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Transition metal doped nanostructured zinc oxide semiconductor: An efficient reusable as a heterogeneous catalyst for the synthesis of Knoevenagel-Doebner and Biginelli reaction

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We report the synthesis of nanocrystalline zinc oxide (ZnO), Cu-ZnO and Cd-ZnO as a catalyst to the heterogeneous organic reaction. The preparation Knoevenagel-Doebner reaction such as of 3-styrylchromones with trans selectivity derived from a nucleophile 2,4-dinitrotoluene (pKa=4.1) and 4-nitrophenylacetic acid (pKa=3.9) was carried out using nanocrystalline Cu-ZnO as a catalyst. Nanocrystalline Cd-ZnO found an efficient heterogeneous catalyst for benzimidazole synthesis. Whereas the undoped ZnO catalyst founds useful for Biginelli reaction to such as 3,4-dihydropyrimidin-2(1H)-ones/thiones. The synthesis of ZnO and Cu-ZnO catalysts were carried via the simple solution based route. The effect of solvent to the synthesis technique, particle size, morphology of this nanomaterial's for catalytic activity is investigated. The different analytical techniques such as UV, FTIR, XRD, BET, EDAX and FESEM were used to characterize catalysts. As synthesized catalyst used for Knoevenagel condensation of 2,4-dinitrotoluene and Knoevenagel-Doebner reaction of 4-nitrophenylacetic acid in the synthesis of 3-styrylchromones and 3,4-dihydropyrimidin-2(1H)-ones/thiones. We have also reported the effect of solvents, particle size and morphology to its semiconducting optical properties of the material. The catalyst was found to be reused up to five cycles without any significant loss of catalytic activity. In this report, I will discuss the protocol we developed nanocrystalline ZnO and Cu/Cd-doped ZnO as a catalyst for the heterogeneous organic reaction. The overall study shows that nanocrystalline ZnO can be an alternative to TiO_2 catalyst. Our approach is novel, economical, efficiently achieves moderate to excellent yields.

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