



Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/lcyc20>

FACILE STEREOSELECTIVE SYNTHESIS OF (E)- AND (Z)-ALLYL BROMIDES FROM THE BAYLIS-HILLMAN ADDUCTS USING MgBr_2

Subramanian Ravichandran ^a

^a School of Chemistry, University of Hyderabad, Hyderabad, 500 046, India
Published online: 09 Nov 2006.

To cite this article: Subramanian Ravichandran (2001) FACILE STEREOSELECTIVE SYNTHESIS OF (E)- AND (Z)-ALLYL BROMIDES FROM THE BAYLIS-HILLMAN ADDUCTS USING MgBr_2 , Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry, 31:13, 2059-2062, DOI: [10.1081/SCC-100104426](https://doi.org/10.1081/SCC-100104426)

To link to this article: <http://dx.doi.org/10.1081/SCC-100104426>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

SYNTHETIC COMMUNICATIONS, 31(13), 2059–2062 (2001)

FACILE STEREOSELECTIVE SYNTHESIS OF (*E*)- AND (*Z*)-ALLYL BROMIDES FROM THE BAYLIS-HILLMAN ADDUCTS USING MgBr_2

Subramanian Ravichandran

School of Chemistry, University of Hyderabad,
Hyderabad – 500 046, India

ABSTRACT

A simple and convenient synthesis of the title compounds is described.

(2*Z*)-2-(Bromomethyl)alk-2-enoates are versatile building blocks for stereoselective synthesis of natural products such as necic acid, α -methylene- γ -butyrolactones and α -alkylidene- β -lactams. These fascinating compounds have been synthesized from Baylis-Hillman reaction products, i.e. methyl-3-hydroxy-2-methylenealkanoates using NEt_3/MsCl ,¹ $\text{CuBr}_2/\text{silica gel}$,² $\text{HBr-H}_2\text{SO}_4$,³ $\text{NCS/NBS-Me}_2\text{S}$,⁴ PBr_3 ,⁵ oxalylchloride/DMF/ CHCl_3 ,⁶ (HCA- PPh_3) complex⁷ and by the reaction of $\text{AlCl}_3/\text{CH}_2\text{Cl}_2$ ⁸ with the acetate derived from the corresponding alcohol.

In continuation of our research programme,⁹ I herein report a convenient synthesis of methyl(2*Z*)-2-(bromomethyl)alk-2-enoates by treating methyl-3-hydroxy-2-methylenealkanoates with acetic anhydride and magnesium bromide according to the following eq. 1.

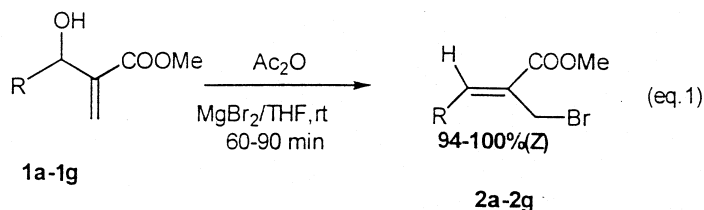


Table 1. Synthesis of Methyl(2*Z*)-2-(bromomethyl)alk-2-enoates^{a,b}

Substrate	R	Time (minutes)	Product	Yield (%) ^c	Z:E ^d
1a	C ₆ H ₅	60	2a ¹²	86	100:0
1b	4-MeC ₆ H ₄	60	2b	83	100:0
1c	4-ClC ₆ H ₄	60	2c	81	96:04
1d	4- ¹ PrC ₆ H ₄	60	2d	81	100:0
1e	4-MeC ₆ H ₄	70	2e	80	95:05
1f	n-pentyl	90	2f	68	94:06
1g	n-hexyl	90	2g	71	95:05

^aAll reaction were carried out in 2 mM scale of alcohol using acetic anhydride (4 mM) and 6 mM scale of magnesium bromide in THF (5 ml) at room temperature.

^bSatisfactory spectral data IR, ¹H (200 MHz), and ¹³C NMR (50 MHz) were obtained.

^cIsolated yields after column chromatography (silica gel, 1% ethyl acetate in hexane).

^dStereochemical assignments and isomeric purities were based on difference in chemical shifts and integration ratios of olefinic protons in ¹H NMR analysis.

In a similar fashion, 3-hydroxy-2-methylenealkane-nitriles (**3a-3g**) on reaction with acetic anhydride and magnesium bromide in THF at room temperature for 1–1.5 hours afforded the desired regiomerically pure (2*E*)-2-(bromomethyl)alk-2-enenitriles (**4a-4g**) in good yields with high (*E*)-selectivity (eq. 2) (Table 2).

From these results, it is clear that esters **1a-1g** and nitriles **4a-4g** provide allyl bromides with opposite stereochemistry. This observation is consistent with our earlier results¹⁰ and may be explained either to the

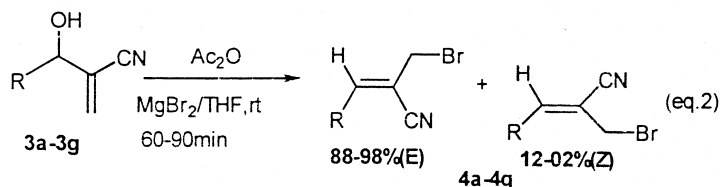


Table 2. Synthesis of (2*E*)-2-(bromomethyl)alk-2-enenitriles^{a,b}

Substrate	R	Time (minutes)	Product	Yield (%) ^c	<i>E:Z</i> ^d
3a	Phenyl	60	4a ¹³	85	93:07
3b	4-MeC ₆ H ₄	60	4b	84	95:05
3c	4-ClC ₆ H ₄	60	4c	83	96:04
3d	4- ¹ PrC ₆ H ₄	75	4d	81	98:02
3e	4-MeC ₆ H ₄	70	4e	84	94:06
3f	n-pentyl	90	4f	79	88:12
3g	n-hexyl	90	4g	77	92:08

difference in steric demands between the nitrile and ester groups or to the chelation effects.

In summary this study provides a simple stereoselective synthesis of (*Z*)- and (*E*)-allyl bromides thus demonstrating the efficiency of magnesium bromide, a very mild Lewis acid, as a stereoselective brominating reagent.

EXPERIMENTAL

All of the required Baylis-Hillman products were obtained by the reaction of the corresponding aldehydes with methacrylate/acrylonitrile in the presence of a catalytic amount of DABCO according to the literature procedure.¹¹

General Procedure

To a solution of alcohol (**1a–1g**, **3a–3g**) (2 mM) and acetic anhydride (4 mM) were added to freshly prepared magnesium bromide (6 mM) in THF (5 ml). The reaction mixture was stirred at room temperature for 1–1.5 h and monitored by TLC. On completion of the reaction, solvent was removed under reduced pressure and the residue purified by column chromatography (silicagel, 1% EtOAc in hexane) to furnish the desired product (**2a–2g**, **4a–4g**) in good yields.

ACKNOWLEDGMENTS

SR thanks his brothers SS and Dr. SP for financial support and constant encouragement in research.



REFERENCES

1. Chavan, S.P.; Ethiraj, K.S.; Kamat, S.K. *Tetrahedron Lett.* **1997**, *38*, 7415.
2. Gruice, A. Foucaud, A. *New J. Chem.* **1991**, *15*, 943.
3. Buchholz, R.; Hoffmann, H.M.R. *Helv. Chim. Acta* **1991**, *74*, 1213.
4. Hoffmann, H.M.R.; Rabe, J. *J. Org. Chem.* **1985**, *50*, 3849.
5. Semmelhack, M.F.; Wu, E.S.C. *J. Am. Chem. Soc.* **1976**, *98*, 3384.
6. McFadden, H.G.; Harris, R.L.N.; Jenkins, C.L.D. *Aust. J. Chem.* **1989**, *42*, 301.
7. Ameer, F.; Drewes, S.E.; Houston-McMillan, M.S.; Kaye, P.T. *J. Chem. Soc. Perkin. Trans 1* **1985**, 1143.
8. Basavaiah, D.; Pandiaraju, S.; Padmaja, K. *Synlett.* **1996**, *4*, 393.
9. Basavaiah, D.; Bakthadoss, M.; Pandiaraju, S. *Chem. Commun.* **1998**, 1638 and references cited therein.
10. Basavaiah, D.; Bhavani, A.K.D.; Pandiaraju, S.; Sarma, P.K.S. *Synlett.* **1995**, *3*, 243.
11. Hoffman, H.M.R.; Rabe, J. *Angew. Chem. Int. Ed. Engl.* **1983**, *22*, 795.
12. Spectral data for **2a**: ^1H NMR (200 MHz, CDCl_3): δ 3.85 (s, 3H), 4.36 (s, 2H), 7.33–7.57 (m, 5H), 7.84 (s, 1H); ^{13}C NMR (50 MHz, CDCl_3): δ 26.62, 52.38, 128.60, 128.86, 129.55, 134.12, 143.11, 166.43; IR (neat): 1705, 1620 cm^{-1} .
13. Spectral data for **4a**: ^1H NMR (200 MHz, CDCl_3): δ 4.19 (s, $-\text{CH}_2$ protons, (*Z*)-isomer), 4.23 (d, $-\text{CH}_2$ protons, $J=0.8$ Hz, (*E*)-isomer) 7.23 (s, vinylic proton, (*E*)-isomer), 7.34 (s, vinylic proton, (*Z*)-isomer), 7.37–7.54 (m, 3H), 7.73–0.82 (m, 2H); ^{13}C NMR (50 MHz, CDCl_3): δ 26.63, 32.70, 108.06, 117.03, 129.04, 129.23, 130.44, 131.39, 132.41, 146.47, 147.21 in these the signals at 26.63, 130.44, 147.21 are due to minor (*Z*)-isomer: IR (KBr): 2120, 1610 cm^{-1} .

Received in the Netherlands September 14, 2000



Request Permission or Order Reprints Instantly!

Interested in copying and sharing this article? In most cases, U.S. Copyright Law requires that you get permission from the article's rightsholder before using copyrighted content.

All information and materials found in this article, including but not limited to text, trademarks, patents, logos, graphics and images (the "Materials"), are the copyrighted works and other forms of intellectual property of Marcel Dekker, Inc., or its licensors. All rights not expressly granted are reserved.

Get permission to lawfully reproduce and distribute the Materials or order reprints quickly and painlessly. Simply click on the "Request Permission/Reprints Here" link below and follow the instructions. Visit the [U.S. Copyright Office](#) for information on Fair Use limitations of U.S. copyright law. Please refer to The Association of American Publishers' (AAP) website for guidelines on [Fair Use in the Classroom](#).

The Materials are for your personal use only and cannot be reformatted, reposted, resold or distributed by electronic means or otherwise without permission from Marcel Dekker, Inc. Marcel Dekker, Inc. grants you the limited right to display the Materials only on your personal computer or personal wireless device, and to copy and download single copies of such Materials provided that any copyright, trademark or other notice appearing on such Materials is also retained by, displayed, copied or downloaded as part of the Materials and is not removed or obscured, and provided you do not edit, modify, alter or enhance the Materials. Please refer to our [Website User Agreement](#) for more details.

[Order now!](#)

Reprints of this article can also be ordered at

<http://www.dekker.com/servlet/product/DOI/101081SCC100104426>