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$NaBH_4/PhCO_2H$: AnEfficient system for Reductive Amination of Aldehydes

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ABSTRACT

$NaBH_4/PhCO_2H$system has been used for thereductive aminationofa varietyof aldehydes withanilines. The reductive amination reactions have been performed within 60-120 min in THFunder reflux conditionsin high to excellent yields of products (85-95%).

Key words: $NaBH_4$, $PhCO_2H$, Reductive amination, Aldehydes, Amines.

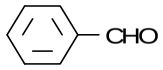
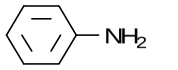
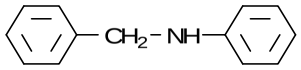
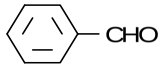
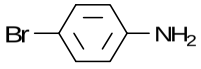
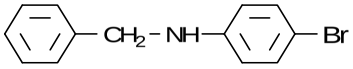
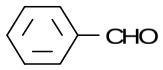
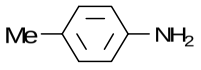
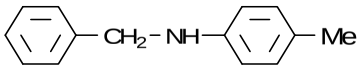
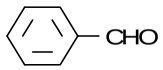
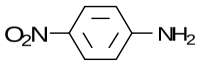
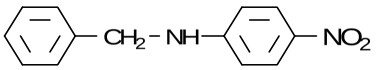
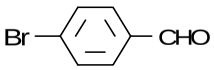
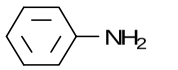
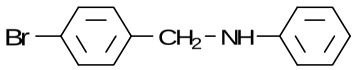
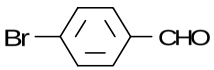
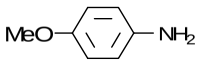
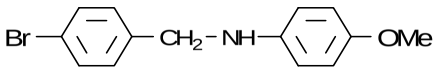
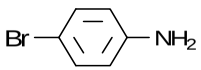
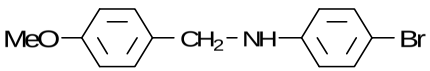
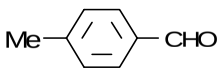
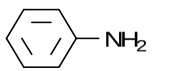
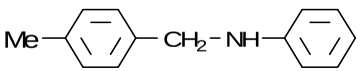
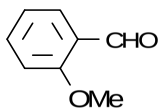
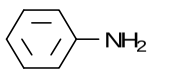
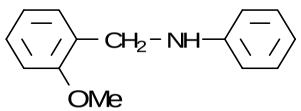
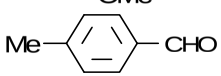
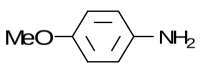
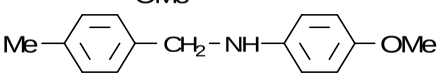
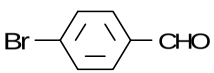
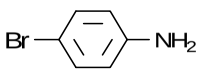
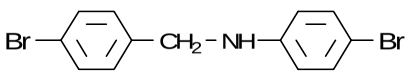
INTRODUCTION

Amines can be synthesized from their corresponding of aldehydes. So much methodhas been used for this purpose such as: the reduction of nitro, cyano, azide, carboxamide compounds or the alkylation of amines. These methods have problemssuch as: harsh reaction conditions, overalkylation, low chemical selectivity and generally poor yields. Another method is the reductive amination. Thisreactionhas been carried out by sodium borohydridewith different reducing system[1-2].Previously, we have reported some systems for this achievement[3-7].In continuing our efforts for the development of new reducing systems,in this context;we have reported the reductive amination reaction of aldehydes with anilines by $NaBH_4$ in the presence of benzoic acid in THF.

RESULTS AND DISCUSSION

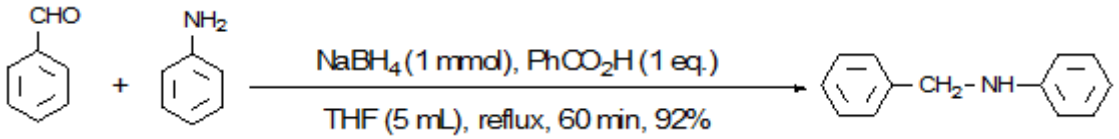
The model reaction has been performed by reductive amination of benzaldehydeand aniline. This reaction was carried outwith different molar ratio of the benzaldehyde/aniline/$PhCO_2H$/$NaBH_4$in different solvents for the optimazition reaction conditions. Our experiments have been shown that using 1 eq.of benzoic acidin THF (5 mL) under reflux conditions is the best conditions to complete the reductive amination of benzaldehye (1 mmol) and aniline (1 mmol) to *N*-benzylaniline. The reductive aminationwas completed within 60 min with 92% yields of product as shown in scheme 1.

Table 1. Reductive Amination of Aldehydes (1 mmol) with Anlines (1 mmol) by $NaBH_4$ (1 mmol) in the presence of benzoic acid(1 mmol) in THF (5 mL) under reflux conditions

Entry	Aldehydes	Anilines	Products	Time/min	Yield[a]/%
1				60	92
2				70	87
3				60	89
4				60	88
5				60	95
6				60	90
7				90	85
8				80	87
9				120	85
10				90	95
11				60	90

[a] Yields refer to isolated pure products (±5%).

A variety of aldehydes and anilines have been used by this reducing system.Experiments have been shown the correspondingsecondary amines were obtained in excellent yields (85-95%) within 60-120 minas shown in table 1.The influence of benzoic acid is not clear but we have observedsodium borohydride is slowly decomposed by activated benzoic acid. Consequently, it is liberated hydrogen gas *in situ*. Thus, the generated molecular hydrogen accelerates the reduction reaction.



Scheme 1

EXPERIMENTAL

The products were characterized by their ^{1}H NMR (400 MHzBruker)or IR (PerkinElmer FT-IR RXI) and comparison with authentic samples (melting or boiling points). TLC was applied for the purity determination of substrates, products and reaction monitoring over silica gel 60 F_{254} aluminum sheet.

Reductive amination of banzaldehyde and aniline with $NaBH_4$/Benzoic acid system (typical procedure)

In a round-bottomed flask (10 mL) equipped with a magnetic stirrer, a solution of benzaldehyde (0.106 g, 1 mmol), aniline (0.093 g, 1 mmol) and activated benzoic acid(0.122 g, 1 mmol) was preparedin THF (5 mL). Then the $NaBH_4$ (0.036 g, 1 mmol) was added to the reaction mixture and stirred under reflux conditions. TLC monitored the progress of the reaction (eluent; CCl_4/Ether: 5/2). The reaction was filtered after completion within 60 min. Evaporation of the solvent and short column chromatography of the resulting crude material over sil-ica gel (eluent; CCl_4/Ether: 5/2) afforded the *N*-benzylaniline (0.l66 g, 92% yield, Table 1, entry 1).

CONCLUSION

In this context, we have shown that the $NaBH_4$/benzoic acidis convenient system for the reductive amination of a variety of aldehydes and anilines to their corresponding secondary amines. The reduction reactions were accomplished with $NaBH_4$ (1 mmol) and activated benzoic acid (1 mmol) in THFunder reflux conditions.High efficiency of the reduction reactions and easy work-up procedure makes as an attractive new protocol for reductive amination of aldehydes.

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REFERENCES

1. Alinezhad, H.;Tollabian, Z.*Bull. Korean Chem. Soc.***2010**, *81*, 1927-1930.
2. Alinezhad, H.;Tajbakhsh, M.;Mahdavi, N.*Synth. Commun.***2010**,*40***,** 951-956.
3. Setamdideh, D.; Sepehraddin . D. *J. Mex. Chem. Soc.* **2014**, *57*, 22-25.
4. Setamdideh, D.; Hasani, S.; Noori, S. *J. Chin. Chem. Soc.***2013**, *60*, 1267-1271.
5. Pourhanafi, S.; Setamdideh, D.; Khezri, B. *Orient. J. Chem.* **2013**, *29*, 709-712.
6. HasanloieTaie, S.; Setamdideh, D. *Orient. J. Chem.* **2014**, *30*, 341-344.
7. Arefi, H.; Setamdideh, D. *Orient. J. Chem.* **2014**, *30*, 299-302.