TRANSFORMATION OF THE SPIROISOQUINOLINE TO THE BENZINDANOAZEPINE

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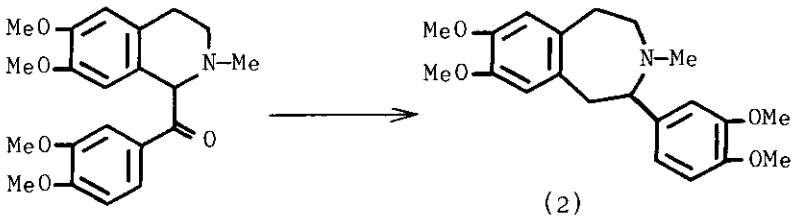
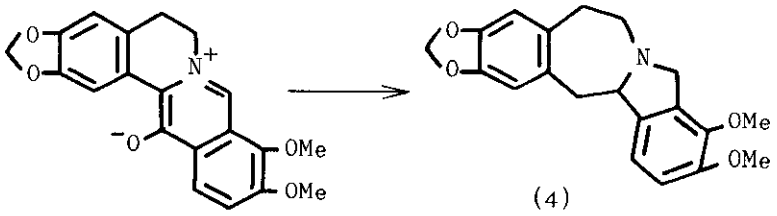
The spiroisoquinolines (5), (8), (11), and (14) were transformed to the benzindanoazepines (6,7), (9,10), (12,13), and (15,16), in high yield, respectively, under the reductive condition using zinc and acetic acid.

1-Benzoyl-1,2,3,4-tetrahydro-2-methylisoquinoline (1) was transformed to a benzazepine (2) under the reductive condition.[1] Neoxyberberine (3) was also converted to the dibenzocyclopent[b]azepine (4) under the similar condition.[2] These types of rearrangement are useful method for the syntheses of the benzazepine derivatives. Recently the benzindanoazepine derivative was found to be an important key intermediate for the synthesis of the rhoeadine type alkaloids.[3,4] We have also investigated the transformation of the spiroisoquinoline to the benzindanoazepine under the reductive condition and here wish to report our successful results.

Firstly, a mixture of the N-methylspiroisoquinoline (5)[5] and zinc dust in acetic acid was vigorously stirred under reflux for 1.5 hr to give a diastereoisomeric mixture in 85 % yield, which was composed of compound A [δ ($CDCl_3$) 6.66 and 6.55 (2H, each s, C_1-H and C_4-H), 5.85 (2H, s, OCH_2O), 4.77 (1H, d, J 9 Hz, C_{7a}-H), 2.57 (3H, s,



(1) (2)



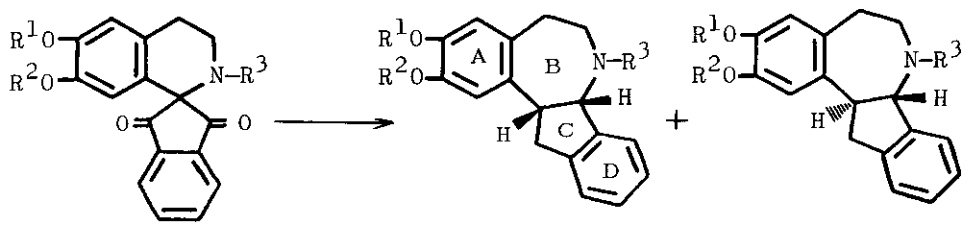
(3) (4)

NCH_3)] and compound B [δ ($CDCl_3$) 6.78 and 6.59 (2H, each s, C_1-H and C_4-H), 5.86 (2H, s, OCH_2O), 4.38 (1H, d, J 8.5 Hz, C_{7a}-H), 2.36 (3H, s, NCH_3)] in the ratio of 1 : 3. In the consideration of the stable conformation of the benzindanoazepine skeleton, if the junction between ring B and C is trans, the hydrogen at C-7a position exists upper of ring A. On the other hand in the case of cis fused one, the hydrogen is on the same plane of ring A. It was therefore considered from the chemical shift of the C_{7a}-proton that the compound A is a cis fused benzindanoazepine (6) and the compound B is trans (7). Although the mass spectra [m/e 297 (M^+)] of cis-(6) and trans-isomer (7) showed minor variations in relative intensities of some frag-

ment ions, the fragmentation pattern of both spectra were similar each other.

N-Methylspiroisoquinoline (8)[6] was treated under the same condition as above to give a diastereoisomeric mixture (73 % yield) of cis- (9) [δ ($CDCl_3$) 6.72 and 6.61 (2H, each s, C_1-H and C_4-H), 4.78 (1H, d, J 9.5 Hz, C_{7a}-H), 2.59 (3H, s, NCH_3), m/e 309 (M^+) and trans-benzindanoazepine (10) [δ ($CDCl_3$) 6.87 and 6.66 (2H, each s, C_1-H and C_4-H), 4.54 (1H, d, J 9 Hz, C_{7a}-H), 2.41 (3H, s, NCH_3), m/e 309 (M^+)] in the ratio of 1 : 3.

Secondly, the same reaction with sec.-aminospiroisoquinoline as above was examined; the spiroisoquinoline (11)[5] gave a diastereoisomeric mixture (79 % yield) of cis- (12) and trans-benzindanoazepine (13) in the ratio of 1 : 3. The mixture of cis- (12) and trans-isomer (13) was methylated with 37 % formalin and sodium borohydride to give a mixture of cis- (6) and trans-benzindanoazepine (7), whose nmr spectra and glc behaviour were identical with the above authentic samples. Similarly, the spiroisoquinoline (14)[6] was converted to a diastereoisomeric mixture, in 72 % yield, of cis- (15) and trans-benzindanoazepine (16), which on reductive methylation gave a diastereoisomeric mixture of



(5), (8), (11), (14) (6), (9), (12), (15) (7), (10), (13), (16)

(5), (6), (7) : $R^1+R^2=-CH_2-$, R^3=Me

(8), (9), (10) : $R^1=R^2=R^3$=Me

(11), (12), (13) : $R^1+R^2=-CH_2-$, R^3=H

(14), (15), (16) : $R^1=R^2$=Me, R^3=H

cis- (9) and trans-benzindanoazepine (10).

Thus a novel reductive transformation of spiroisoquinoline to benzindanoazepine has been accomplished.

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