Selective hydrogenolysis of phenols to arenes by metal–support cooperation

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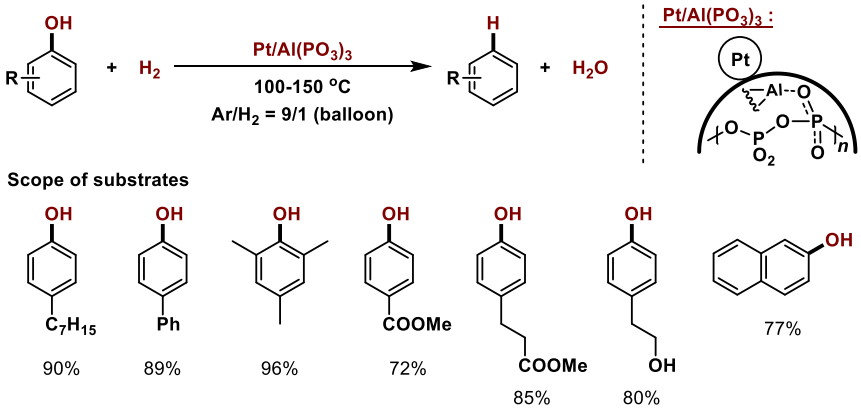
Hydrogenolysis of phenols to arenes is useful as a new synthetic route to basic chemical arenes from biomass substances such as lignin. Also, selective hydrogenolysis of functionalized phenols under mild condition is expected to be applied to fine chemical synthesis. Recently, various heterogeneous or homogeneous catalysts[1, 2] have been reported for the hydrogenolysis of phenols to arenes. In general, it is challenging to achieve high conversion by maintaining high selectivity since the C(sp^2)–OH bond is strong and/or the over-reduction to cyclohexanes could be problematic. As far as we know, there have been no reports on widely applicable hydrogenolysis of phenols to arenes with high selectivity under mild condition.

Here we report the use of $Al(PO_3)_3$-supported Pt nanoparticles ($Pt/Al(PO_3)_3$) for the selective hydrogenolysis of phenols to afford arenes under relatively low temperature (<150 °C) and ambient pressure (Ar/H_2 = 9/1, 1 atm). $Pt/Al(PO_3)_3$ could be applicable to various kinds of structurally diverse phenols (including sterically highly demanding phenols and lignin model compounds), giving the corresponding arenes in moderate to high yields. The catalyst was truly heterogeneous and could be reused several times. Mechanistic studies suggested that the metaphosphate anion in $Al(PO_3)_3$ contributes to the high efficiency of $Al(PO_3)_3$ support, likely *via* formation of the surface phenol phosphate species to facilitate the C(sp^2)–O bond cleavage. The present catalyst system could find a broad application in bio-refinery and fine chemical synthesis.



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