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SILYLATION IN ORGANOSULFUR CHEMISTRY
THE PREPARATION OF THIOIMIDES[1a]

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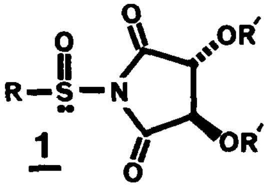
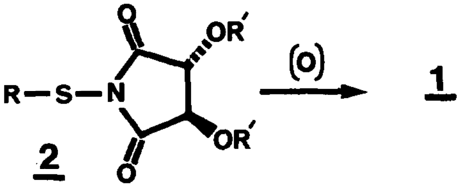
As part of our program on the synthesis of chiral sulfinyl derivatives[2] we desired a general route to compounds of type 1. One entry to this class could involve the oxidation of thioimide 2 to 1. This step has ample literature precedent in that thiophthalimides can be converted to the sulfinyl analogs with m-chloroperbenzoic acid in high yield[3]. There are several procedures for the preparation of thiosuccinimides; however in our hands application of these methods was unsuccessful or unsuitable for the synthesis of 2[4].



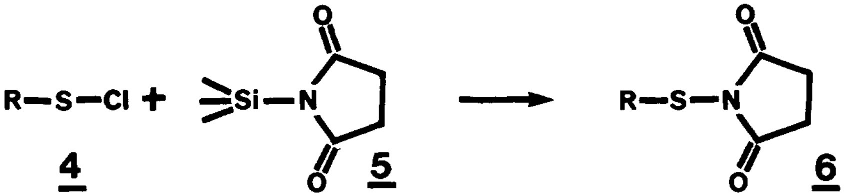
1

1 R = aralkyl
R' = H, CH_3



2

Work in our and other laboratories[6] with silylated succinimide and related derivatives suggested an alternate approach to the problem. We have shown that the reaction of sulfur mono- and dichlorides with trimethylsilyl benzimidazole gives near-quantitative yields of the sulfur transfer reagent 3[5]; therefore it seemed reasonable to react sulfenyl chlorides 4[7] with trimethylsilylsuccinimide (5)[6d].

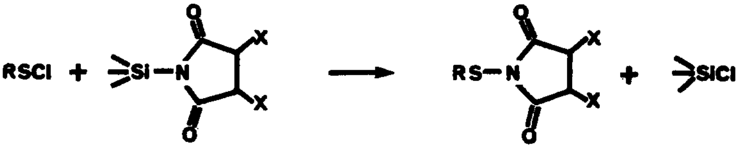


When 5 was added to neat 4 (R = $C_6H_5CH_2$-), N-(benzylthio)succinimide (6, R = $C_6H_5CH_2$-) resulted in 80% yield. While CCl_4 can be used as solvent in this reaction, yields are usually considerably lower and reaction times longer. The reaction appears to be general in that alkyl and aryl thiosuccinimides can be prepared in about 75% yield (see Table).

A typical procedure is as follows: N-trimethylsilyl-(+)-(R)-2,3-dimethoxysuccinimide (8 mmol) and a 50% molar excess of benzenesulfenyl chloride were stirred neat under nitrogen at room temperature. After 2 minutes the reaction mixture had solidified. The product was washed with hexane to remove excess sulfenyl chloride[9]. The thioimide was dissolved in 3-4 ml of $CHCl_3$ and precipitated with hexane. Recrystallization from 60% hexane-40% ethanol gave N-(phenylthio)-(+)-(R)-2,3-dimethoxysuccinimide in 76% yield, mp 109-111°, $[\alpha]_D^{20}$ + 166° (c = 0.94, acetone)[10].

Studies continue on aspects of this interchange reaction.

TABLE



Thioimide R^{a}	X	Reaction time[b]	mp °C (lit mp)	Isolated yield (%)
CH_3-	H	0.5 hr	76-78	75[d]
CH_3CH_2-	H	4.0 hr	48-49 (48-49)[4e]	58[f,g]
$C_6H_5CH_2$-	H	3 min	161-163 (165-166)[4b]	80[e]
C_6H_5-	H	1.5 hr	115-116 (118-119)[4a]	92[e]
p-$CH_3C_6H_4$-	H	2.0 hr	113-114.5 (114.5-115)[4e]	91[e]
p-$NO_2C_6H_4$-	H	2.0 hr	164-167 (173-175)[4c]	58[d]
o-$NO_2C_6H_4$-	H	5 min	208-210 (210)[4d]	77[d]
CH_3-	CH_3O-	5 min[c]	79-80	70[h,j]
C_6H_5-	CH_3O-	3 min[c]	109-111	76[e,i,k]

a All new compounds gave satisfactory elemental analyses and spectral properties
b Reaction temperature 60° C
c Room temperature
d Recrystallized from ethanol
e Precipitated from $CHCl_3$-hexane
f Precipitated from ether-hexane
g Purified by column chromatography on Florisil
h Recrystallized from ether
i Recrystallized from 60% hexane-40% ethanol
j $[\alpha]_D^{20}$ +233° (c = 1.00, acetone)
k $[\alpha]_D^{20}$ +166° (c = 0.94, acetone)[10]

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8. We are grateful to Dr. L. Q. Bao for the synthesis of the precursor to this molecule.

9. In the case of thiosuccinimides the product is next dissolved in $CHCl_3$ and washed with water.

10. This molecule (2, R = C_6H_5, R' = CH_3) was derived from tartrimide $[\alpha]_D^{20}$ +212°; an earlier preparation of 2 gave $[\alpha]_D^{20}$ +182° (from tartrimide of $[\alpha]_D^{20}$ +225°).

ACKNOWLEDGMENT

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