Abstract

Application of palladium-catalyzed cross-coupling and carbonylation reactions in synthetic chemistry offers significant advantages compared to classical organic methodologies. For example, reactions can be conducted under milder conditions with high selectivity to the desired products.

In the presented thesis DNA-supported palladium (Pd/DNA) catalysts were synthesized under mild conditions and used in cross-coupling and carbonylation reactions. Interaction of palladium with DNA was evidenced in the Pd/DNA materials and the kind of palladium precursor and its amount influenced their morphology. The synthesized Pd/DNA catalysts contained Pd nanoparticles.

The synthesized Pd/DNA catalysts demonstrated good catalytic activity in Suzuki-Miyaura coupling of aryl bromides and boronic acid derivatives in aqueous solution. In addition, they proved stable and afforded similar yield of biaryl product in seven recyclings.

The Pd/DNA catalyst showed satisfactory results in the synthesis of various amides from aryl iodides and aromatic and aliphatic amines in water. In reactions with aliphatic amines, the solid CO source, $Mo(CO)_6$, gave better results than the gaseous CO. The Pd/DNA catalyst showed satisfactory recycling potential in the synthesis of *N*-phenylbenzamide.

For the first time, the Pd/DNA catalysts were applied in carbonylative Sonogashira coupling with $Mo(CO)_6$ and gaseous CO. The kind of the DNA biopolymer, used as a palladium support, influenced the reaction yield. The effect of water on the reaction course was observed. When water was used as a co-solvent, the reaction selectivity completely changed into the classic Sonogashira product. Adding DNA enhanced the stability of the catalyst in recycling experiments.

Pd/DNA catalyzed an efficient one-pot four-component synthesis of β-enaminones with trialkylamines under carbonylation conditions. The synthesis includes two processes, namely alkynone formation in a copper-free carbonylative Sonogashira coupling and oxidative *N*-dealkylation of tertiary amine. In addition, the Pd/DNA catalyst proved stable and could be reused five times.

Keywords: palladium, Pd nanoparticles, DNA, Suzuki-Miyaura coupling, aminocarbonylation, carbonylative Sonogashira coupling, β-enaminones.