Green synthesis and structural characterization of zinc sulfide nanoparticles

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Zinc sulfide, ZnS as an important II–IV group semiconductor compound with a direct wide band gap energy of 3.66 eV at 300 K has a high index of refraction and a high transmittance in the visible range, that has attracted much research interest due to its excellent properties of luminescence and photochemistry [1]. ZnS has been used widely as heterogeneous catalysis, fuel cells, magnetic recording, and optoelectronic devices [2-5]. In addition, ZnS has attracted much attention in pollutant treatment [6]. Several methods have been applied to prepare ZnS nanoparticles such as sol–gel, solid state reaction, gas-phase condensation, liquid-phase chemical precipitation, precipitation in aqueous and organic media, thermal decomposition, hydrothermal synthesis, microemulsion method, microwave, and sonochemical method.

Ionic liquids (ILs) have remarkable physicochemical properties such as extended temperature range of liquid state, air- and water-stability, low toxicity, high ionic conductivity, ability to dissolve a variety of materials, and importantly no measurable vapor pressure. They continue to attract an increasing amount of interest for their promising roles as an alternative recyclable and environmentally benign reaction media for chemical processes. They also offer possibilities for fundamental studies of their effects on chemical reactions and synthetic processes [7-9].

In this work, ZnS nanoparticles were synthesized using microwave irradiation in a green solvent, 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl) imide, $[C_4mim]$ $[NTf_2]$. The ZnS nanoparticles crystals were characterized by means of powder X-ray diffraction (XRD), transmission electron microscopy (TEM), Raman spectroscopy, FT-IR spectroscopy, UV–Vis absorption spectroscopy, and photoluminescence spectroscopy. The sizes of prepared nanoparticles were in the range of 3.13 to 7 nm.

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