

SINGLET OXYGEN INDUCED STEREOSELECTIVE PHOTO FRIES MIGRATION OF ACYLAMINES

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ABSTRACT

Singlet oxygen has been observed to induce stereoselective photo Fries migration of acylamines to *p*-aminoacetophenones. Only minor reaction occurs at the ortho position when para position is substituted. This type of inducement of rearrangement by singlet oxygen has not been observed earlier.

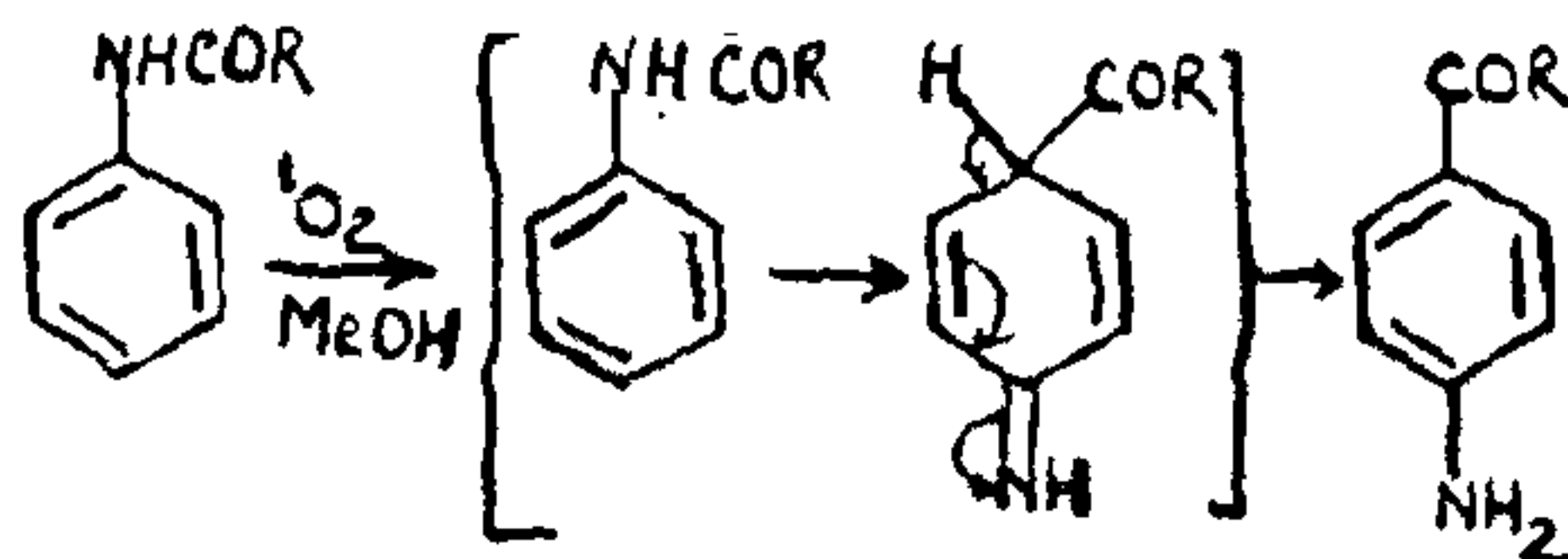
SINGLET oxygen, an excited form of oxygen, has recently been employed in the photo-oxygenation of various synthetic and natural heterocyclic compounds¹⁻⁴. The reactions of singlet oxygen discovered so far can mainly be divided into three types, viz., (i) the ene type reaction, (ii) the dioxetane formation and (iii) the formation of hydroperoxides. All these reactions can be explained on the basis of its structure which has two electrons in one orbital, leaving thereby one vacant orbital which makes singlet oxygen electrophilic in character to interact with electron rich olefins⁵.

It has been observed that acylated amines, when exposed to ultraviolet light, undergo photo Fries type of migration to give a mixture of *ortho* and *para* acetophenones⁶⁻⁸. While the mechanism of photo Fries migration of phenolic acetates has been a subject of recent interest, the corresponding reaction in the acylated aryl amines has not been very much explored⁹⁻¹⁰. Since singlet oxygen is known to bring about hydroxylation of phenolic compounds^{1,2,11}, it was considered important to investigate whether a similar hydroxylation also takes place in the case of amines. Our preliminary results indicate that no such reaction does take place in the case of acylamines such as acetanilide but instead singlet oxygen induces a stereoselective migration of the acyl group to the *para* position with a very minor reaction which leads to the formation of *o*-aminoacetophenones. In this respect singlet oxygen appears to behave as β -cyclodextrin which when added to the reaction medium orients the rearrangements to take place in the *para* position¹². The prime results of our initial work on the problem are reported in this communication while detailed investigations on the mechanism of the reaction are in progress.

Acetanilide (200 mg) was dissolved in methanol (100 ml) with 10^{-3} times its molar concentration of the sensitizer, methyleneblue. The solution was irradiated with 100 watt tungsten filament lamp (120 hr) while oxygen was passed through the solution continuously. To avoid side reactions, a potassium chromate screen was placed between the lamp and the solution to arrest u.v. radiations and progress of the reaction was monitored by TLC. The involvement of 1O_2 was con-

firmed by carrying out the reaction in the presence of well-known free radical and singlet oxygen quenchers like quinol and β -carotene respectively, when no reaction was observed. Again when oxygen was not circulated no reaction occurred. After about 75% of the reaction, the solvent was removed under reduced pressure and the residue extracted with ether, ethyl acetate and chloroform. The organic extracts were evaporated and subjected to column chromatography (silica gel) using petroleum ether-benzene (1 : 1) as the eluent to yield a gummy residue which, after preparative TLC, gave a yellow compound, m.p. 105-6°, R_f 0.65 (benzene-petroleum ether, 4 : 5) ν_{max}^{KBr} 3450 (NH₂), 2960, 2920, 1680, 1610 cm^{-1} in good yield (30%). It was identified as *p*-aminoacetophenone by comparison with an authentic sample.

The reaction can be considered to take place, via excitation of the acetanilide molecule by energy transfer from singlet oxygen to give a radical pair trapped in the solvent cage which then rearranges to yield *p*-amineacetophenone as shown below :



Solvent Cage

o-Amineacetophenone and *p*-hydroxyacetanilide were obtained as minor components. This reaction illustrates that singlet oxygen can induce the selective photo rearrangement of acylamines. The corresponding reaction, when carried out in the case of phenyl acetate and β -naphthyl acetate, yielded only polymeric coloured compounds which could not be resolved into different components, thereby indicating that the reaction may not be that useful in phenyl acetates as it is in the case of acylated amines,

It is significant that when *p*-bromoacetanilide and *p*-nitroacetanilide were subjected to a similar photo-oxygenation, they did not give any *ortho* substituted product and starting materials were recovered unchanged.

Further investigations on the reaction of other acylamines, the nature and mechanism of the reaction and energy transfer process during rearrangement are in progress.

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SYNTHESIS OF HETEROCYCLES VIA LACTONES¹—A NOVEL SYNTHESIS OF SULPHUR CONTAINING HETEROCYCLES²—SYNTHESIS OF 1-DESAZA-1-THIA-15, 16, 17, 18, 19, 20-HEXADEHYDROYOHIMBANE

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ABSTRACT

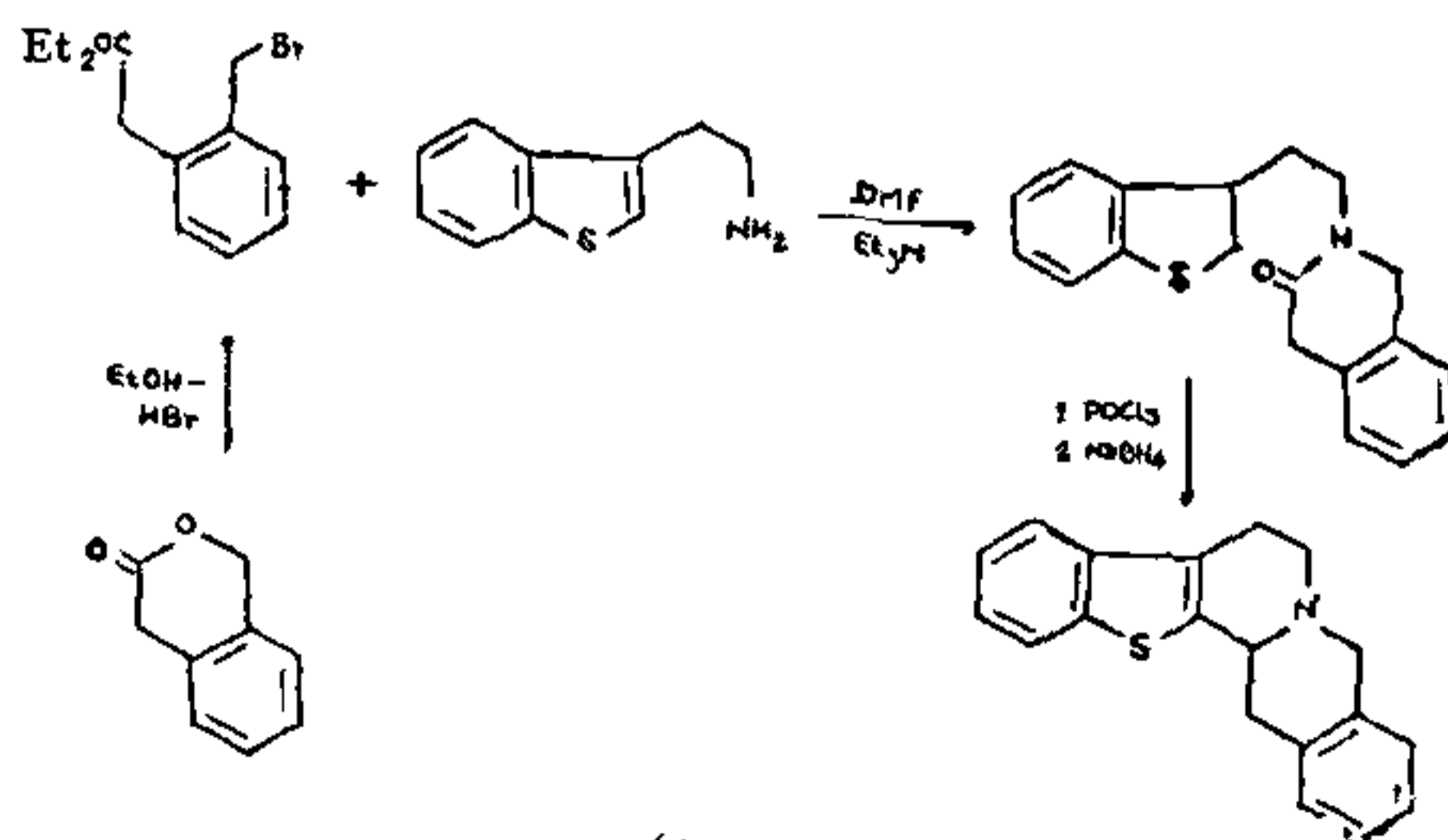
Recently we reported some convenient syntheses of the isoquinoline alkaloids using 3-isochromanones and the bromo esters derived from them. Now, a new synthesis of a sulphur-heterocycle, viz., 1-desaza-1-thia-15, 16, 17, 18, 19, 20-hexadehydropyohimbane(V) is being described using the 3-isochromanone.

INTRODUCTION

RECENTLY some new syntheses of 1,2,3,4-tetrahydroisoquinoline³, N-benzyl-1,2,3,4-tetrahydroisoquinoline⁴, N-phenethyl-1,2,3,4-tetrahydroisoquinoline, and berbine⁵ alkaloids have been reported from this laboratory using the 3-isochromanones and the bromo esters derived from them as the potential tools. Our continuing experiments on synthesis of heterocycles have led us to successful utilization of the bromo ester (II) for the sulphur containing heterocycle synthesis and we report the results in the present paper.

3-Isochromanone (I) was prepared by the method of Swan⁶. This on dissolution in cooled ethanolic-

hydrobromic acid gave the bromo ester (II). The ester (II) was condensed with benzo (b) then-3-ylethylamine⁷ (III) in dimethylformamide under basic conditions to give N-(β-benzo (b) then-3-yl)ethyl-1,2,3,4-tetrahydro-3-isoquinolone (IV). The lactam (IV) was cyclized using phosphoryl chloride and reduced to give the title compound 1-desaza-1-thia-15, 16, 17, 18, 19, 20-hexadehydropyohimbane(V) (Scheme 1).



(SCHEME 1)

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