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Tertiary amines from lignin using commercial copper catalyst

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PURPOSE OF THE ABSTRACT

Tertiary alkyl amines are an indispensable class of molecules in chemistry, finding application in polymer synthesis (e.g. polyurethanes), agro industry and pharmaceutics [1,2]. For their production, N-alkylation of alcohols by hydrogen borrowing provides an atom efficient pathway, producing water as sole byproduct [3,4]. During hydrogen borrowing amination (HBA), the alcohol is converted to a more reactive aldehyde intermediate, which then condense with an alkylamine to form the final tertiary amine. A variety of metal catalyst based on Co, Cu, Fe, Ni, Ru and Ir, have proven to be suitable for this conversion. [5] Especially inexpensive Cu and Ni based catalyst have aroused interest due to their excellent dehydrogenation activity and good selectivity towards the final amine. [6-7]

Catalytic upgrading of lignin-derived monomers into heteroatom functionalized products plays a pivotal role in the future employability of currently emerging lignocellulose biorefineries. In this context, a hydrogen borrowing approach was establish using for the first time a heterogeneous commercial copper catalyst to make tertiary amines form an aromatic lignin model monomer. Various standard industrial noble and non-noble metal catalyst were evaluated with reporting of excellent mass balances and a corresponding reaction network. Low pressure hydrogen was key to high catalyst activity and tertiary amine selectivity. Diverse aliphatic and aromatic secondary amine reagents could be used with moderate to excellent yields. The recoverable catalyst was could be reused at least four times and catalyst deactivation as studied by ToF-SIMS clarified the fouling mechanism.

FIGURES

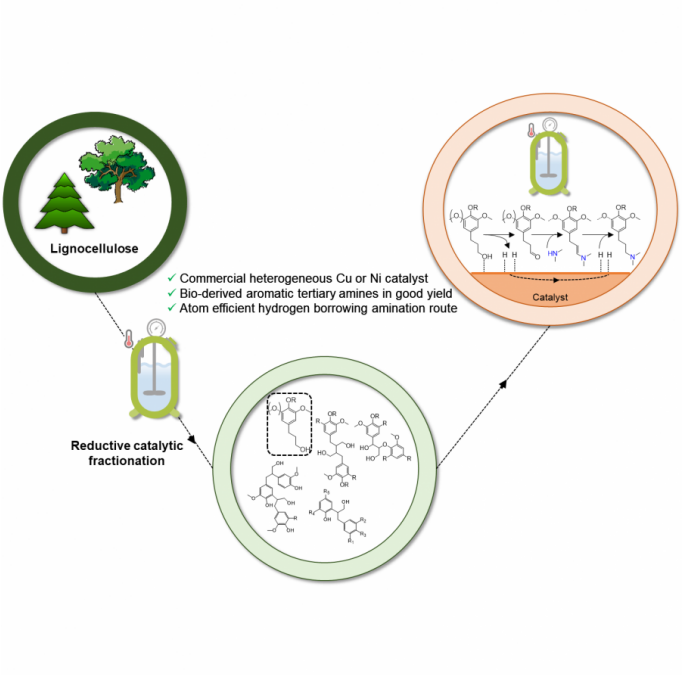

FIGURE 1

Hydrogen borrowing amination of lignin-derived monomers using a heterogeneous metal catalyst

FIGURE 2

KEYWORDS

Hydrogen borrowing amination | Heterogeneous catalysis | Lignin monomer upgrading

BIBLIOGRAPHY