Anal. Calcd for $C_{14}H_{19}NO_2$: C, 72.07; H, 8.21; N, 6.00. Found: C, 71.80; H, 8.40; N, 6.01.

Compound **1b** was isolated as an oil: IR (film) 1550, 1360 (NO_2), 980, 920 cm^{-1} ($RCH{=}CH_2$); NMR[13] δ 7.15–7.4 (m, 5 H), 5.8–6.1 (m, 1 H), 5.75 (m, 1 H), 3.74 (m, 1 H), 0.8–2.0 (m, 11 H).

Alkylation of 2-Nitropropane. Performed analagously to alkylation of nitroethane except that acetic acid was not added during work-up. Column chromatography of the crude product afforded cinnamaldehyde in 50% yield, identified by its spectra and comparison to an authentic sample. Further elution of the column afforded 4,4-dimethyl-4-nitro-1-phenyl-1-butene (**7a**) in 29% yield. VPC analysis indicated this to be >93% pure with a small amount of the internal isomer. Kugelrohr distillation gave the analytical sample: bp 95–105 C (0.02 torr); IR (film) 1540, 1360 (NO_2), 960 cm^{-1} ((*E*)-RCH=CHR); NMR δ 7.38 (s, 5 H), 6.55 (d, 1 H, J = 16 Hz), 6.02 (dt, 1 H, J = 7, 16 Hz), 2.78 (d, 2 H, J = 7 Hz), 1.62 (s, 6 H).

Anal. Calcd for $C_{12}H_{15}NO_2$: C, 70.22; H, 7.37; N, 6.82. Found: C, 69.97; H, 7.09; N, 6.96.

Alkylation of Phenylnitromethane. Procedure A: Cinnamyl Acetate. An ice-cold solution containing lithium methoxide (536 mg, 14.1 mmol) in methanol (10 mL) was treated with phenylnitromethane (2.00 g, 14.6 mmmol) and after 10 min, the volatiles were stripped off under vacuum. To the resulting white solid THF (50 mL), $Pd[PPh_3]_4$ (0.40 g, 0.35 mmol), triphenylphosphine (0.89 g, 3.39 mmol), and cinnamyl acetate (618 mg, 3.51 mmol) were added. The mixture was refluxed for 2 h, cooled, and added to water–methylene chloride. Acetic acid (20 mL) was added, and the organic layer was separated, washed, dried, and concentrated. The residue was chromatographed to afford the C-alkylate (746 mg, 84% yield) as a 79:21 mixture (VPC) of 4-nitro-1,4-diphenyl-1-butene (**3a**) and 4-nitro-3,4-diphenyl-1-butene (**3b**), respectively. The major isomer was purified by repeated recrystallization from aqueous ethanol; three recrystallizations were necessary: mp 69–71 °C; IR (KBr) 1534 and 1359 cm^{-1} (NO_2); NMR δ 7.1–7.5 (m, 10 H), 6.53 (d, 1 H, J = 16 Hz), 6.03 (dt, 1 H, J = 7, 16 Hz), 5.55 (dd, 1 H, J = 6, 8 Hz), 2.7–3.7 (m, 2 H).

Anal. Calcd for $C_{16}H_{15}NO_2$: C, 75.87; H, 5.97; N, 5.53. Found: C, 75.96; H, 5.89; N, 5.58.

Procedure B: 2-Butenyl Acetate. Procedure A was repeated except that 2-butenyl acetate (367 mg, 3.21 mmol) was substituted for cinnamyl acetate. The crude product was chromatographed to afford the C-alkylate (499 mg, 51% yield) as a 49:51 mixture (VPC) of 5-nitro-5-phenyl-2-pentene (**4a**) and 3-methyl-4-nitro-4-phenyl-1-butene (**4b**), respectively. Kugelrohr distillation gave the same mixture of isomers: bp 45–50 °C (0.2 torr). Analytical samples were prepared by preparative VPC. Compound **4a** was obtained as an oil: IR (film) 1547, 1361, (NO_2), 959 cm^{-1} ((*E*)-RCH=CHR); NMR[13] δ 7.37–7.5 (m, 5 H), 5.5–5.7 (m, 1 H) 5.46 (dd, 1 H, J = 6, 8 Hz), 5.2–5.4 (m, 1 H), 2.6–3.2 (m, 2 H), 1.62 (d, 3 H, J = 6.5 Hz).

Anal. Calcd for $C_{11}H_{13}NO_2$: C, 69.09; H, 6.85; N, 7.32. Found: C, 68.88; H, 6.88; N, 7.24.

Compound **4b** was obtained as an oil: IR (film) 1550, 1360 (NO_2), 985, 920 cm^{-1} ($RCH{=}CH_2$); NMR[13] δ 7.3–7.6 (m, 5 H), 4.9–5.9 (m, 4 H), 3.2–3.4 (m, 1 H), 1.17 (d, 3 H of one diastereomer, J = 7 Hz), 0.80 (d, 3 H of one diastereomer, J = 7 Hz).

Anal. Calcd for $C_{11}H_{13}NO_2$: C, 69.09; H, 6.85; N, 7.32. Found: C, 69.15; H, 6.93; N, 7.33.

Alkylation of Ethyl Nitroacetate. Performed in the same manner as the alkylation of phenylnitromethane. Ethyl nitroacetate was removed from the crude product by heating at 37–40 °C (0.02 torr) for 8 h. The residue was chromatographed to afford the C-alkylate in 73% yield as an oil. VPC analysis indicated predominantly (>96:4) ethyl 2-nitro-5-phenyl-4-pentenoate (**5a**). The analytical sample was crystallized from aqueous ethanol: mp 57.5–58.5 °C; IR (KBr) 1750 (C=O), 1560, 1370 cm^{-1} (NO_2); NMR δ 7.33 (s, 5 H), 6.65 (d, 1 H, J = 16 Hz), 6.12 (dt, 1 H, J = 7, 16 Hz), 5.23 (t, 1 H, J = 7 Hz), 4.32 (q, 2 H, J = 7 Hz), 3.12 (t, 2 H, J = 7 Hz), 1.28 (t, 3 H, J = 7 Hz).

Anal. Calcd for $C_{13}H_{15}NO_4$: C, 62.64; H, 6.07; N, 5.62. Found: C, 62.41; H, 5.95; N, 5.53.

Also isolated in early fractions from the column was the dialkylate ethyl 2-nitro-5-phenyl-2-(3-phenyl-2-propenyl)-4-pentenoate (72 mg, 11% yield) as an oil: IR (film) 1740 (C=O), 1550, 1370 cm^{-1} (NO_2); NMR δ 7.33 (m, 10 H), 6.57 (d, 2 H, J = 16 Hz), 6.05 (dt, 2 H, J = 7, 16 Hz), 4.28 (q, 2 H, J = 7 Hz), 3.15 (d, 4 H, J = 7 Hz), 1.25 (t, 3 H, J = 7 Hz).

Alkylation of ethyl 2-nitrobutanoate was performed in the same manner as the alkylation of phenylnitromethane except that acetic acid was not added. Column chromatography of the crude product afforded the C-alkylate in 89% yield as an oil. VPC analysis indicated this to be predominantly (>97:3) ethyl 2-ethyl-2-nitro-5-phenyl-4-pentenoate (**6a**): NMR δ 7.27 (s, 5 H), 6.50 (d, 1 H, J = 16 Hz), 5.97 (dt, 1 H, J = 7, 16 Hz), 4.25 (q, 2 H, J = 7 Hz), 3.07 (d, 2 H, J = 7 Hz), 2.27 (q, 2 H, J = 7 Hz), 1.23 (t, 3 H, J = 7 Hz), 0.93 (t, 3 H, J = 7 Hz).

Anal. Calcd for $C_{15}H_{19}NO_4$: C, 64.97; H, 6.91. Found: C, 64.71; H, 6.85.

Registry No. 1a, 79918-44-8; **1b**, 79918-45-9; **2a**, 79918-46-0; **2b**, 79918-47-1; **3a**, 79918-48-2; **3b**, 79918-49-3; **4a**, 79918-50-6; **4b**, 79918-51-7; **5a**, 79918-52-8; **6a**, 79918-53-9; **7a**, 79918-54-0; $Pd(PPh_3)_4$, 14221-02-4; nitroethane, 79-24-3; cinnamyl acetate, 103-54-8; 1-nitropentane, 628-05-7; 2-nitropropane, 79-46-9; phenylnitromethane, 622-42-4; 2-butenyl acetate, 628-08-0; ethyl nitroacetate, 626-35-7; ethyl 2-nitro-4-phenyl-2-(3-phenyl-2-propenyl)-3-butenoate, 79918-55-1; ethyl 2-nitrobutanoate, 2531-81-9; cinnamaldehyde, 104-55-2.

Disproportionation of Aryl Alcohols and Cis to Trans Isomerization of Styryl Derivatives on Palladium/Carbon Catalyst

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Received June 5, 1981

Hydrogenolysis of a carbon–oxygen bond α to the aromatic ring in derivatives of benzyl alcohol occurs under a variety of conditions.[1] We found recently that benzyl ethers of carbohydrates (*O*-benzyl derivatives) undergo facile catalytic transer hydrogenolysis at room temperature to toluene and the corresponding sugar in the presence of palladium/carbon, with formic acid as the hydrogen donor and methanol as the solvent.[2] In extending the study to some related classes of compounds, a variety of other reactions have been found to occur on palladium/carbon; these are described here.

In addition to an *O*-benzyl substituent, *O*-triphenylmethyl was readily removed by catalytic transfer hydrogenation in the presence of formic acid. As triphenylmethane was the product, this reaction was analogous to the formation of toluene from the benzyl ether. The corresponding alcohol, triphenylmethanol (**1**), also gave triphenylmethane under the same reaction conditions (Table I), whereas benzyl alcohol (**2**) was unaffected. However, diphenylmethanol (**3**) yielded diphenylmethane, showing that the presence of two adjacent phenyl groups is sufficient to induce hydrogenolysis of the carbon–oxygen bond.

In the *absence* of formic acid, diphenylmethanol (**3**) produced a mixture of benzophenone and diphenylmethane. That is, without an added hydrogen donor, the palladium/carbon functioned as a disproportionation (oxidation–reduction) catalyst.[3] Analogous behavior was

(1) H. O. House, "Modern Synthetic Reactions", 2nd ed., W. A. Benjamin, New York, 1972, p 23.

(2) V. S. Rao and A. S. Perlin, *Carbohydr. Res.*, **83**, 175 (1980).

(3) (a) Disproportionation during heterogeneous catalysis is well-known and may occur as well during homogeneous catalysis; for example, see P. M. Maitlis, "The Organic Chemistry of Palladium", Academic Press, New York, 1971, p 143; (b) M. J. Andrews and C. N. Pillai, *Indian J. Chem., Sect. B*, **16B**, 465 (1978); these authors reported the disproportionation of diphenylcarbinol (**3**) on Raney nickel in xylene at 90 °C.

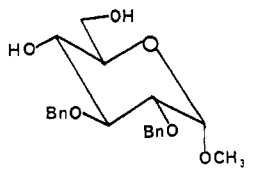
0022-3263/82/1947-0367$01.25/0

Table I. Reactions of Aryl Alcohols and Styryl Derivatives on Pd/C

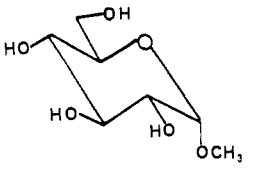
compd	product(s)	mass spectrum,[a] m/e
Ph_3COH (1)	Ph_3CH[b,c]	
$PhCH_2OH$ (2)	no reaction	
Ph_2CHOH (3)	Ph_2CH_2,[c] Ph_2CO[c]	
$PhCH(OH)CH_3$ (4)	$PhCOCH_3$[c,d]	
m-$HOC_6H_4CH(OH)CH_3$ (7)	*m*-$HOC_6H_4COCH_3$	136 (M, 52.9), 121 (M − CH_3, 100), 93 (M − CH_3CO, 55.8), 43 (CH_3CO, 5.8)
	m-$HOC_6H_4CH_2CH_3$	122 (M, 43.6), 107 (M − CH_3, 100)
m-$CF_3C_6H_4CH(OH)CH_3$ (8)	*m*-$CF_3C_6H_4COCH_3$[d]	188 (M, 11.2), 173 (M − CH_3, 100), 145 ($CF_3C_6H_4$, 76.5)
m-$IC_6H_4CH(OH)CH_3$ (9)	no reaction	
$PhCH(OH)CH_2OH$ (10)	$PhCOCH_2OH$[e]	136 (M, 3.3), 105 (PhCO, 69.5)
	$PhCH_2CH_2OH$	91 ($PhCH_2$, 7.9)
$PhCH_2CH_2OH$ (11)	no reaction	
$PhCH{=}CHCH_2OH$ (12)	$PhCH_2CH_2CH_2OH$	136 (M, 20.2), 118 (M − H_2O, 55.1), 117 (M − H_3O, 100), 105 ($PhCH_2CH_2$, 13.5), 91 ($PhCH_2$, 90.8)
	PhCH=CHCHO	132 (M, 55.9), 131 (M − H, 100), 104 (M − CO, 25), 103 (PhCHCH, 54.6), 102 (M − CH_2O, 11.4)
m-OCH_3-*p*-$HOC_6H_3CH{=}CHCH_2OH$ (13)	*m*-OCH_3-*p*-$HOC_6H_3CH_2CH_2CH_2OH$[f]	182 (M, 3.9), 164 (M − H_2O, 3.5), 151 ($(OCH_3)(OH)C_6H_3CH_2CH_2$, 3.5), 137 ($(OCH_3)(OH)C_6H_3CH_2$, 100), 105 (137 − CH_3OH, 3.3)
trans-PhCH=CHCOOH (14)	no reaction	
trans-*m*-OCH_3-*p*-$HOC_6H_3CH{=}CHCOOH$ (15)	no reaction	
cis-*p*-$HOC_6H_4CH{=}CHCOOH$ (16)	*trans*-*p*-$HOC_6H_4CH{=}CHCOOH$[c]	
cis-PhCH=CHPh (17)	*trans*-PhCH=CHPh[c]	

[a] Only ions important for structural identification are listed. Assignments and relative intensities are given in parentheses. [b] With formic acid. [c] The ^1H NMR spectrum was indistinguishable from that reported, e.g., C. J. Pouchert and J. R. Campbell, Eds., "The Aldrich Library of NMR Spectra", Aldrich Chemical Co., Milwaukee, WI, 1980. [d] The complementary reduction product was not recovered due to loss on workup. [e] ^1H NMR ($CDCl_3$) δ 8.05 (2 H, dd, Ph 2,6-H, $J_{2,3}$ = 7.5, $J_{2,4}$ = 2.0 Hz), 7.9–7.4 (3 H, m, Ph 3,4,5-H), 5.0 (2 H, s, CH_2) 3.56 (1 H, br s, D_2O-exchangeable, OH); this product was formed also when formic acid was present as the hydrogen donor. [f] The corresponding cinnamaldehyde derivative was not isolated.

exhibited by 1-phenylethanol (4), which gave acetophenone. These observations raised the possibility that 3 or 4 might serve as the hydrogen donor in a catalytic transfer hydrogenation reaction. Indeed, this was shown to be feasible by smooth, quantitative *O*-debenzylation at room temperature of methyl 2,3-di-*O*-benzyl-α-D-glucopyranoside (5) to methyl α-D-glucopyranoside (6), with



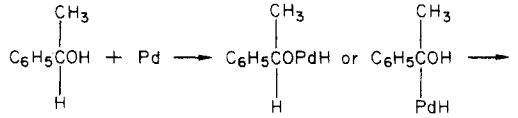
5



6

palladium/carbon in methanol containing 4 (15 mol/mol of 5) in place of formic acid. Consequently if an acidic medium is to be avoided for O-debenzylation, the use of such an alcohol as 4 may be a suitable alternative.[4]

Presumably 4 functions as a hydrogen donor by reacting with the catalyst to generate palladium hydride, in the manner shown in eq 1. Substituents on the aromatic ring



$C_6H_5COCH_3 + PdH_2$ (1)

were shown to have a marked influence on the degree of reactivity: i.e., the *m*-hydroxy derivative (7) readily afforded the corresponding ketone, together with 3-ethylphenol, whereas under the same reaction conditions the *m*-trifluoromethyl derivative (8) underwent disproportionation to the extent of only 50% in the same reaction time, and the *m*-iodo derivative (9) remained unchanged.

By analogy with 4, 2-phenylethane-1,2-diol (10) yielded the corresponding 2-oxo compound, although 2-phenylethanol (11) and benzyl alcohol (2) did not react. Overall, then, these results show that only a secondary hydroxyl function undergoes disproportionation. Also, the hydroxyl function requires activation by an aromatic ring which, however, may be offset by a strong electron-withdrawing and/or highly polarizable substituent[5] (as in 8 and 9).

A disproportionation reaction also was observed with cinnamyl alcohol (12) on palladium/carbon in methanol, leading to the formation of 3-phenylpropanol, cinnamaldehyde, and possibly, an acetylenic alcohol[6] (eq 2), although only hydrogenation occurred when formic acid was

$$C_6H_5CH{=}CHCH_2OH \rightarrow C_6H_5CH_2CH_2CH_2OH + [C_6H_5{\equiv}CCH_2OH] \rightarrow [C_6H_5CH{=}C{=}CHOH] \rightarrow C_6H_5CH{=}CHCHO \quad (2)$$

(4) The use of 1-phenylethanol (4) as a hydrogen donor in homogeneous reactions with dichlorotris(triphenylphosphine)ruthenium as a catalyst has been reported in the following: (a) Y. Sasson and J. Blum, *Tetrahedron Lett.*, 2167 (1971); (b) G. Brieger and T. J. Nestrick, *Chem. Rev.*, 74, 567 (1974).

(5) As pointed out by the referees, the unreactivity of the *m*-iodo derivative 9 might have been due to inactivation, or poisoning, of the catalyst. Nevertheless, the sluggish reaction of the corresponding *m*-CF_3 derivative 8 indicates that electronic effects are operative in these reactions.

(6) Cinnamaldehyde might have been formed by direct dehydrogenation of 12, as noted by the referees. However, the presence of a singlet at δ 3.82 in the ^1H NMR spectrum of the reaction mixture is suggestive of a third product containing an isolated CH_2OH group (the deuterium-exchangeable OH signal was a broad singlet). Furthermore, the inertness of an allylic alcohol (next paragraph), although lacking activation by a phenyl moiety, also supports the proposed intermediacy of the acetylenic alcohol.

introduced, as 3-phenylpropanol was obtained in quantitative yield. Coniferyl alcohol (3-methoxy-4-hydroxycinnamyl alcohol, **13**) gave the corresponding derivative of 3-phenylpropanol.

Simple allylic alcohols appear to be unaffected by the catalyst in the abence of of a hydrogen donor. Thus, hex-3-ene-2,5-diol (in admixture with the corresponding 3-yne) was recovered unchanged from a treatment with palladium/carbon in methanol. In the presence of formic acid, nevertheless, both the alkene and alkyne were readily hydrogenated to give hexane-2,5-diol.[7]

No reaction was observed with cinnamic acid (**14**) or it coniferyl analogue (**15**). However, it is noteworthy that *cis*-*p*-hydroxycinnamic acid (**16**) was converted quantitatively into its trans isomer by palladium/carbon in methanol at room temperature. Alkene isomerization with palladium salts or complexes is known,[8] although metallic palladium appears to require much higher temperatures.[9] Also, partial cis to trans isomerization may occur during catalytic hydrogenation over palladium/carbon, for example, as observed[10] with *cis*-cinnamic acid and *cis*-stilbene; in the absence of hydrogen, however, no isomerization of these two compounds was detected.[10] By contrast, we found that *cis*-stilbene (**17**) was isomerized completely to *trans*-stilbene.

Experimental Section

Solutions were evaporated below 40 °C under diminished pressure or, with highly volatile products, were distilled at atmospheric pressure. Eastman Chromagram sheets of silica gel with fluorescent indicator were used for thin-layer chromatography. Proton magnetic resonance spectra were recorded with a Varian T-60 or HA-100 spectrometer. Mass spectra were obtained with an LKB 9000 spectrometer, with an on-line GC component, at an ion source voltage of 70 eV. Palladium (10%) on activated charcoal and compounds **1** to **4** as well as **14–17** were obtained from Aldrich Chemical Co. Inc., whereas compounds **10** and **12** were obtained from Eastman Kodak. Compounds **7–9** were kindly provided by G. K. Hamer, and **13** was provided by B. I. Fleming.

Reaction of Aryl Alcohols on Palladium Charcoal. In a representative experiment, a solution of diphenylmethanol (**3**, 0.1 g) in methanol (5 mL) was added to a stirred suspension of 10% palladium on charcoal (0.5 g) in the same solvent (5 mL) maintained under a nitrogen atmosphere. After 16 h, the catalyst was filtered off and washed with methanol (in some instances, the catalyst also was washed with water), and the filtrates were combined and evaporated. The residue was found to be a mixture of diphenylmethane and benzophenone by comparison of its ^{1}H NMR spectrum with spectra of the known compounds.

Isomerization of *cis*-Stilbene to *trans*-Stilbene. Under the conditions described in the preceeding section, liquid *cis*-stilbene (0.1 g) in the presence of 10% palladium on charcoal (0.5 g) afforded *trans*-stilbene in quantitative yield (mp 122–124 °C) which was indistinguishable from an authentic specimen by ^{1}H NMR.

Catalytic Transfer Hydrogenation of Methyl 2,3-Di-*O*-benzyl-α-D-glucopyranoside. A solution of **5** (0.2 g) in methanol (5 mL) was added to a stirred suspension of 10% palladium on charcoal (1 g) in the same solvent (10 mL) maintained under a nitrogen atmosphere, followed by 1-phenylethanol (1 g) in methanol (5 mL). After 16 h when TLC examination indicated that the reaction was complete, the catalyst was filtered off and successively washed with methanol and water, and the filtrates were combined and evaporated. The residue, dissolved in deuterium oxide (99.5%, 0.5 mL) afforded a ^{1}H NMR spectrum indistinguishable from that of methyl α-D-glucopyranoside; no other products were detected.

Acknowledgment. We express our gratitude to the Natural Sciences and Engineering Research Council of Canada for generous support. Dr. O. Mamer kindly furnished the mass spectra.

Registry No. **1**, 76-84-6; **2**, 100-51-6; **3**, 91-01-0; **4**, 98-85-1; **5**, 17791-36-5; **7**, 2415-09-0; **8**, 454-91-1; **9**, 79917-56-9; **10**, 93-56-1; **11**, 60-12-8; **12**, 104-54-1; **13**, 458-35-5; **14**, 140-10-3; **15**, 537-98-4; **16**, 4501-31-9; **17**, 645-49-8; Pd, 7440-05-3.

(7) See footnote *c* of Table I.
(8) Reference 3, p 128.
(9) (a) S. Carra and V. Ragaini, *J. Catal.*, **10**, 230 (1968); (b) V. Ragaini, G. Somerzi, and S. Carra, *ibid.*, **13**, 20 (1969).
(10) G. Bellinzona and F. Bettinetti, *Gazz. Chim. Ital.*, **90**, 426 (1960).

Synthesis Using Allylidenedihydropyridines. 9.[1] First Preparation of Thiino[3,2-*a*]indolizine Derivatives

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Received August 27, 1981

Previous studies in our laboratory have demonstrated that indolizines and pyrazolo[1,5-*a*]pyridines substituted with both an amino and an electron-poor vinyl group on the five-membered ring were synthesized via an allylidenedihydropyridine route[2,3] and were converted into the corresponding pyridine-fused heterocycles under acidic and basic conditions.[4] The latter finding has opened a route to new condensed indolizines and pyrazolopyridines, and we are especially interested to extend it to other derivatives. We now describe the first preparations of some thiino[3,2-*a*]indolizine derivatives from acidic treatment of 2-(alkylthio)-1-(2-cyanovinyl)indolizines.

The key compounds, 2-(alkylthio)-1-(2-cyanovinyl)-indolizines **16–23**, were synthesized in moderate yields from pyridinium salts **1–5** according to known sequences (Scheme I),[2] and their structures were determined by physical and spectral comparison with known indolizines **16** and **18**. One possible method to prepare thiinoindolizine, the S-deprotection of these indolizines **16–23** was initially investigated by using bases[5] such as sodium/liquid NH_3, potassium hydroxide, and potassium *tert*-butoxide, but none of the expected 2-mercaptoindolizines or other significant products were obtained, perhaps because indolizines **16–23** have cyano and ester groups which are more sensitive to hydrolysis than the sulfide linkage. When indolizines **16–22** with an ethoxycarbonyl group in the 3-position were heated with strong acids, however, substances with extremely strong

(1) For part 8 of this series, see Kakehi, A.; Ito, S.; Watanabe, K. *Bull. Chem. Soc. Jpn.* **1980**, *53*, 1775.
(2) Kakehi, A.; Ito, S.; Uchiyama, K.; Kondo, K. *J. Org. Chem.* **1978**, *43* 2896.
(3) Kakehi, A.; Ito, S.; Maeda, T.; Takeda, R.; Nishimura, M.; Tamashima, M.; Yamaguchi, T. *ibid.* **1978**, *43*, 4837.
(4) (a) Kakehi, A.; Ito, S.; Watanabe, K.; Ono, T.; Miyajima, T. *Chem. Lett.* **1979**, 205 (b) *J. Chem. Res., Synop.* **1980**, 18; *J. Chem. Res., Miniprint* **1980**, 401–425.
(5) In general, simple alkyl substituents such as a methyl and an ethyl group are not appropriate for the deprotection of sulfides, but the formations of some thiol derivatives from alkyl aryl sulfides under basic conditions were reported. See (a) Field, L.; Grunwald, F. A. *J. Org. Chem.* **1951**, *16*, 946. (b) Overberger, C. G.; Biletch, H.; Orttung, F. W. *Ibid.* **1959**, *24*, 289.

0022-3263/82/1947-0369$01.25/0