Case Study on Water Quality Challenges in Sirgitti Bilaspur, India"*** submitted by **Aditya Pandey, Kadambini Singh Thakur, Muhammad Arshad** of B.Tech. 4th Semester, in partial fulfillment of the requirements for the award of degree in Bachelor of Technology (B. Tech) in Chemical Engineering, is according to the students their own investigation carried out by them in the Department of Chemical Engineering, School of Studies of Engineering & Technology, GGV, during the session 2024-25.

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ABSTRACT

Wastewater contamination is a growing concern due to increasing industrial, agricultural, and domestic activities. This review explores the potential of zeolite–iron composite materials for efficient wastewater treatment. Zeolite's high surface area and ion exchange capacity, combined with iron's redox reactivity, create a synergistic composite capable of removing heavy metals, organics, and nutrients from contaminated water. The work discusses the structure, preparation, and mechanisms of action of zeolite–iron composite, highlighting their advantages (cost-effectiveness, reusability) and challenges (iron leaching, regeneration). A case study of the Sirgitti water body at Bilaspur, Chhattisgrah illustrates real-world

pollution scenarios, with analysis of local water quality indices and contributing factors. The integration of advanced treatment technologies such as zeolite–iron composites is evaluated for local application. Future research directions include the development of nanocomposites and hybrid systems, pilot studies, and life cycle assessments. This paper aims to guide both scientific understanding and practical implementation for sustainable water management.

1. INTODUCTION

The problem wastewater contaminants