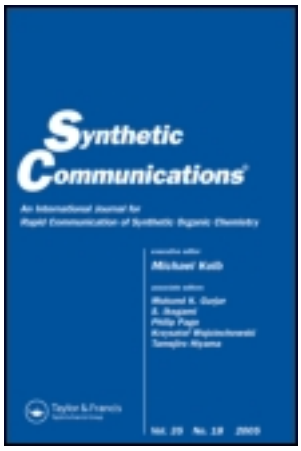


Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/lsyc20

PTC Sulfanylation of Arylacetates

Liliana Marzorati [a] , Marco Antonio da Silva [a] , Blanka Wladislaw [a] & Claudio Di Vitta [a]

[a] Instituto de Química, Universidade de São Paulo, São Paulo, S.P., Brazil

Version of record first published: 15 Aug 2006.

To cite this article: Liliana Marzorati , Marco Antonio da Silva , Blanka Wladislaw & Claudio Di Vitta (2003): PTC Sulfanylation of Arylacetates, Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry, 33:20, 3491-3495

To link to this article: http://dx.doi.org/10.1081/SCC-120024728

MARCEL DEKKER, INC. • 270 MADISON AVENUE • NEW YORK, NY 10016

SYNTHETIC COMMUNICATIONS®
Vol. 33, No. 20, pp. 3491–3495, 2003

PTC Sulfanylation of Arylacetates

Liliana Marzorati,* Marco Antonio da Silva, Blanka Wladislaw, and Claudio Di Vitta

Instituto de Química, Universidade de São Paulo, São Paulo, S.P., Brazil

ABSTRACT

Phase-transfer catalysis, in the absence of solvent, was successfully applied to the sulfanylation of a series of arylacetates leading, in most cases, to acceptable yields of α-monosulfanylated derivatives.

Key Words: Sulfanylation; Phase-transfer catalysis; α-Phenylsulfanyl arylacetates.

The monosulfanylation of carboxylic esters, followed by oxidation and thermolysis of the resulting sulfinyl derivatives, proved to be an useful approach for introducing a conjugated double bond into saturated esters. This sulfanylation–dehydrosulfanylation method was successfully

*Correspondence: Liliana Marzorati, Instituto de Química, Universidade de São Paulo, Av. Prof. Lineu Prestes, 748—P.O. Box 26077, CEP, São Paulo, S.P. 05513-970, Brazil; E-mail: lmarzora@iq.usp.br.

DOI: 10.1081/SCC-120024728 0039-7911 (Print); 1532-2432 (Online)

applied to model compounds and to the synthesis of pheromones.[1,2] The introduction of an α-sulfanyl group is usually performed by quenching the ester enolate with sulfur electrophiles as, for example, disulfides or thiolsulfonates. The quantitative generation of the enolate, using strong bases in aprotic medium, guarantees high yields of sulfanylated products.[1,3] However, more recently, the electrophylic sulfanylationc of activated carboxylic acid derivatives, such as α-sulfonyl esters and α-sulfonyl thiolesters, could be successfully performed under phase-transfer catalysis, using the weaker base K_2CO_3.[4,5] These results prompted us to explore a phase-transfer catalytic protocol for the preparation of α-sulfanylated arylacetates that would be potential precursors of arylacrylates in an alkylation–dehydrosulfanylation sequence.

In order to avoid hydrolysis of the ester functionality and to maximize anionic activation,[6] we decided to investigate the reaction of a series of arylacetates (**1a–g**) with diphenyldisulfide by solid–liquid phase-transfer catalysis, using K_2CO_3,[7] at 60°C, in the absence of solvent. The catalyst of choice was tetrabutylammonium hydrogen sulfate (TBAHS), as opposed to benzyltriethylammonium chloride (TEBAC) that was readily deactivated by complete debenzylation in the presence of the liberated phenylsulfide anion.[8]

The α-phenylsulfanyl arylacetates were obtained in roughly the same moderate yields, irrespectively of the nature of the substituent at the *para*-position of the aromatic ring, with exception of the nitro derivative **2e**, isolated in very low yield from a mixture of starting material and decompostion products (Table 1).

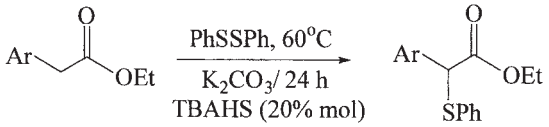
It should be mentioned that experiments performed using ester **1b** as a model compound demonstrated that the uncatalyzed reaction occurs to a negligible extend (less than 5%), and that reducing the amount of base (1 equiv.) causes a sharp decrease in yield of sulfanylated ester (**2b**), that could be isolated in only 30% yield.

In summary, an alternative simple method for obtention of α-phenylsulfanyl arylacetates was developed, avoiding the use of expensive organometallic reagents.

EXPERIMENTAL

The ^{1}H-NMR spectra were recorded on a Bruker AC 200 spectrometer, using tetramethylsilane as internal standard. Melting points were determined using an Electrothermal model 9100 apparatus. Microanalyses were performed on a Perkin Elmer 2400 B CHN elemental analyzer. Mass spectra were recorded on a HP 58901 model spectrometer.

Table 1. Sulfanylation of arylacetates under PTC conditions.



1 **2**

Arylacetate (**1**)	Ar	α-Phenylsulfanyl arylacetate (**2**) (yield %)[a]
a	Ph	63
b	*p*-$MeOC_6H_4$	60
c	*p*-MeC_6H_4	60
d	*p*-ClC_6H_4	51
e	*p*-$NO_2C_6H_4$	28[b]
f	α-Naphtyl	64[c]

[a]Yields refer to products isolated by column chromatography on silica using benzene (**2a**, **2b**, **2c,** and **2e**) or hexane/ethyl acetate (98:2) (**2d** and **2f**) as eluents.
[b]After isolation, the product was further purified by crystallization from ethanol/water.
[c]Using 25 mol% of catalyst and longer reaction time (30 h).

Gravity column chromatography was performed on Merck Kieselgel 60 (70–230 mesh).

Typical Procedure for Sulfanylation of Arylacetates

A mixture of ester **1a** (0.50 g, 3.0 mmol), diphenyldisulfide (0.65 g, 3.0 mmol), anhydrous potassium carbonate (0.82 g, 6.0 mmol) and TBAHS (0.20 g, 0.60 mmol) was vigorously stirred at 60°C for 24 h. After cooling to r.t., water and dichloromethane were added to the reaction mixture. The organic extract was treated with water (3×10 mL), dried over anhydrous magnesium sulfate and concentrated under reduced pressure. The crude product was purified by column chromatography, using benzene as eluent, yielding **2a** (63%) as a yellow liquid identified by comparison with reported spectral data.[9]

Sulfanylated esters **2b–f** were prepared analogously. Spectral data for compounds **2c, d** were in accordance with reported ones.[9]

2b. ^{1}H-NMR ($CDCl_3$/TMS, 200 MHz) $\delta = 1.15$ (t, 3H, $J = 7.0$ Hz), 3.78 (s, 3H), 4.04–4.16 (m, 2H), 4.87 (s, 1H), 6.84 (d, 2H, $J = 8.9$ Hz), 7.23–7.26 (m, 3H), 7.35–7.40 (m, 4H). MS (70 eV) m/z (relative intensity) 302 (M^+, 10), 193 (100), 121 (78), 109 (37). Anal. calcd. for $C_{17}H_{18}O_3S$: C 67.52, H 6.00. Found: C 67.50, H 5.99.

2e. ^{1}H-NMR ($CDCl_3$/TMS, 200 MHz) $\delta = 1.20$ (t, 3H, $J = 7.0$ Hz), 4.11–4.22 (m, 2H), 4.92 (s, 1H), 7.26–7.38 (m, 5H), 7.58 (d, 2H, $J = 8.7$ Hz), 8.16 (d, 2H, $J = 8.7$ Hz). MS (70 eV) m/z (relative intensity) 317 (M^+, 28), 244 (100), 198 (23), 109 (24), 77 (21). Anal. calcd. for $C_{16}H_{15}NO_4S$: C 60.55, H 4.76. Found: C 60.56, H 4.76. M.p.: 70–71°C.

2f. ^{1}H-NMR ($CDCl_3$/TMS, 200 MHz) $\delta = 1.14$ (t, 3H, $J = 7.3$ Hz), 4.08–4.21 (m, 2H), 5.67 (s, 1H), 7.25–7.90 (m, 11H), 8.17 (bd, 1H, $J = 7.3$ Hz). MS (70 eV) m/z (relative intensity) 322 (M^+, 23), 249 (16), 213 (100), 141 (21). Anal. calcd. for $C_{20}H_{18}O_2S$: C 74.50, H 5.63. Found: C 74.64, H 5.64. M.p.: 69–70°C.

ACKNOWLEDGMENTS

We gratefully acknowledge CNPq and FAPESP for financial support.

REFERENCES

1. Trost, B.M.; Salzmann, T.N.; Hiroi, K. New synthetic reactions—sulfenylations and dehydrosulfenylations of esters and ketones. J. Am. Chem. Soc. **1976**, *98*(16), 4887.
2. Trost, B.M. Alpha-sulfenylated carbonyl-compounds in organic-synthesis. Chem. Rev. **1978**, *78*(4), 363.
3. Foray, G.; Peñéñory, A.; Rosi, R.A. A novel reaction of *N*-phenylthiocaprolactam: the alpha-sulfenylation of ketones under mild conditions. Tetrahedron Lett. **1997**, *38*(12), 2035.
4. Wladislaw, B.; Marzorati, L.; Claro Junior, N.F.; Di Vitta, C. A new methodology for obtaining alpha-oxo ester equivalents: sulfanylation of alpha-sulfonyl carboxylic esters in a solid/liquid phase transfer catalytic system. Synthesis **1997**, 420.
5. Wladislaw, B.; Marzorati, L.; Donnici, C.L.; Biaggio, F.C.; Neves, R.M.A.; Claro Junior, N.F. PTC sulfanylation of some carboxylic

acids derivatives activated by alpha-sulfonyl or alpha-sulfinyl group, in solid-liquid system. Phosphorus, Sulfur and Silicon **1997**, *123*, 197.
6. Bram, G.; Loupy, A.; Sansoulet, J. Anionic activation by solid liquid-phase transfer catalysis without solvent—an improvement in organic-synthesis. Israel J. Chem. **1985**, *26*(3), 291.
7. In preliminary experiments, performed using liquid–liquid system (50% aq. $NaOH/CH_2Cl_2$), no sulfanylated product could be isolated, and extensive hydrolysis of the ester reagent could be observed after 24 h.
8. Dou, J.M.H.; Gallo, R.; Hassanaly, P.; Metzger, J. Behavior and stability of catalysts in biphase and triphase transfer catalysis. J. Org. Chem. **1977**, *42* (26), 4275.
9. Florac, C.; Le Grel, P.; Baudy-Floc'h, M.; Robert, A. A facile one-pot synthesis of alpha-hydroxy acids and their derivatives. Synthesis **1991**, 741.

Received in the USA April 17, 2003

MARCEL DEKKER, INC. • 270 MADISON AVENUE • NEW YORK, NY 10016