

CHAPTER - II

Scope, Objective and Summary of the Work

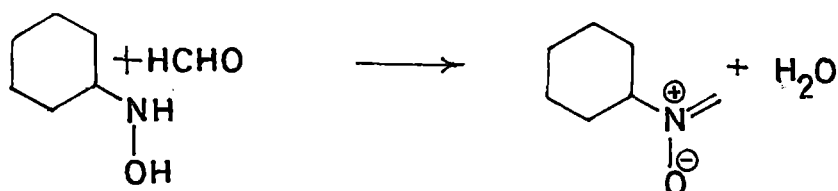
The Chemistry of 1,3-dipoles is vast and of much interest. Within the term '1,3-dipoles' a large number of different types of compounds having some special characteristics in common are encompassed. Nitrones belong to the type of 1,3-dipolar compounds. Therefore, nitrones obviously deserve all the common theoretical and practical importances of all other 1,3-dipoles. In addition to the common properties, nitrones having some uniqueness are endowed with much popularity and attention. And for these reasons from E. Beckmann's time down to the present days nitrone-chemistry is gradually being enriched by valuable contributions from different workers in organic chemistry. Now lots of different methods are available for their preparation. It has also been found that they react with a wide variety of multiple bonds and the conditions they require, are also milder. The reactions often afford good yields. It is worth mentioning that R. Huisgen and his group practically fully elucidated the chemistry of nitrones as well as other 1,3 dipoles. The regioselectivity and stereospecificity of such additions had long been a vexing problem, but K.N. Houk and his co-workers have solved the problem. And now the regioselections and stereospecificities are predictable for the additions.

Discovery of α -chloronitrene and its reactions paved a new avenue in the nitrene-chemistry. The chemistry of α -chloronitrenes

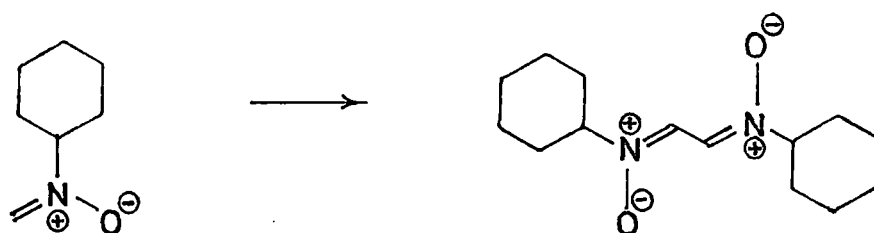
was originated and developed by Prof. A. Eschenmoser and his school^{177,178,179}.

Another new vista of the nitron chemistry is the intramolecular cycloadditions. Such type of reactions have been reviewed by A. Padwa¹⁸⁰ and U. I. Oppolzer¹⁸¹. Due to these vast synthetic potentiality of the nitrones, a number of natural products and other biologically active substances have been designed and synthesized via nitron routes¹⁸². Therefore, the scope of the nitron chemistry is abundant. One of the objective of the present work is to elucidate the cycloaddition patterns of N-cyclohexyl methylene nitron with a wide variety of dipolarophiles. Among the numerous nitrones that have been studied so far, majority of them bear at least one C-substituent. Baldwin et al have discovered a new route to synthesize methylene nitrones by the action of diazomethane on nitroso compounds¹⁷⁰ and their cycloadditions¹⁷¹ have been studied in a few cases. On the whole the cycloadditions of methylene nitrones have not been much studied. The methylene nitrones are free from the steric effects of the cycloadditions and in some cases behave differently from other nitrones.

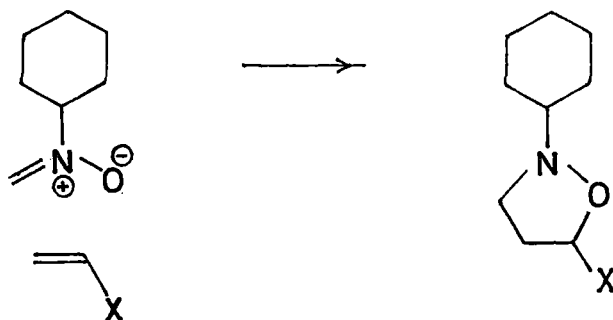
N-cyclohexyl methylene nitron has been prepared by the action of dry formaldehyde gas¹⁸³, generated by heating paraformaldehyde, on a methanolic solution of the N-cyclohexyl hydroxyl amine.



A very conspicuous property of the nitronium ion is that it undergoes dimerization with the loss of two hydrogen atoms.



The reactions of the nitronium ion with the moderately electron deficient dipolarophiles are observed to be smooth and invariably all of the reactions occur at room temperature yielding mainly the 5-substituted adducts. Acrylonitrile and methyl acrylate yielded only the 5-substituted 1,2-isoxazolidines.

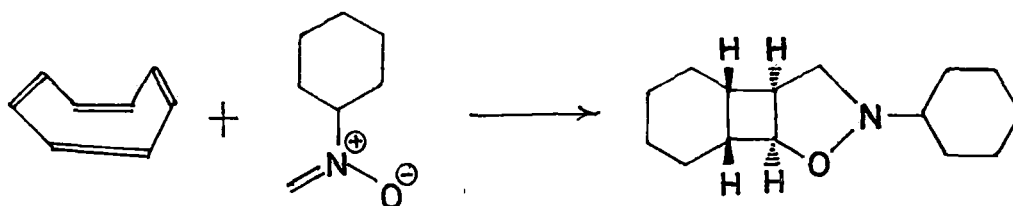


But in the additions of the nitron with methyl crotonate, methyl cinnamate, and coumarin at room temperature the regioselections gradually favour the 4-substituted isomers. An interesting observation has been made during cycloaddition of the nitron with methyl cinnamate at room temperature and under reflux. At room temperature the addition afforded 2-cyclohexyl 4-phenyl 5-carbomethoxy 1,2-isoxazolidine but under reflux the other regioisomer 2-cyclohexyl 4-carbomethoxy 5-phenyl 1,2-isoxazolidine is found as a major product.

The reactions of the nitron with tetracyanoethylene and p-benzoquinone are very vigorous at room temperature and deeply coloured products are isolated in these reactions. It is apparent that the reactions have proceeded through intense charge-transfer intermediates.

The additions with normal and moderately electron rich dipolarophiles are sluggish but occur under high pressure. Such additions with unsymmetrical dipolarophiles viz, styrene, methylene cyclopentane, ethyl vinyl ether and 2,3-dihydropyran, have afforded the 5-substituted products.

All the additions are found to be stereospecifically cis in nature. The addition with cyclooctatetraene proceeds with simultaneous electrocyclic ring-closure.



Baldwin et al found that the addition products of N-tert-butyl or N-aryl methylene nitrones with activated acetylenes underwent further transformations between room temperature and 80°.

N-cyclohexyl methylene nitronium reacts smoothly with the activated acetylenes. The adduct with phenyl methyl propilate is found unchanged even on refluxing in benzene for several hours.