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A Novel Method of Annulation through α,β-Epoxy Sulfoxides with the Aid of Intramolecular Radical Cyclization[1)]

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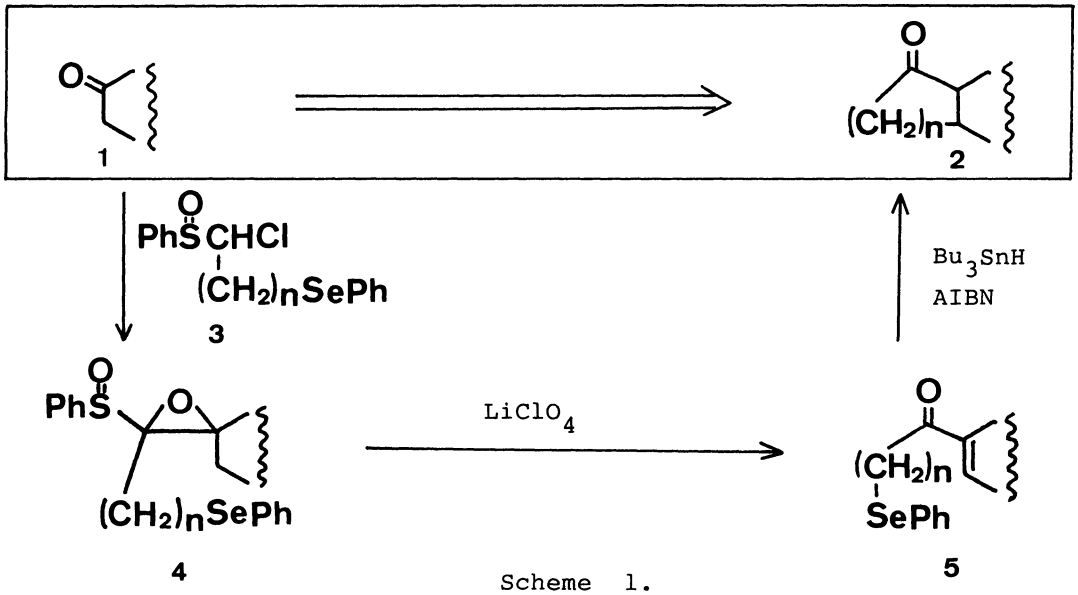
A novel method of annulation was realized from ketones through α,β-epoxy sulfoxides with the aid of endo-type intramolecular radical cyclization. In these reactions 1-chloroalkyl phenyl sulfoxides having phenylseleno group on an end of the alkyl group acted as synthons of the annulation.

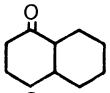
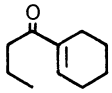
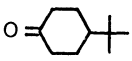
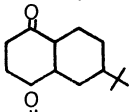
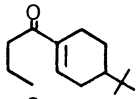
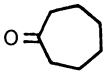
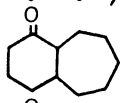
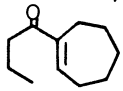
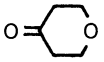
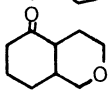
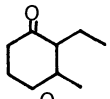
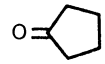
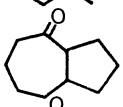
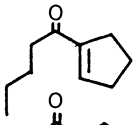
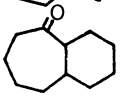
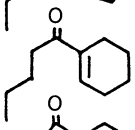
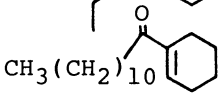
The construction of cyclic systems is of most importance in organic synthesis. Recently, we have reported a new method for a synthesis of α,β-unsaturated carbonyl compounds from ketones through α,β-epoxy sulfoxides with carbon homologation.[2)] This method can be expanded into a new method of annulation with the aid of endo-type radical cyclization.[3)] This method is shown in Scheme 1.



Scheme 1.

Alkylation of a ketone (1) with 1-chloroalkyl phenyl sulfoxide having phenylseleno group on an end of the carbon chain (3)[4)] followed by treatment with a base gave the α,β-epoxy sulfoxide (4) in high overall yield. Treatment of 4 with lithium perchlorate in heating toluene in the presence of tributylphosphine oxide gave the enone (5) in good yield.[2)] Radical cyclization of 5 usually took place smoothly by tributyltin hydride with 20 mol% of α,α'-azobis(isobutyronitrile) (AIBN) in refluxing benzene. Representative results of this method of annulation are listed in Table 1.

Table 1. Preparation of Cyclic Systems from Ketones Through α,β-Epoxy Sulfoxides with the Aid of Radical Cyclization

Entry	Ketone (1)	n in 3	Enone (5) (Yield/%)	Cyclic product[a] (2) (Yield/%)	Reduced product (Yield/%)
1		3	(87)	 (82)	 (13)
2		3	(82)	 (83)	 (13)
3		3	(98)	 (82)	 (10)
4		3	(51)	 (81)	—[b]
5		3	(80)	 (83)	—[b]
6		4	(67)	 (52)	 (24)
7		4	(97)	 (76)	 (11)
8		11	(62)	—[c]	 (80)

a) A mixture of nearly equal amount of diastereomer. b) Not isolated.
c) Not determined.

The results in Table 1 indicate that this method is quite promising for the preparation of 6-membered cyclic products, however somewhat difficult for 7-membered cyclic products. In spite of the good results reported by Porter,[5] product having large ring (14-membered ring) could not be obtained so far (entry 8).

References

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4) T. Satoh, T. Kumagawa, A. Sugimoto, and K. Yamakawa, Bull. Chem. Soc. Jpn., 60, 301 (1987).
5) N. A. Porter, D. R. Magnin, and B. T. Wright, J. Am. Chem. Soc., 108, 2787 (1986).

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