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Name of the Scholar	**:**	Afzal Ansari
Name of the Supervisor	**:**	Prof. Weqar Ahmad Siddiqi
Name of the Department/Centre	**:**	Applied Sciences and Humanities
Topic of Research	**:**	Studies of Metal-based Nanomaterials: Synthesis and their Application in Wastewater Treatment

Findings

In the present work, the metal-based nanomaterials have been successfully synthesized by enhancing their application in wastewater treatment and antibacterial properties. The structural and morphological parameters of synthesized nanoparticles were investigated by using UV, XRD, SEM, EDX, TEM, and DLS analysis. Further, the catalytic treatment performance of domestic wastewater was evaluated in terms of pH, COD solubilization, solids reduction, phosphorous, and total nitrogen reduction under aerobic and anaerobic operating conditions. Moreover, the photocatalytic activity of synthesized nanoparticles in an aqueous solution of BPB dye was examined using visible light at varying irradiation intervals. The SFZVI nanoparticles show excellent photocatalytic performance with a maximum degradation of 97.65% followed by nZVI (86.48%) alone. The kinetic study has revealed that the dye degradation process follows pseudo-second-order kinetics. Furthermore, the synthesized nanoparticles were further evaluated and revealed that SFZVI showed excellent antibacterial activity against the *E. coli* and *B. subtilis* pathogens. Moreover, an innovative and creative sustainable technique was used to synthesize TiO_2 using *Acorus calamus* leaf extract as a new biogenic source. The photocatalytic activity of biosynthesized TiO_2 nanoparticles in an aqueous solution of RhB dye was investigated under visible light irradiation at different time intervals. The synthesized TiO_2 nanoparticles exhibit strong photocatalytic activity, degrading 96.59% of the RhB dye. Further, the biosynthesized TiO_2 nanoparticles was showed excellent antimicrobial activity against the selected pathogenic bacteria.