MoO_3 nanostructures from EGCG assisted sonochemical route: Evaluation of its application towards forensic and photocatalysis

H.S.Yogananda[ab] H.Nagabhushana[c] G.P.Darshan[d] R.B.Basavaraj[c] B.Daruka Prasad[e] M.K.Sateesh[f] G.K.Raghu[g]

Department of Physics, Sai Vidya Institute of Technology, VTU, Bangalore 560064, India

Research and Development Center, Bharathiar University, Coimbatore 641046, India

Prof. C.N.R. Rao Centre for Advanced Materials Research, Tumkur University, Tumkur 572 103, India

Department of Physics, Acharya Institute of Graduate Studies, Bangalore 560 107, India

Department of Physics, B. M. S. Institute of Technology and Management, Affiliated to VTU- Belagavi, Bangalore 560 064, India

Molecular Diagnostics and Nanotechnology Laboratories, Department of Microbiology and Biotechnology, Bangalore University, Bangalore 560 056, India

Department of Chemistry, Siddaganga Institute of Technology, Tumkur 572103, India

Abstract

Molybdenum trioxide (MoO_3) nanostructures (NS) were prepared via facile Epigallocatechin gallate mediated sonochemical route. Morphological evolution was studied by varying EGCG concentration, ultrasound irradiation time, sonication power, pH and calcination temperature showed the hexagonal and flakes type of NS. h- MoO_3 and α-MoO_3 phases of the compounds were confirmed through powder X-ray diffraction and the nanoscale crystallite sizes were confirmed through TEM analysis supported with EDS analysis for the composition purity. Chemical bondsand the energy gaps were analyzed by FTIR and DRS methods respectively. DRS with Munk function confirm that the prepared compounds are wide band gap semiconducting materials. Electrode of electrochemical setup was modified by coating with h-MoO_3 nanorods and studied the analytical quantification of dopamine shows the insensitiveness of MoO_3 towards electrochemical reactions in the selected potential window confirms its use as an ideal electrochemical interface. Use of h-MoO_3 NS powder as a dusting agent in fingerprint applications showed the enhanced level of visualization of fingerprints helps in powder dusting application to effective recognition of the individuals at crime scene. Pure h-MoO_3 micro-rods and pure α-MoO_3 showed good photochromic behavior under sunlight irradiation. Nontoxic MoO_3 superstructures can prevent the growth of various harmful microorganisms and provides a long-lasting antibacterial effect for inanimate surfaces used in public and healthcare environments.

Keywords

Ultrasonication; Sonochemistry; Micro-rods; Biosensing; Latent fingerprints; Antipathogens