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## ASYMMETRIC SYNTHESIS OF ENANTIOPURE $\alpha$ -SULFENYL DITHIOACETALS AND $\alpha$ -SULFENYL ALDEHYDES

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**Abstract** The  $\text{BF}_3 \cdot \text{Et}_2\text{O}$  promoted thiolytic cleavage of the diastereomeric oxazolidines (**1'R**)-**2** and (**1'S**)-**2** has been studied. The thioacetalisations took place with concomitant thioetherification at the carbinol centres, giving rise to the  $\alpha$ -sulfenyl dithioacetals ( $\alpha$ -SDTA's) (**S**)-**3** and (**R**)-**3** respectively. Selective manipulation of the latter compounds was also achieved. Thus, oxidative hydrolysis gave the corresponding  $\alpha$ -sulfenyl aldehydes which were shown to be enantiopure.

### INTRODUCTION

In our ongoing studies on the use of nor-ephedrine in asymmetric synthesis, we recently discovered that tri-*s*-butyl borohydride addition to methyl ketone **1** could be directed to either the *Si* or the *Re* carbonyl  $\pi$ -face with virtually complete selectivity under "chelating" or "naked" conditions (scheme).<sup>1</sup> The thiolytic removal of the nor-ephedrine moiety from (**1'R**)-**2** and (**1'S**)-**2** was next investigated.

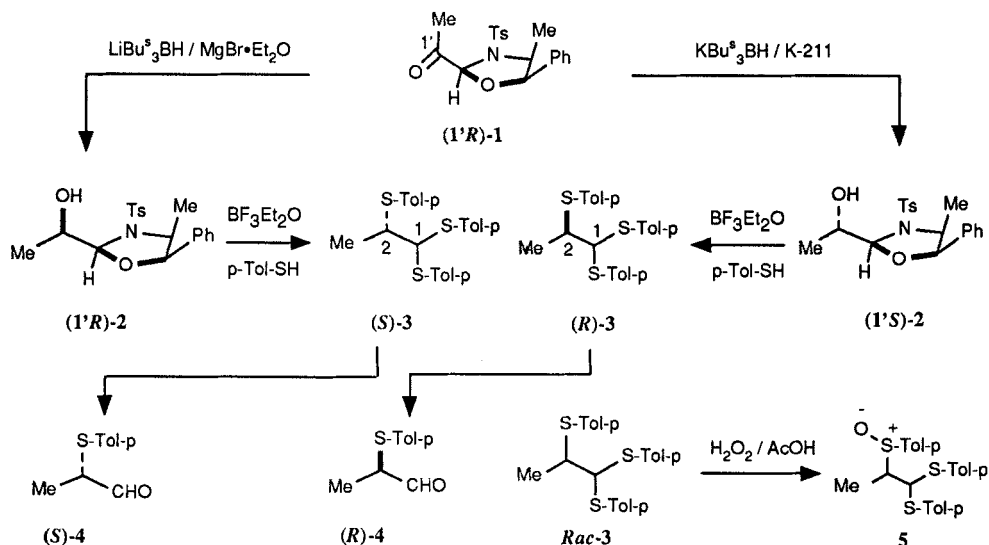
### MECHANISTIC STUDY OF THE THIOLYSIS

In striking contrast with our previous results,<sup>2</sup> separate treatment of the carbinols (**1'R**)-**2** and (**1'S**)-**2** with *p*-thiocresol and  $\text{BF}_3 \cdot \text{Et}_2\text{O}$  in  $\text{CH}_2\text{Cl}_2$  gave the  $\alpha$ -sulfenyl dithioacetals ( $\alpha$ -SDTA's) (**S**)-**3** and (**R**)-**3** respectively.

The mechanism of this multiple transformation is believed to involve the following steps in chronological order: *a*) a rate determining thioacetalisation; *b*) an acid promoted thiiranium ion<sup>3</sup> formation (*via* intramolecular displacement at C-2); *c*) a regioselective interception at C-1 of the thiiranium ions by a third thiol molecule.

Additional experiments proved that the postulated dithioacetal intermediate is converted to the  $\alpha$ -SDTA under the same reaction conditions. Conversely, re-equilibration of the latter compounds to the parent thiiranium ions via internal displacement at C-2 is not possible. It thence follows that the  $\alpha$ -SDTA's **3** are

generated from **2** with net inversion of stereochemistry. Moreover, they are not expected to racemise during the reaction.



### SELECTIVE MANIPULATION OF THE $\alpha$ -SDTA's

Treatment of (S)-**3** and (R)-**3** with  $(\text{CF}_3\text{CO}_2)\text{PhI}$  in  $\text{MeCN}/\text{H}_2\text{O}^4$  afforded the  $\alpha$ -sulfenyl aldehydes<sup>5</sup> (S)-**4** and (R)-**4** which were shown to be enantiopure.<sup>6</sup> On the other hand, oxidation of **Rac-3** with  $\text{H}_2\text{O}_2$  in  $\text{AcOH}$  gave sulfoxide **5** as a single diastereoisomer. Thus, depending on the oxidizing system, either the dithioacetal or the thioetheral sulfur atom in **3** could be conveniently selected.

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6. To the best of our knowledge this method represents the first asymmetric synthesis of enolisable enantiopure  $\alpha$ -sulfenyl aldehydes. See for example: J-H. Youn, R. Herrmann, I. Ugi, *Synthesis*, 159. (1987).