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S. Raja Ram [a], K. Purushothama Chary [a] & D. S. Iyengar [a]

[a] Discovery Laboratory, Organic Division II, Indian Institute of Chemical Technology, Hyderabad, 500 007, India

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A NOVEL AND EFFICIENT PRODUCTION OF AMINES FROM AZIDES USING LiCl/$NaBH_4$

S. Raja Ram, K. Purushothama Chary and D. S. Iyengar*

Discovery Laboratory, Organic Division II,
Indian Institute of Chemical Technology, Hyderabad-500 007 India

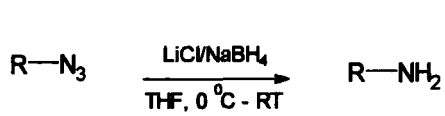
Abstract: *A practical & efficient reagent system LiCl/$NaBH_4$ is used for the production of amines from azides is described.*

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 $LiAlH_4$,[2] Zinc Borohydride,[3] Samarium iodide,[4] (BER)-nickel acetate,[5] benzyl triethylammonium tetrathiomolybdate,[6] Zn-$NiCl_2.6H_20$-THF,[7] $Zn(BH_4)_2$(dabco)[8] and $MePh_3P^+BH_4^-$,[8] etc. Most of the available reagents reported have some disadvantages in relation to their general applicability, selectivity and longer reaction time.

* To whom the correspondence should be addressed
IICT Communication No. 4413
E-mail: iyengar@iict.ap.nic.in

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 $LiCl/NaBH_4$. Thus treatment of one equivalent of azide with one equivalent of $LiCl/NaBH_4$ reagent in dry THF solvent under nitrogen atmosphere at 0 ^{0}C to room temperature provided quantitative formation of the amines within 30 minutes (Scheme 1).

Scheme 1

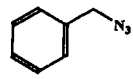
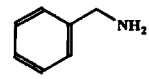
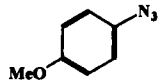
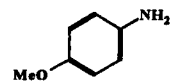
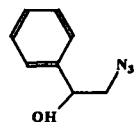
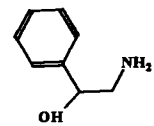
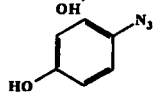
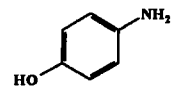
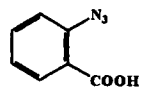
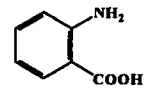
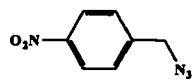
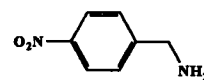
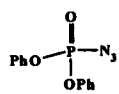
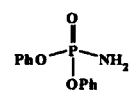
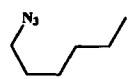
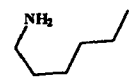
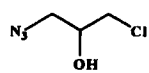
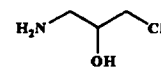


When LiCl (1 eq) reacts with $NaBH_4$ (1 eq), in THF solvent generates insitu formation of $LiBH_4$.[10] The formation of amines from azides could be rationalized on this basis. Our results on the reduction of a variety of aliphatic, aromatic azides are summarized in the **Table 1**. Chemoselective reduction 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 ^{0}C, $NaBH_4$ (1eq) was added in portion to the above solution. To this reagent system at 0 ^{0}C was added azide (1eq) in dry THF (5ml). After complete addition of azide

Table 1 Production of Amines from Azides using LiCl/$NaBH_4$

Entry	Substrate	Product	Yield[a] (%)
1			95
2			94
3			87
4			90
5			85
6			86
7			89
8			90
9			85

[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}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 Na_2SO_4. 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 ^{1}H 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/$NaBH_4$.

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