

Greener Syntheses and Chemical Transformations: Sustainable Alternative Methods and Applications of Nano-Catalysts

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The presentation summarizes our sustainable chemical synthesis activity involving benign alternatives, such as the use of supported reagents, and greener reaction medium in aqueous or solvent-free conditions.¹ The synthesis of heterocyclic compounds, coupling reactions, and a variety of name reactions² are the main beneficiaries as exemplified by the synthetic reactions catalyzed by basic water or polystyrene sulfonic acid (PSSA) in aqueous media in conjunction with microwave (MW) irradiation.²

Vitamins B₁, B₂, C, and tea and wine polyphenols which function both as reducing and capping agents, provide extremely simple, one-pot, green synthetic methods to bulk quantities of nanomaterials in water.^{3a} Shape-controlled synthesis of noble nanostructures via MW-assisted spontaneous reduction of noble metal salts using sugars will be presented.^{3b} A general method has been developed for the cross-linking reaction of poly (vinyl alcohol) (PVA) with metallic systems; bimetallic systems,^{3c} and SWNT, MWNT, and C-60.^{3d} The strategy is extended to the formation of biodegradable carboxymethylcellulose (CMC) composite films with noble nanometals;^{3e} such metal decoration and alignment of carbon nanotubes in CMC is possible using MW approach^{3f} which also enables the shape-controlled bulk synthesis of Ag and Fe nanorods in poly (ethylene glycol).^{3g} MW hydrothermal process delivers magnetic nanoferrites⁴ and micro-pine structured catalysts are obtainable in water from readily available metal salts.⁵ Sustainable route to nano particles using polyphenols from winery waste,⁶ their applications in catalysis,^{7,8} toxicity⁹ and environmental remediation¹⁰ will be highlighted.

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