**ABSTRACT**

The current advancements in nanotechnology suggest a sustainable development in the green synthesis of bimetallic nanoparticles (BMNPs) through green approaches. Though challenging, nano phyto technology has versatile methods to achieve desired unique properties like optic, electronic, magnetic, therapeutic, and catalytic efficiencies. Bio-inspired, facile synthesis of bifunctional BMNPs is possible using abundant, readily available natural plant sources, bio-mass wastes and microorganisms. Synergistic effects of two different metals on mixing, bring new insight for the vast applications, which is not achievable in using monometallic NPs. By adopting bio-inspired greener approaches for synthesizing NPs, the risk of environmental toxicity caused by conventional physicochemical methods become negligible. This article hopes to provide the significance of cost-effective, one-step, eco-friendly and facile synthesis of noble/transition bimetallic NPs. This review article endows an overview of the bio-mediated synthesis of bimetallic NPs, classifications of BMNPs, current characterization techniques, possible mechanistic aspects for reducing metal ions, and the stability of formed NPs and bio-medical/industrial applications of fabricated NPs. The review also highlights the prospective future direction to improve reliability, reproducibility of biosynthesis methods, its actual mechanism in research works and extensive application of biogenic bimetallic NPs.