**Abstract**

The antioxidative and antidiabetic properties of Costus speciosus leaf extract assisted nanoparticles (CS–Pt modified TiO2) were compared with pristine TiO2 NPs along with standard ascorbic acid (AA). CS-Pt nanoparticles were synthesized through bioreduction process and supported on titanium dioxide semiconductor. Costus speciosus (CS) leaf extract was used as reducing and capping agent. Initially, CS-Pt nanoparticles synthesis was carried out with ethanolic extract of CS, later, two different wt% of CS-Pt supported TiO2 were prepared through sol-gel cum solvothermal process. The prepared materials have been characterized using different characterization techniques such as XRD, FT-IR, Raman, SEM, HR-TEM, EDS, DRS, PL and XPS measurements. CS-Pt-TiO2 nanocomposites showed well dispersion of Pt nanoparticles on TiO2 surface. The prepared materials have been effectively utilized for in-vitro antioxidant and in vitro antidiabetic activity. Moreover, the photocatlytic activity of the materials has been tested toward NBB degradation under visible light. CS-Pt NPs modified TiO2 composites show better activity when compared with pristine TiO2 in all cases.