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Greener strategies for organics and nanomaterials: Sustainable applications of magnetic nanocatalysts and modified graphitic carbon nitrides

Sustainable efforts for the greener synthesis of diverse nanoparticles and their varied applications as recyclable and reusable nano-catalysts are important in this burgeoning field. Vitamins B1, B2, C, beet juice, antioxidants from blackberry, blueberry, pomegranate, turmeric and tea- and wine polyphenols, provide simple approach to bulk quantities of nanomaterials in eco-friendly medium. Synthesis via microwave (MW)-assisted spontaneous reduction of noble metal salts with sugars, MW cross-linking reaction of poly (vinyl alcohol) (PVA) with metallic systems and CNT's, formation of biodegradable cellulose composite films with noble metals; and the shape-controlled bulk synthesis of Ag and Fe nanorods in PEG will be depicted. MW process delivers magnetic nanoferrites and micro-pine structured catalysts from common metal salts. Sustainable route to nanoparticles using waste from winery or biodiesel byproduct, glycerol and their applications in catalysis (magnetic nano-catalysts or organocatalysis), toxicity and environmental remediation will be highlighted, especially their recyclability and reuse via magnetic separation. The utility of nano-catalysts (Pd, Ni, Ru, Ce, Cu, etc.) immobilized on biodegradable and recyclable supports e.g. cellulose and chitosan or on magnetic ferrites via ligands such as dopamine or glutathione will be presented. The utility of heterogenized bimetallic Ag-Pd nanoparticles on graphitic carbon nitride (AgPd@g-C_3N_4) will be highlighted and exemplified by upgrading of biofuel via hydrodeoxygenation of vanillin under visible light irradiation using formic acid as a hydrogen source including direct aminoformylation of nitroarenes. Photocatalytic C-H activation using VO@g-C_3N_4 catalyst for direct oxidative esterification of alcohols, oxygen insertion reaction in hydrocarbons and selective oxidation of alcohols and hydrogenation of alkenes and alkynes using visible light as the source of energy will be described; these strategies fulfill most of green chemistry principles whilst producing functional chemicals with extreme level of waste minimization.

Biography

Rajender S Varma completed his PhD from Delhi University in 1976. After Postdoctoral Research at Robert Robinson Laboratories, Liverpool, UK, he was a faculty at Baylor College of Medicine and Sam Houston State University. He joined Sustainable Technology Division at US EPA in 1999 and Palacky University, Czech Republic during the year 2014. He has over 40 years of research experience in management of multi-disciplinary technical programs and is extensively involved in sustainable aspects of chemistry that includes, development of environmentally benign methods using alternate energy input using microwaves, ultrasound and mechanochemistry and efficient technologies for the sustainable remediation of contaminants, and environmental sciences. Lately, he focused on greener approaches to assembly of nanomaterials and sustainable synthetic applications of magnetically retrievable nano-catalysts in benign media. He is a member of the Editorial Advisory Board of several international journals and has published over 455 scientific papers and awarded 15 US patents.

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