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Heterogeneous catalytic reduction of anthropogenic pollutant, 4-nitrophenol by Au/AC nanocatalysts

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Activated carbon-supported gold nanocatalysts (Au/AC) were synthesized by the homogeneous deposition–precipitation (HDP) method by adding dropwise of NaBH4 into the aqueous solution of HAuCl4. Catalytic activity of these nanocatalysts was investigated for the reduction of the anthropogenic pollutant, 4-nitrophenol (4-NP) to 4-aminophenol (4-AP). The physico-chemical properties of the nanocatalysts were characterized by XRD, TEM, BET surface area, pore size distribution, XPS and UV–vis spectroscopy techniques. Gold nanoparticles (Au NPs) with high percentage of dispersion on a high surface area activated carbon (AC) support, show excellent catalytic performance in terms of activity and selectivity for 4-NP reduction. The reaction rate was measured to be pseudo-first-order with respect to 4-NP. The pseudo-first-order rate constant and the activation energy were estimated to be 1.2–4.2 × 10−3 s−1 at 25oC and 26.38 kJ mol−1, respectively. Moreover, the catalytic activity was found to increase with increase in Au content of the catalyst. The reusability of the nanocatalyst showed a better reduction of 4-NP to 4-AP even after 5 successive re-cycles. The foregoing study clearly suggests that synthesis of Au/AC nanocatalysts by HDP method is efficient towards the development of a newer and a novel catalyst.

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