

Short Communications

Pakistan J. Sci. Ind. Res., Vol. 15, Nos. 4-5, August-October 1972

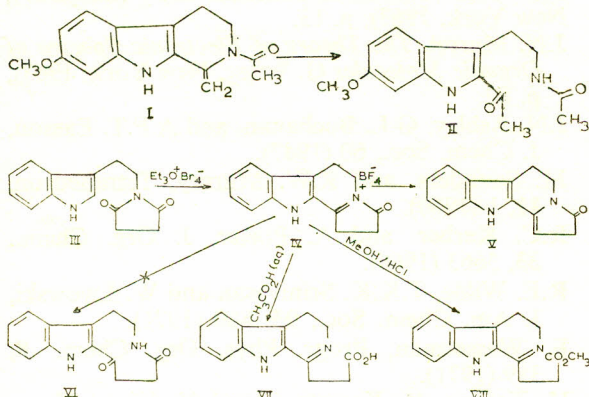
**CLEAVAGES OF 1,2,3,5,6,11-HEXAHYDRO-3-
OXOINDOLIZINO [8, 7-b] INDOL-4-IUM
TETRAFLUOROBORATE**

ATTA-UR-RAHMAN,* and ANWER BASHA

*Postgraduate Institute of Chemistry, University
of Karachi, Karachi 32*
VIQAR UDDIN AHMED
PCSIR Laboratories, Karachi 39

(Received November 1, 1972)

We have recently described a hydrolytic cleavage of N_B -acetylharmaline I to afford the corresponding 2-acetylindole II.¹ It appeared interesting to attempt a similar cleavage of lactam V in order to obtain keto-lactam VI, a potentially important intermediate for the syntheses of Strychnos alkaloids.



Lactam V was readily obtainable in good yields via a novel cyclization-elimination reaction, developed by one of us,¹ involving the treatment of imide III with $\text{Et}_3\text{O}^+\text{BF}_4^-$. Since the mechanism of acid hydrolysis of the enamide V would involve the generation of iminium salt IV, the hydrolysis experiments were directly performed on fluoroborate salt IV.

When the fluoroborate salt IV was refluxed for several hours in aqueous acetic acid, it was converted to a new substance which behaved like an imino acid and moved very slightly when subjected to TLC. The IR spectrum showed the presence of a carboxyl group and the UV spectrum was characteristic of such conjugated indoles,² showing typical shifts in acid and base. The assigned structure VII was confirmed by NMR and mass spectrometry.

Similarly when the immonium compound was refluxed in methanolic hydrogen chloride, it was converted to the corresponding iminoester VIII which was characterized as the hydrochloride. The ester possessed a band at 1720 cm^{-1} in its IR spectrum and showed a characteristic UV spectrum.

It is interesting that the greater π overlap forced by the presence of a 5-membered ring results in a de-

stabilization and hence a preferential cleavage of the N -carbonyl bond. The high value of the $\text{C}=\text{O}$ stretching frequency (1795 cm^{-1}) in IV is indicative of the highly electrophilic character of this non-amidic carbonyl group. The course of the reaction may thus be rationalized.

References

1. Atta-ur-Rahman, J. Chem. Soc. (Perkin, I,) 736 (1972).
2. R.N. Schut and T.J. Leipzig, J. Heterocyclic Chem., 3, 101(1966).

Pakistan J. Sci. Ind. Res., Vol. 15, Nos. 4-5, August-October 1972

**REACTIONS OF HARMALINE AND ITS
DERIVATIVES**

Part. III¹

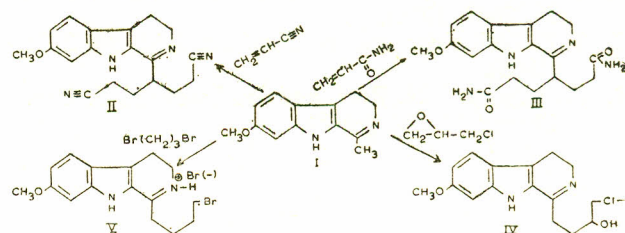
ATTA-UR-RAHMAN* and FATIMA ZEHRA

*Postgraduate Institute of Chemistry, University of
Karachi, Karachi 32*

(Received November 1, 1972)

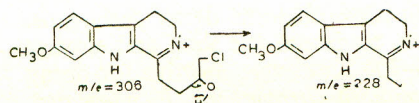
We have recently demonstrated the existence of an imine-enamine equilibrium in harmaline I,^{2,3} by deuteration studies^{1,4} and used it for the synthesis of several indoloquinolizidines. The ketimine and aldimine systems offer attractive possibilities for organic synthesis via their enamine tautomers. In a study of such potentialities, we have investigated the reaction of harmaline with various electrophiles and obtained several corresponding alkylated products in high yields.

When harmaline was treated with a twofold excess of acrylonitrile in methanol-benzene at 25°C , it afforded a new crystalline substance, m.p. 145°C . The IR spectrum showed the presence of $\text{C}\equiv\text{N}$ stretching vibrations at 2240 cm^{-1} . The characteristic bathochromic shifts observed in the UV spectrum of the product in acidic media indicated that the harmaline chromophore was still intact. A prominent molecular ion at $m/e=320$ in the mass spectrum indicated that two molecules of acrylonitrile had attacked a molecule of harmaline. The lack of olefinic protons in the NMR spectrum ruled out the N -alkylated product. On the basis of these data, structure II was assigned. Harmaline similarly reacted with a large excess of acrylamide to afford the corresponding di- C -alkylated substance III, m.p. 184°C , in high yields.



*All correspondence to be addressed to this author at University Chemical Laboratories, Lensfield Road, Cambridge, England.

When harmaline is treated with epichlorohydrin at 25°C in 1:1 methanol-benzene, the epoxide is readily opened to afford a new substance, m.p. 161°C after 48 hr in over 80% yield. The product possessed a yellowish green fluorescence and showed a prominent loss of chloroacetaldehyde from the corresponding molecular ion. The lack of olefinic protons in its NMR spectrum was in agreement with the assigned C-alkylated structure IV. Harmaline similarly afforded the corresponding displacement product V with 1,3-dibromopropane in DMF. The C-alkylated substance was obtained as a hygroscopic crystalline salt.



References

1. Atta-ur-Rahman, J. Chem. Soc., 731 (1972), Parts I and II.
2. F. Goebel, Ann Chem., 363,38 (1841); R.H.F. Manske, W.H. Perkin and R. Robinson, J. Chem. Soc., 1(1927).
3. Atta-ur-Rahman, E. Foresti Serantoni and L. Riva di Sanseverino, Pakistan J. Sci. Ind. Res., accepted for publication.
4. Atta-ur-Rahman and Tayyaba Burney, Pakistan J. Sci. Ind. Res., 15(1), 9 (1972)
5. R.N. Schut and T.J. Leipzig, J. Heterocyclic Chem., 3,101(1966).