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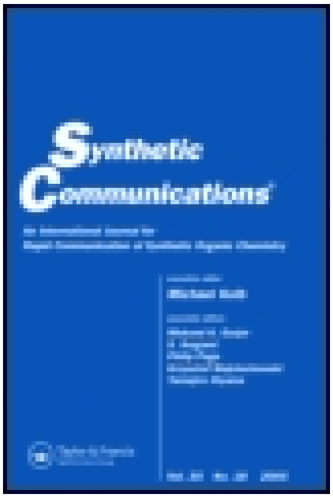

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Superoxide-Mediated Regioselective Deblocking of the Tosyl Group from N-Tosylcarboxamides

R. S. Raghuvanshi [a] & K. N. Singh [a]

[a] Department of Applied Chemistry , Institute of Technology, Banaras Hindu University , Varanasi, India

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Superoxide-Mediated Regioselective Deblocking of the Tosyl Group from N-Tosylcarboxamides

R. S. Raghuvanshi and K. N. Singh
Department of Applied Chemistry, Institute of Technology, Banaras
Hindu University, Varanasi, India

Abstract: In situ–generated tetraethylammonium superoxide brings about an easy and selective cleavage of the N—S bond of N-tosylcarboxamides, providing a new method for the deblocking of the tosyl group from such substrates.

Keywords: Detosylation, N-tosylcarboximide, superoxide

The importance of selective introduction and removal of protecting groups in organic synthesis is well established.[1,2] The *p*-toluenesulfonyl(tosyl) group is the best-known protecting group,[3] but its removal is not straightforward. The removal of the tosyl group has been achieved by employing a variety of substrates.[3–6] There are two methods for the reductive deblocking of the tosyl group from N-tosylcarboxamides. The first method involves the electrochemical reduction of different types of N-tosylcarboxamides under various experimental conditions,[7] the whereas the second one employs reductive deprotection using lithium powder in the presence of a catalytic amount of naphthalene in tetrahydrofuran (THF) at temperatures ranging between -78 and 20°C.[5] The desulfonylation of N-sulfonylamide can be achieved by the reaction of samarium(II) iodide (SmI_2) in THF at room temperature[8] and under neutral conditions by reaction with tributyltin hydride.[9]

In light of this and as a part of our ongoing research to extend the applicability of the superoxide ion in organic synthesis,[10] we report herein a mild

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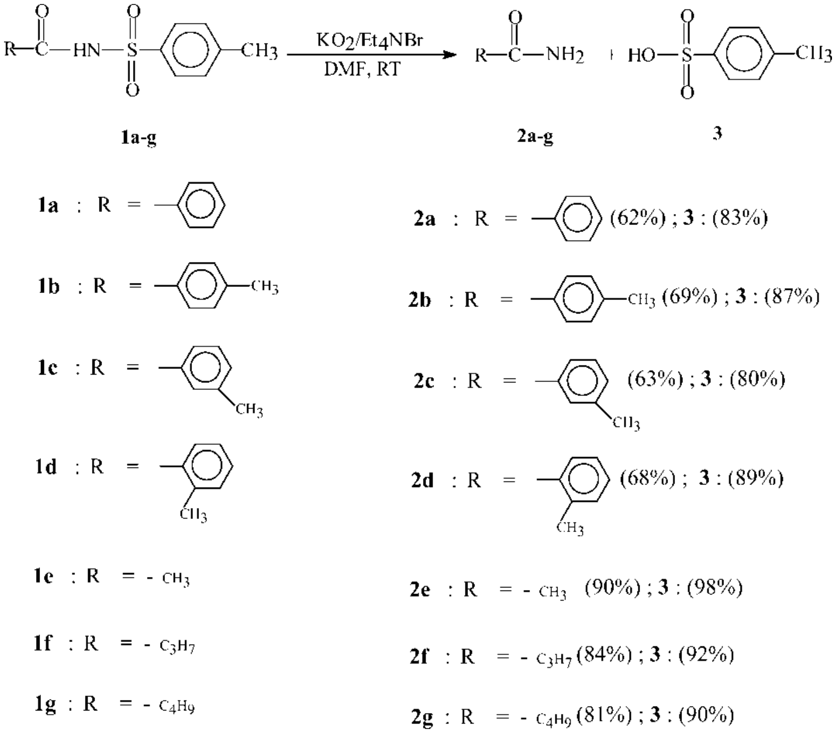
Address correspondence to K. N. Singh, Department of Applied Chemistry, Institute of Technology, Banaras Hindu University, Varanasi, India. E-mail: knsinghbhu@yahoo.co.in

and efficient deprotective method for N-tosylcarboxamide using in situ–generated tetraethylammonium superoxide in dry DMF at room temperature (Scheme 1).

In the present study, Et_4NO_2 has been generated in situ by the phase-transfer reaction of KO_2 and Et_4NBr in dimethylformamide at room temperature and subsequently allowed to react with a number of N-tosylcarboxamides (**1a–g**).

Various N-tosylcarboxamides, viz. N-benzoyl-*p*-toluenesulphonamide (**1a**), N-*p*-toluoyl-*p*-toluenesulphonamide (**1b**), N-*m*-toluoyl-*p*-toluenesulphonamide (**1c**), N-*o*-toluoyl-*p*-toluenesulphonamide (**1d**), N-acetyl-*p*-toluenesulphonamide (**1e**), N-propionyl-*p*-toluenesulphonamide (**1f**), and N-butyryl-*p*-toluenesulphonamide (**1g**), were allowed to react with KO_2 in the presence of Et_4NBr in dry DMF at room temperature. The N-tosylcarboxamides (**1a–g**) undergo selective N—S bond cleavage to give the corresponding amides (**2a–g**) and p-toluenesulphonic acid (**3**) in reasonably good yield under the mild reaction condition of Et_4NO_2.

A three-fold molar excess of KO_2 and 1.5-fold molar excess of Et_4NBr with respect to the substrate were employed to achieve the cleavage. Each reaction



Scheme 1.

was monitored by thin-layer chromatography (TLC) for its completion. The products were fully identified by their melting points and spectral data, which were in full agreement with the values described in the literature.

Thus, tetraethylammonium superoxide gives rise to the selective cleavage of the N—S bond of the N-tosylcarboxamides, affording deprotected carboxamides and p-toluenesulphonic acid under mild and nonaqueous aprotic conditions.

EXPERIMENTAL

Potassium superoxide and tetraethylammonium bromide were procured from E. Merck, Germany, and were used as received. Dry N,N-dimethylformamide (DMF) from Aldrich, USA, was stored over molecular sieves (4 Å) prior to use. The other reagents and solvent were of A.R. grade. Substrates used in the present investigation were prepared according to literature procedure.[11]

Reaction of In Situ–Generated Tetraethylammonium Superoxide with N-Tosylcarboxamides (1a–g) General Procedure

Potassium superoxide (0.43 g, 0.006 mol) and tetraethylammonium bromide (0.63 g, 0.003 mol) were weighted under a nitrogen atmosphere using an atmosbag and transferred into a three-necked round-bottom flask equipped with a magnetic stirrer, nitrogen inlet, and a Leibig condenser protected by a calcium chloride drying tube. Dry dimethylformamide (30 ml) was added to it, and the mixture was agitated magnetically for 15 min to facilitate the formation of tetraethylammonium superoxide. Finally, the substrate N-tosylcarboxamide (0.002 mol) was admitted to it, and the stirring continued at room temperature until the complete loss of the substrate was indicated by TLC. The nitrogen gas was bubbled throughout to avoid atmospheric moisture. After the reaction was over, mixture was treated with brine solution (20 ml) to decompose the unreacted potassium superoxide. Saturated sodium hydrogen carbonate solution (20 ml) was added to it, and the solution was extracted with $CHCl_3$ (3 × 20 ml) and dried over anhydrous Na_2SO_4, filtered, and evaporated to give the products **(2a–g)**. The aqueous phase was acidified with hydrochloric acid and extracted with $CHCl_3$ (3 × 20 ml) to isolate the p-toluenesulphonic acid **(3)**.

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REFERENCES

1. Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991.
2. Kocienski, P. *Protecting Groups*; Thieme Verlag: Stuttgart, 1994.
3. Entwistle, I. D.; Wood, W. W. In: *Comprehensive Organic Synthesis*; Trost, B. M., Fleming, I., Eds.; Pergamon Press: Oxford, 1991; Vol. 8.
4. Sabitha, G.; Reddy, B. V. S.; Abraham, S.; Yadav, J. S. Deprotection of sulfonamide using iodotrimethylsilane. *Tetrahedron Lett.* **1999**, *40* (8), 1569–1570, and references cited therein.
5. Alonso, E.; Ramon, D. J.; Yus, M. Reductive deprotection of allyl, benzyl and sulfonyl substituted alcohols, amines and amides using a naphthalene-catalysed lithiation. *Tetrahedron* **1997**, *53* (42), 14355–14368.
6. Haskins, C. M.; Knight, D. W. Efficient indole N-tosylation using thioglycolate. *Tetrahedron Lett.* **2004**, *45* (3), 599–601, and references cited therein.
7. Casadei, M. A.; Gessner, A.; Inesi, A.; Jugelt, W.; Moracci, F. M. Electrodic cleavage of the N-S bond in N-tosylcarboxamides: A new entry to N-unsubstituted lactams. *J. Chem. Soc., Perkin Trans. 1* **1992**, 2001–2004.
8. Knowles, H.; Parsons, A. F.; Pettifer, R. M. Desulfonylation of amides using samarium iodide. *Synlett* **1997**, (3), 271–272.
9. Parsons, A. F.; Pettifer, R. M. A radical approach to N-desulfonylation. *Tetrahedron Lett.* **1996**, *37* (10), 1667–1670.
10. (a) Singh, S.; Verma, M.; Singh, K. N. Superoxide induced oxidation of γ-lactones to γ-ketocarboxylic acids in aprotic medium. *Synth. Commun.* **2004**, *34* (24), 4471–4475; (b) Singh, S.; Singh, K. N. Superoxide-mediated synthesis of N-aminoaziridines from N-aminoheterocycles and olefins. *Synth. Commun.* **2005**, *35* (19), 2597–2602; (c) Singh, K. N.; Kumar, R. Some studies on the reaction of in-situ generated tetraethylammonium superoxide with 2-oxazolin-5-ones. *Indian J. Chem.* **2005**, *44B*, 381–386; (d) Shukla, A. K.; Verma, M.; Singh, K. N. Superoxide induced deprotection of 1,3-dithiolanes: A convenient method of dedithioacetalization. *Indian J. Chem.* **2004**, *43B*, 1748–1752.
11. Kemp, A. D.; Stephen, H. The preparation of some N-substituted derivatives of p-toluenesulphonamide. *J. Chem. Soc.* **1948**, 110–112.