

Table 2. Acetylation of alcohols with acetic anhydride in the presence of trimethyl(phenyl)ammonium tribromide in acetone at room temperature^a

Substrate	Product	Reaction time, min	Yield, ^b %	Substrate	Product	Reaction time, min	Yield, ^b %
Ia	IIa	50	95	Ig	IIg	200	94
Ib	IIb	60	98	Ih	IIh	105	98
Ic	IIc	90	94	Ii	IIi	50	91
Id	IId	170	94	Ij	IIj	24 h	No reaction
Ie	IIe	70	93	Ij	IIj	120	98
If	IIf	120	90	Ik	IIk	24 h	83 ^c

^a Molar ratio substrate–catalyst–acetic anhydride 1 : 0.1 : 2.5.

^b Yield of the isolated compound.

^c The product was purified by short column chromatography.

anilinium tribromide in acetone under mild conditions (Scheme 1, Table 2).

The reactions were easily carried out by mixing 1 mmol of alcohol, 0.1 mmol of *N,N,N*-trimethylanilinium tribromide, and 2.5 mmol of acetic anhydride in acetone, followed by stirring of the resulting mixture at room temperature for appropriate time. Finally, the reaction mixture was quenched with water, and the product was isolated by extraction with methylene chloride. No acetylation of 2-phenylethanol (**II**) was observed for at least 24 h in the absence of *N,N,N*-trimethylanilinium tribromide, whereas in the presence of the catalyst the reaction was complete in 50 min (Table 2).

In summary, we have developed an efficient, simple, and environmentally friendly procedure for the acetylation of alcohols. Mild conditions, nontoxic reactants, and easy reaction work-up are some of the notable features of this protocol.

EXPERIMENTAL

The acetylated products were characterized by comparison of their spectral (IR, ¹H and ¹³C NMR) and physical data with authentic samples.

Acetylation of 4-*tert*-butylbenzyl alcohol with acetic anhydride in the presence of a catalytic amount of *N,N,N*-trimethylanilinium tribromide (typical procedure). *N,N,N*-Trimethylanilinium tribromide, 0.038 g (0.1 mmol), was added to a solution of 0.164 g (1 mmol) of 4-*tert*-butylbenzyl alcohol and 0.255 g (2.5 mmol) of acetic anhydride in 5 ml of acetone, and the reaction mixture was stirred for 70 min at room temperature (the progress of the reaction was monitored by TLC). After reaction completion, 5 ml of water was added to the mixture under stirring, and the product was extracted with methylene

chloride (5×5 ml). The extract was dried over anhydrous Na₂SO₄ (1.5 g) and evaporated to obtain 0.202 g (98%) of 4-*tert*-butylbenzyl acetate (**III**).

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REFERENCES

- Lee, C.W., Hwang, H.Y., Jeong, H.M., Yoon, U.C., and Chi, K.W., *Synth. Met.*, 2009, vol. 159, p. 1820.
- Mrozek, L., Dvorakova, L., Mandelova, Z., Rarova, L., Rezacova, A., Placek, L., Opatrilova, R., Dohnal, J., Paleta, O., Kral, V., Drasar, P., and Jampilek, J., *Steroids*, 2011, vol. 76, p. 1082.
- Schilter, B., Scholz, G., and Seefelder, W., *Eur. J. Lipid Sci. Technol.*, 2011, vol. 113, p. 309.
- Nagase, R., Matsumoto, N., Hosomi, K., Higashi, T., Funakoshi, S., Misaki, T., and Tanabe, Y., *Org. Biomol. Chem.*, 2007, vol. 5, p. 151.
- Zoller, A. and Marcilla, A., *J. Appl. Polym. Sci.*, 2011, vol. 121, p. 1495.
- Verdelet, T., Mercey, G., Correa, N., Jean, L., and Renard, P.Y., *Tetrahedron*, 2011, vol. 67, p. 8757.
- Zolfigol, M.A., Khazaei, A., Ghorbani-Choghama-rani, A., Rostami, A., and Hajjami, M. *Catal. Commun.*, 2006, vol. 6, p. 399.
- Osiglio, L., Romanelli, G., and Blanco, M., *J. Mol. Catal. A: Chem.*, 2010, vol. 316, p. 52.
- Chandrasekhar, S., Ramachander, T., and Takhi, M., *Tetrahedron Lett.*, 1998, vol. 39, p. 3263.
- Orita, A., Tanahashi, C., Kakuda, A., and Otera, J., *J. Org. Chem.*, 2001, vol. 66, p. 8926.
- Ghosh, R., Maiti, S., and Chakraborty, A., *Tetrahedron Lett.*, 2005, vol. 46, p. 147.
- Hosseini-Sarvari, M. and Sharghi, H., *Tetrahedron*, 2005, vol. 61, p. 10903.
- Shirini, F., Hossein-Imanzadeh, G., Mousazadeh, S.A.R., Mohammadpoor-Baltork, I., and Abedin, M., *Chin. Chem. Lett.*, 2010, vol. 21, p. 1187.

14. Kadam, S.T., Lee, H., and Kim, S.S., *Bull. Korean Chem. Soc.*, 2009, vol. 30, p. 1071.
15. Kim, J.G. and Jang, D.O., *Bull. Korean Chem. Soc.*, 2009, vol. 30, p. 1435.
16. Karimi, B. and Maleki, J., *J. Org. Chem.*, 2003, vol. 68, p. 4951.
17. Moghadam, M., Tangestaninejad, S., Mirkhani, V., Mohammadpoor-Baltork, I., Babaghanbari, M., Zarea, M., Shariati, L., and Taghavi, S.A., *J. Iran. Chem. Soc.*, 2009, vol. 6, p. 523.
18. Zolfigol, M.A., Salehi, P., Ghorbani-Choghamarani, A., Safaiee, M., and Shahamirian, M., *Synth. Commun.*, 2007, vol. 37, p. 1817.
19. Ghorbani-Choghamarani, A., Goudarziafshar, H., Nikoorazm, M., and Yousefi, S., *Lett. Org. Chem.*, 2009, vol. 6, p. 335.
20. Ghorbani-Choghamarani, A., Hajjami, M., Goudarziafshar, H., Nikoorazm, M., Mallakpour, S., Sadeghizadeh, F., and Azadi, G., *Monatsh. Chem.*, 2009, vol. 140, p. 607.
21. Ghorbani-Choghamarani, A., Goudarziafshar, H., Nikoorazm, M., and Yousefi, S., *Can. J. Chem.*, 2009, vol. 87, p. 1144.
22. Ghorbani-Choghamarani, A., Goudarziafshar, H., and Zamani, P., *Chin. Chem. Lett.*, 2011, vol. 22, p. 1207.
23. Ghorbani-Choghamarani, A., Chenani, Z., and Mallakpour, S., *Synth. Commun.*, 2009, vol. 39, p. 4264.
24. Ghorbani-Choghamarani, A., Zolfigol, M.A., Hajjami, M., Darvishi, K., and Golamnia, L., *Collect. Czech. Chem. Commun.*, 2010, vol. 75, p. 607.
25. Ghorbani-Choghamarani, A. and Azadi, G., *J. Iran. Chem. Soc.*, 2011, vol. 8, p. 1082.