



# Selective semi-hydrogenation of propargylamines using palladium magnetic nanocatalyst

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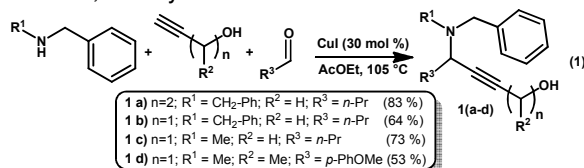
## INTRODUCTION

Selective hydrogenation of alkynes is an important transformation in organic synthesis and, the development of methodologies to obtain olefins is still challenging.<sup>1</sup> Nowadays, there is a growing demand for process that allows transformations on highly functionalized molecules as synthetic intermediates for pharmaceutical products. In that sense, the preparation and modification of propargylamines has gained popularity in recent years.<sup>2</sup> Propargylamine derivatives can be synthesized by A<sup>3</sup> coupling, which is a multicomponent reaction between an aldehyde, an amine and an alkyne.

Palladium is the most widely used catalysts to perform hydrogenation of alkynes but the evaluation of the catalytic activity and selectivity of new catalysts is usually made with simple alkynes. Herein, we report the synthesis of functionalized propargylamines, and the development of new highly active and selective magnetic Pd nanocatalyst<sup>3</sup> to perform the partial hydrogenation of these compounds. In the last ten years, the use of magnetic nanoparticles (MNPs) as catalyst supports brought a new perception of catalysis in terms activity, selectivity and sustainability.<sup>4</sup> However, Pd supported on MNPs still remains scarcely explored in the hydrogenation of alkynes.

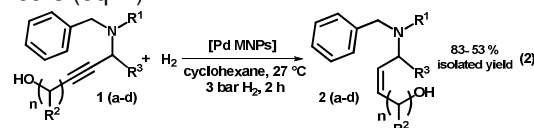
## RESULTS AND DISCUSSION

A series of propargylamines **1a-d** were synthesized by A<sup>3</sup> coupling reaction. In a pressure reactor were placed an alkyne, amine and aldehyde with 30 mol % CuI, in ethyl acetate under 105 °C for 12 h.



The alkynes **1a-d** were obtained with 53-83 % isolated yield (eq. 1). Then, the hydrogenation reaction was studied using a magnetically recoverable catalyst consisting of Pd NPs supported

on an amino modified silica-coated magnetite NPs, denoted as Fe<sub>3</sub>O<sub>4</sub>@SiO<sub>2</sub>NH<sub>2</sub>Pd.<sup>3</sup> In a typical reaction, 1 mmol of alkyne **1**, 1.2 mg of the catalyst (0.0004 mmol Pd), and cyclohexane (5 mL) were placed in a Fischer-Porter glass reactor that was then pressurized with 3 bar H<sub>2</sub>, and kept at 27 °C for 2 hours (eq. 2).



After a careful selection of reaction conditions, the products of debenzoylation or fully hydrogenation were not observed. The catalyst Fe<sub>3</sub>O<sub>4</sub>@SiO<sub>2</sub>NH<sub>2</sub>Pd was highly active, the alkenes **2** were obtained in good isolated yields and the reaction was chemo- and stereoselective. Even more, the use of a magnetically recoverable catalyst allowed a simple separation through the application of external magnet, thereby eliminating the requirement of catalyst filtration after completion of the reaction. Additionally the use of a heterogeneous catalyst removes toxic metal residue in the product, a concern in the synthesis of pharmaceutical products.

## CONCLUSION

A series of propargylamines were synthesized by A<sup>3</sup> coupling and subsequently semi-hydrogenated to the corresponding aminoalkenes in good isolated yields, under mild reaction conditions using a magnetically recoverable Pd nanocatalyst. Several functional groups were tolerated during the selective hydrogenation of highly functionalized molecules.

## ACKNOWLEDGEMENTS

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