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BOOK OF ABSTRACTS OF THE 8TH MEETING ON MEDICINAL BIOTECHNOLOGY

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Reduction of gallic acid by in situ BH_3

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Lithium aluminum hydride ($LiAlH_4$, LAH) is one of the most widely used reducing agents in organic synthesis due to its high reactivity and broad applicability. It efficiently reduces carbonyl-containing compounds such as esters, carboxylic acids, amides, and nitriles to the corresponding alcohols or amines, whereas sodium borohydride ($NaBH_4$) is generally limited to reducing aldehydes and ketones[1] under mild conditions. The superior reactivity of LAH arises from the highly polar Al-H bond, which enables hydride transfer to less reactive carbonyl groups.[2] However, LAH presents important drawbacks: it is highly moisture-sensitive, reacts violently with water or protic solvents, and requires strictly anhydrous conditions, aprotic solvents such as THF or diethyl ether, and an inert atmosphere. On the other hand, some studies are shown a new alternative to use $NaBH_4$ in the presence of an electrophile, as iodine, generating new alternatives to the use of LAH.[3] This work presents a safer and more convenient alternative for the reduction of carboxylic acids using gallic acid as a model substrate. The methodology employs $NaBH_4$ in the presence of boron trifluoride diethyl etherate ($BF_3{\cdot}Et_2O$), which generates borane (BH_3) *in situ*, a much stronger reducing species capable of efficiently converting carboxylic acids into primary alcohols.[4] Compared with LAH, this approach offers milder reaction conditions, improved operational safety, and easier handling, since *in situ* generation of BH_3 avoids direct manipulation of highly reactive reducing agents while maintaining high reduction efficiency. The reduction of gallic acid is particularly significant due to its multiple hydroxyl groups and the sensitivity of the aromatic structure, making selectivity essential. Controlled addition of gallic acid to the BH_3 solution proved effective for conversion into 3,4,5-trihydroxybenzyl alcohol while minimizing possible interactions between free BF_3 and phenolic groups. Overall, this methodology represents a practical and valuable alternative for safer and milder organic reductions with good functional-group tolerance.

KEYWORDS: *gallic acid, phenolic acids, phenolic alcohols*

REFERENCES:
1 Rickborn, B.; Wuesthoff, M. T. *J. Am. Chem. Soc.* 1970, *92* (23), 6894–6904. https://doi.org/10.1021/ja00726a028.
2 Clayden, J.; Greeves, N.; Warren, S.; Wothers, P. *Organic Chemistry*; Oxford University Press: Oxford, UK, 2001.
3 Simek, J. W.; Tuck, T.; Bush, K. C. *J. Chem. Educ.* 1997, *74* (1), 107. https://doi.org/10.1021/ed074p107.
4 Cho, S.-D.; Park, Y.-D.; Kim, J.-J.; Falck, J. R.; Yoon, Y.-J.. *Bull Korean Chem Soc* 2004, *25* (3), 407.