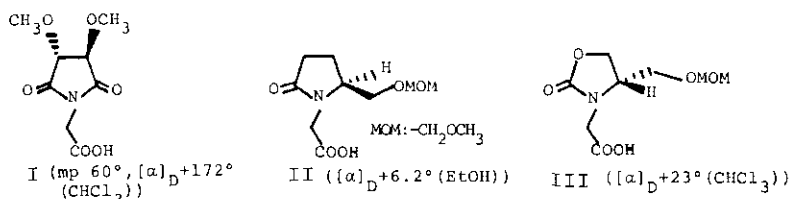


ASYMMETRIC SYNTHESIS OF  $\beta$ -LACTAMS USING CHIRAL FIVE-MEMBERED HETEROCYCLIC COMPOUNDS DERIVED FROM (+)-TARTARIC ACID AND L-AMINO ACIDS

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Although a large number of methods for the synthesis of  $\beta$ -lactams have been developed, only a few examples were reported for the asymmetric synthesis. One of the common procedures for preparing  $\beta$ -lactams is the cycloaddition of a ketene and an imine.



We describe our studies on models for asymmetric [2+2]cycloadditions of chiral ketene derivatives derived from chiral five-membered heterocyclic compounds (I, II, and III) to imine. Compounds I, II, and III were synthesized from (+)-tartaric acid, L-glutamic acid, and L-serine, respectively. They were converted into the corresponding ketenes *in situ*, and were reacted with imine prepared from benzaldehyde and aniline to afford a diastereomeric mixture of *cis* and *trans*  $\beta$ -lactams. The results were summarized in Table I. Only *trans* isomer (68% asymmetric induction) was obtained using I. On the other hand, *cis* isomers were formed as major product using II and III, and very high asymmetric induction (94%) was attained in these cases. Absolute configurations of IV (major diastereomer of *cis* compound) were determined by the correlation with the known phenylalaninol derivative (VI) according to the procedure as shown in Scheme I, and were determined to be 3S, 4R.

Table I

| Reagent | Yield (%) | cis/trans | Ratio of Major Diastereomers | Asymmetric Induction (%) |
|---------|-----------|-----------|------------------------------|--------------------------|
| I       | 47        | 0/100     | 84/16                        | 68                       |
| II      | 63        | 86/14     | 97/3                         | 94                       |
| III     | 70        | 99/1      | 97/3                         | 94                       |

