Title:	Effect of calcination temperature on the morphology and catalytic properties of ZnO nanostructures fabricated from a chiral precursor for photodegradation of both cationic and anionic dyes
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Keywords:	calcination ZnO nanostructures
Issue Date:	2022
Publisher:	Royal Society of Chemistry
Citation:	New Journal of Chemistry, 46(8), 3645-3657
Abstract:	Diverse ZnO nanostructures (ZnO_1 to ZnO_3) were synthesized by direct calcination of a chiral MOF precursor {[Zn4(μ3-OH)2(D-2,4-cbs)2(H2O)4]·5H2O}n (Zn-CBS) at three different temperatures of 600, 700 and 800 °C, respectively. On the basis of the field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) analyses, 3D microflowers (ZnO_1), 3D polyhedrons (ZnO_2) and 1D nanorods (ZnO_3) are formed with an increase in temperature from 600 to 800 °C. The powder X-ray diffraction (PXRD), energy dispersive X-ray analysis (EDX), and elemental mapping confirmed their crystallinity and the wurtzite phase purity. Interestingly, only 3D microflowers (ZnO_1) comprising nanorods inherited the chiral nature of the parent MOF. Furthermore, only agglomerated ZnO microspheres without any diversity are obtained if Zn(OAc)2·2H2O is used as the precursor at three different temperatures, confirming the importance of innovative metal organic framework mediated synthesis (MOFMS). From the solid state diffuse reflectance spectra, the optical band gap values for ZnO nanostructures were found to be in the range of 3.10–3.17 eV. Their surface areas and pore sizes were determined by the N2 adsorption study at 77 K. On the other hand, their luminescence behaviour in the dispersed mode (solvent: water, methanol or ethanol) was noteworthy: nanorods showed a blue emission with a strong band at 531 nm, while only broad features were observed for microflowers and polyhedrons upon excitation at 380 nm. Utilizing such distinct properties, the as-synthesized ZnO nanostructures were studied for a comparative photocatalytic degradation of the organic pollutants: a cationic dye – methylene blue (MB) and an anionic dye – Congo red (CR) in water under UV light. The nanorods were found to be better than microflowers and polyhedrons for MB, while the microflowers showed an exceptional activity toward CR. In both cases, the degradation rates (first order for MB and pseudo second order for CR) were either comparable to or much better than the reported values. Their recyclability and photostability up to four cycles was very good. The detailed mechanism of their degradation is also discussed with support from the scavenger experiments carried out for ZnO_1 and ZnO_3.
Description:	Only IISERM authors are available in the record
URI:	https://doi.org/10.1039/d1nj05405h (https://doi.org/10.1039/d1nj05405h) http://hdl.handle.net/123456789/4704 (http://hdl.handle.net/123456789/4704)
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