Catalysis under environmental conditions requires robust nanoparticles that can resist leaching of the organic shell and possess significant resistance to aggregation under extreme pH values. Robust gold-aryl nanoparticles AuNPs-COOH were fabricated by mild reduction of the water-soluble gold(III) diazonium salt, [HOOC-4-C₆H₄N≡N]AuCl₄, and fully characterized in solution and solid states. The nanoparticles show high stability in acidic and basic solutions with different pH values and moderate temperatures. Nitrophenols are among the most common organic pollutants in industrial and agricultural wastewaters due to their toxicity, anthropogenic, and inhibitory nature. The reduction of 4-nitrophenol (4-NPh) to 4-aminophenol (4-APh) catalyzed by gold-aryl nanoparticles was complete in less than five minutes. The direct gold-to-carbon bonding may be responsible for enhanced stability and increased catalytic efficiency compared with literature values. In general, the AuNPs-COOH showed high apparent reaction rate constant (k_{app}) for the reaction with a low [Au]/[4-NPh] ratio. Overall, the AuNPs-COOH were found to be highly effective when compared to previously reported systems. The reaction kinetics were treated as a pseudo-first order reaction. The activation parameters for 4-NPh reduction reaction are E_a = 25.48 kJ mol^{-1}, H^\# = 22.97 kJ mol^{-1} and S^\# = -165.84 J mol^{-1} K^{-1}.

References:
