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Effects of triazole-based ligand structures on catalyst loadings and activities of Pd nanoparticle for selective aerobic alcohol oxidation

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A series of triazole-based ligands containing a hydroxyl group, tris(triazolyl) methanol (Htbtm), bis(triazolyl) phenyl methanol (Hbtm), and phenyl(pyridin-2-yl)(triazolyl) methanol (Hpytm), were synthesized and functionalized on 3-chloropropyl silica via deprotonation followed by nucleophilic addition. Subsequent addition of Pd(OAc)2 (OAc = CH3COO–) onto these supports was carried out. It was found that ligand structures significantly affected Pd loading, which followed the trend: SiO2-tbtm > SiO2-btm ~ SiO2-pytm. Moreover, the influence of different ligand structures on Pd stabilization and catalytic efficiency toward Pd nanoparticle (NP)-catalysed aerobic alcohol oxidation to the corresponding aldehydes was studied. Based on XPS analysis, Pd(II) species were reduced *in situ* in the presence of alcohols during the first catalytic reactions to generate the active Pd NPs catalysts. Immobilization of Pd NPs on tbtm, btm, pytm-modified silica supports were confirmed by HR-TEM showing average particle diameters of 6.4, 4.8 and 8.5nm, respectively. At 60°C, the Pd NPs stabilized by SiO2-btm exhibited the highest turnover numbers for aerobic oxidation of benzyl alcohol in an ethanol solvent.

Biography

Supanan Ampawa is studying for a Ph.D. at the Department of Chemistry, Faculty of Science, Mahidol University, Bangkok, Thailand. She has received a prestigious scholarship from Science Achievement Scholarship of Thailand since 2010. During her undergraduate study, she investigated the reactivities of allenes and alkenes in Diels–Alder reactions at Mahidol University. After obtaining the B.Sc. degree (Hons), her Ph.D. project involves the development of novel catalysts for sustainable chemistry. In particular, she prepared a series of bis(triazolyl)phenylmethanol–palladium (II) catalysts which were active for cross-coupling reactions in water. This work was published in Chemistry Select journal in 2018. To improve properties and extend the applications of the triazole-based catalysts, she has currently been investigating the synthesis of heterogeneous triazole-based catalysts on silica support and evaluating the effects of ligand structures on catalyst loadings and activities of Pd nanoparticle catalysts for selective aerobic alcohol oxidation.

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