Applications of bio-resource based sustainable heterogeneous Pd-Nanocatalyst for Cross-Coupling and Michael addition reactions

ABSTRACT

The development of efficient and cost-effective catalysts from renewable sources is crucial for sustainable chemistry. Herein, we developed a bio-heterogeneous Pd-nanocatalyst (PdNc@PA) by incorporating palladium nanoparticles into biodegradable kenaf-cellulose modified with poly(amidoxime) ligands. The catalyst has demonstrated remarkable stability and exceptional catalytic performance in a range of cross-coupling including Mizoroki-Heck, Suzuki-Miyaura, and Tamejiro-Hiyama reactions of inactivated aryl chlorides resulting in high yields of the desired coupling products. Additionally, PdNc@PA was also found to be effective in Michael addition reactions producing N, S, O-alkylated products in high yields. Furthermore, the PdNc@PA catalyst demonstrated robustness and recoverability allowing it to be reused across successive cycles without significant loss of catalytic activity. The incorporation of renewable resources in catalyst development offers an environmentally conscious alternative to traditional synthetic approaches. This research highlights the potential of utilizing biodegradable materials as catalyst supports, which could significantly diminish environmental impact and waste production. Moreover, this study demonstrates the versatility of PdNc@PA as a proficient and reusable catalyst for a diverse array of organic reactions. These discoveries provide an encouraging pathway towards the development of sustainable and economically viable catalysts suitable for industrial applications.