## ABSTRACT

Metal nanoparticles were synthesized via a sustainable route of green synthesis to investigate their activity as antibacterial agent and catalyst to degrade the environmental pollutants in the waste water. Nanoparticles were synthesized by using leaf extract of *Trifolium alexandrinum* as a source of stabilizing and capping agent. Structural and morphological features of these synthesized nanoparticles were characterized by using various techniques including UV-Vis spectroscopy, Fourier transform infrared spectroscopy (FTIR), X-rays diffraction (XRD), Scanning electron microscopy (SEM) and Dynamic light scattering analysis (DLS). Data obtained from these characterization techniques was further applied for the calculation of crystallite size and optical band gap energy. These techniques confirmed the presence of various polyphenols on the surface of synthesized nanoparticles, their size, shape and morphology. Antibacterial activity of sample was checked against both types of bacterial strains by varying different parameters. Sample was successfully applied as a catalyst to degrade the pollutants mainly methylene blue present in the waste water. Samples were found highly active with more than 90% degradation of pollutant in a short time. Further experiments were performed to investigate about the stability of catalyst to be reused and significant results were found up to 3 cycles of MB degradation. Nontoxic, low cost, green synthesized nanoparticles were proven efficient as a catalyst for the degradation of methylene blue.