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A NOVEL AND EFFICIENT PRODUCTION OF AMINES FROM AZIDES USING Lici/NaBH4

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Abstract: A practical & efficient reagent system LiCl/NaBH₄ is used for the production of amines from azides is described.

Reduction of the azide moiety to an amine constitutes a synthetically important process, and since many azides can be prepared with regio and stereo control, subsequent reduction permits a controlled introduction of the amine function.¹ The reaction is of wide applicability and has been effected with a variety of reagents some of them include LiAlH₄,² Zinc Borohydride,³ Samarium iodide,⁴ (BER)-nickel acetate,⁵ benzyl triethylammonium tetrathiomolybdate,⁶ Zn-NiCl₂.6H₂0-THF,⁷ Zn(BH₄)₂(dabco)⁸ and MePh₃P⁺BH₄^{-,8} etc. Most of the available reagents reported have some disadvantages in relation to their general applicability, selectivity and longer reaction time.

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In continuation of our efforts in exploring the potentiality of modified borohydrides,⁹ we observed the production of amines from respective aliphatic and aromatic azides using LiCl/NaBH₄. Thus treatment of one equivalent of azide with one equivalent of LiCl/NaBH₄ reagent in dry THF solvent under nitrogen atmosphere at 0 ^oC to room temperature provided quantitative formation of the amines within 30 minutes (Scheme 1).

$$\frac{\text{Scheme 1}}{\text{R-N}_3} \xrightarrow{\text{LiCl/NaBH}_4} \text{R-NH}_2$$

When LiCl (1 eq) reacts with NaBH₄ (1 eq), in THF solvent generates insitu formation of LiBH₄.¹⁰ The formation of amines from azides could be rationalized on this basis. Our results on the reduction of a variety of aliphatic, aromatic azides are summarized in the **Table 1**. Chemoselective reduction of azide was observed, in the presence of chloro (entry 9), nitro (entry 6), methoxy (entry 2) and carboxylic (entry 5) acid groups. These were not effected with the reagent system.

Typical experimental method for the production of amines from azides:

In a typical procedure, into a two-necked round bottom flask equipped with magnetic bead and nitrogen balloon adapter was placed LiCl (1eq), dry THF (15ml) was syringed into the flask. The contents were cooled to 0 $^{\circ}$ C, NaBH₄ (1eq) was added in portion to the above solution. To this reagent system at 0 $^{\circ}$ C was added azide (1eq) in dry THF (5ml). After complete addition of azide

Entry	Substrate	Product	Yield* (%)
1	×,		95
2	MeO N3	Me0	94
3	Ns	NH ₂	87
4	HO N3	HO NH2	90
5	Соон		85
6	0,3N	02N	86
7	о І РЬО-РN, ОРЬ	0 Рь 0 — РNH ₂ ОРь	89
8	\/	NH ₂	90
9	N3 CI OH	H ₂ N CI	85

Table 1 Production of Amines from Azides using LiCl/NaBH4

^a All reaction were completed within 30 minutes period, Yields (%) refer to isolated and chromatographically pure amines,

contents were brought to room temperature $(35 \, {}^{0}\text{C})$ and magnetically stirred. The progress of the reaction was monitored by TLC clearly indicated the disappearance of the azide within 30 minutes. Contents were cooled and treated with 5% aq. HCl solution gave the separation of organic layer. THF was evaporated under vacuum, crude organic was extracted into ethyl acetate (10ml), washed with water and dried over anhydrous Na₂SO₄. Evaporation of the organic portion provided crude amine. Column chromatography purification of the crude amine furnished pure amine in quantitative yield. All isolated amines (known in the literature) were fully characterized by ¹H NMR, IR and Mass spectral data. In general isolated yields were found in the range of 86 to 95%.

In conclusion, the present results demonstrate an efficient, chemoselective and rapid production of aliphatic & aromatic amines from azides in excellent yields under mild reaction conditions using LiCl/NaBH₄.

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References and Notes:

 (a) "The Chemistsy of azido Group" ed. by Patai, S., Interscience Publishers, London, 1971, p.333. (b) A recent review on Azide Chemistry widely covered various reduction methods see: Sriven, E.; Turnbull, K. Chem. Rev., 1988, 88, 297.

- Bose, A. K.; Kistner, J. F.; Farber, L. J. Org. Chem. 1962, 27, 2925 and references cited there in.
- 3. Ranu, B. C.; Sarkar, A.; Chakraborty, R. J. Org. Chem. 1994, 59, 4114.
- 4. Haung, Y.; Zhang, Y.; Wang, Y. Tetrahedron Lett., 1997, 38, 1065.
- 5. Yoon, N. M.; Choi, J.; Shon, Y. S. Synth. Commun., 1993, 23, 3047.
- Ramesha, A. R.; Bhat, S.; Chandrasekaran, S. J. Org. Chem. 1995, 60, 1609.
- 7. Boruah, A.; Baruah, M.; Prajapati, D.; Sandhu, J. S. Syn. Lett. 1997, 1253.
- Firouzabadi, H.; Adibi, M.; Zeynizadeh, B. Synth. Commun. 1998, 28, 1257, and references cited there in.
- 9. (a) Santosh Laxmi, Y. R.; Iyengar, D. S. Synth. Commun. 1997, 27, 1731.
 (b) Purushothama Chary, K.; Santosh Laxmi, Y. R.; Iyengar, D. S. Synth. Commun. 1999, 29, 1257. (c) Purushothama Chary, K.; Rajaram, S.; Salahuddin, S.; Iyengar, D. S. Synth. Commun. 1999, (in press). (d) Purushothama Chary, K.; Raja Ram, S.; Iyengar, D. S. Synth. Commun. 1999, (in press) (e) Purushothama Chary, K.; Thomas, R. M.; Iyengar, D. S. Ind. J. Chem. Sec. B. 1999 (in press) (f) Purushothama Chary, K.; Hari Mohan, G and Iyengar, D. S. Chem. Let. 1999, 11, 1223.
 (g) Purushothama Chary, K.; Hari Mohan, G and Iyengar, D. S. Chem.

D. S. Synth. Commun. 1999, (in press) (i) Purushothama Chary, K.; Raja Ram, S.; Iyengar, D. S. Synlett, 2000 (in press).

10. Yang, C.; Pittman, Jr. C. U. Synth. Commun. 1998, 28, 2027.

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