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REACTIONS WITH BENZOXAZONES AND SIMILAR COMPOUNDS

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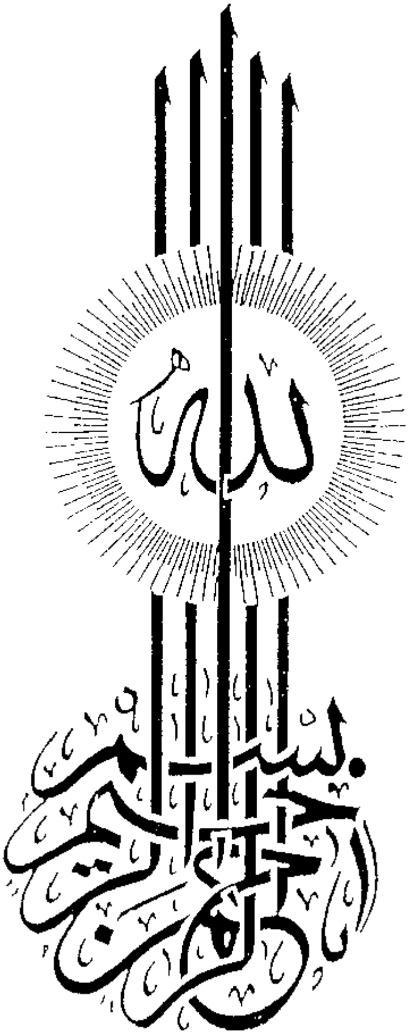
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SUMMARY IN ARABIC

SUMMARY

1. Tetrahalo-o-benzoquinones react with 2-aryl-3,1-benzothiazine-4-thiones to give the hitherto unknown series of spiranes, 4,5,6,7-tetrahalo-2'-aryl-spiro[1,3-benzodioxole-2,4'-(4H-3,1)benzothiazines] (132). Thus, it is found that tetrachloro-o-benzoquinone reacts with 2-phenyl- (131a), 2-p-tolyl- (131b) and 2-p-anisyl- (131c) 3,1-benzothiazine-4-thione in boiling toluene in absence of catalyst to give the spiranes (132a-c), respectively, in good yield.

   The bromo-analogues (132d-f) are obtained by the action of tetrabromo-o-benzoquinone on the thiones in a similar manner (cf. p. 66).

   The benzothiazine-4-thiones are readily obtained by the action of phosphorus pentasulphide on the corresponding benzoxazones through successful improvement of earlier methods.

   The spiranes (132) are cleaved with hydrochloric acid in dioxane to give the corresponding 2-aryl-3,1-benzothiazin-4-ones along with tetrachlorocatechol, presumably through the intermediate formation of resonance stabilised carbonium ion.

The infrared and ultraviolet spectra of the products and the benzothiazine-thiones are determined.

2. The spiranes (132a-c) undergo unusual cleavage, under very mild conditions, with anilines to give tetrachlorocatechol and the corresponding 2-aryl-3-substituted-3H-quinazoline-4-thiones (140), in excellent yield. Thus, it is found that when 4,5,6,7-tetrachloro-2'-phenyl-spiro[1,3-benzodioxole-2,4'-(4H-3,1)benzothiazine] (132a) is allowed to react with aniline, p-toluidine, p-anisidine and p-chloroaniline, the corresponding 3-aryl-2-phenyl-3H-quinazoline-4-thiones (140a-d) are obtained along with tetrachlorocatechol.

The corresponding 3-aryl-2-p-tolyl- and 3-aryl-2-p-anisyl-3H-quinazoline-4-thiones (140e-l) are similarly obtained along with tetrachlorocatechol by the action of the appropriate amine on 4,5,6,7-tetrachloro-2'-p-tolyl- (132b) and 4,5,6,7-tetrachloro-2'-p-anisyl- (132c) -spiro[1,3-benzodioxole-2,4'-(4H-3,1)benzothiazine] respectively (cf. p. 72).

Similarly the spiranes (132a-c) react with phenyl- and benzoylhydrazines to give the corresponding 2-aryl-3-phenylamino- and 2-aryl-3-benzoylamino-3H-quinazoline-4-thiones (141a-f). Meanwhile, with ethyl p-aminobenzoate, the 2-aryl-

-3-(4-carbethoxyphenyl)-3H-quinazoline-4-thiones (145) are obtained. In all cases tetrachlorocatechol is produced (cf. p. 72).

It is proposed that cleavage of the spiranes by the nucleophiles proceeds through rupture of the C-S bond of the thiazine ring followed by recyclisation to give a spiro-benzodioxole quinazoline as an intermediate which is cleaved by the liberated H_2S to give the quinazoline-4-thiones along with the catechol through a β-elemination process (cf. p. 82).

Authentic samples of the quinazoline thiones are obtained by the action of the appropriate amine or hydrazine on the corresponding benzothiazine thione. The quinazoline thiones afford the corresponding quinazolinones upon oxidation with potassium permanganate.

The infrared and ultraviolet spectra of the quinazoline thiones and the quinazolinones are discussed (cf. pp. 78 & 85).

3. In contrast to anilines and hydrazines, it is found that hydroxylamine in ethanol react with the spiranes (132a and b) to give the 2-thioacylaminobenzoates (150a and c), respectively, in addition to the expected 2-phenyl- and 2-p-tolyl-3-hydroxy-3H-quinazoline-4-thiones (149a and b) along with tetrachlorocatechol (cf. p. 88).

The production of the ester (150) apparently results from an enhanced cleavage of the spirane by the solvent itself since it is found that on prolonged boiling of (132a) with ethanol, 2-thiobenzoylaminobenzoate (150a) is exclusively produced.

The ester (150a) is also readily obtained by reacting 2-phenyl-3,1-benzothiazin -4-one with lithium aluminium hydride and decomposing the complex with ethanol. However, when decomposition is made by methanol, the methyl ester (150b) is produced (cf. p. 91).

4. In contrast to the action of amines and hydrazines, it is found that malononitrile as well as ethyl cyanoacetate react with 4,5,6,7-tetrachloro-2'-aryl-*spiro*[1,3-benzodioxole-2,4'-(4H-3,1)benzothiazine] (132) in boiling ethanol to give the corresponding ylidene malononitriles and cyanoacetic esters (152) and (153), respectively, leaving the thiazine ring unmodified. In all cases, tetrachlorocatechol, along with the corresponding 2-thioacylaminobenzoate (150) are produced.

Absorption spectra of the ylidene malononitriles and cyanoacetic esters are investigated and the reaction mechanism is discussed (cf. p. 92).

5. The hitherto unknown series of spiranes 4,5,6,7-tetrachloro-2',3'-diaryl-*spiro*[1,3-benzodioxole-2,4'-(3'H)quinazolines] (155) is obtained by the action of tetrachloro-*o*-benzoquinone on the corresponding 2,3-diaryl-3H-quinazoline-4-thiones. The reaction is remarkably catalysed by peroxides which suggests its homolytic nature. The spiranes (155) are readily cleaved with hydrochloric acid in dioxane to give the corresponding 2,3-diaryl-3H-quinazolinones (cf. p. 96).

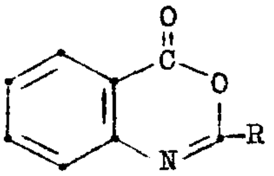
6. The *spiro*[benzodioxole-quinazolines] (155) are cleaved by anilines to give the hitherto unknown series of quinazolinone-anils (156a-h). The latter are readily obtained by the interaction of the corresponding 2,3-diaryl-3H-quinazoline-4-thiones with the appropriate amine in presence of mercuric oxide as desulphurising agent (cf. p. 98).

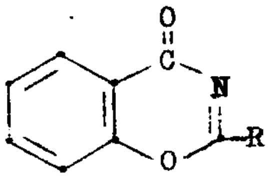
7. 2-Aryl-3,1-benzothiazine-4-thiones (131a-c) react with diazomethane to give the corresponding cis- and trans-1,3-dithioles (162) and (163). In contrast, diaryldiazomethanes as well as 9-diazofluorene afford the corresponding episulphides (165a-d) and (166), when reacted with the thiones. The episulphides are desulphurised readily upon treatment with copper bronze in boiling xylene affording the corresponding ethylenes (167) (cf. p. 100).

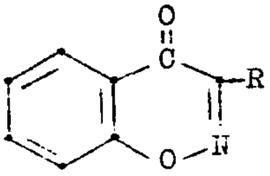
GENERAL PART

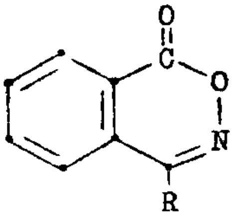
CHEMISTRY OF 3,1,4-BENZOXAZONES AND RELATED COMPOUNDS

The 4-keto benzoxazines are known as benzoxazin-4-one (or benzoxaz-4-one). The important isomers are the 3,1,4-, 1,3,4-, 1,2,4- and 2,3,1- benzoxazin-4-ones have been extensively investigated.









This review deals **mainly** with the chemistry of 3,1,4-benzoxazin -4-ones, 3,1,4-benzothiazin-4-ones and the corresponding (3H)quinazolinones as well as their thiono-derivatives.

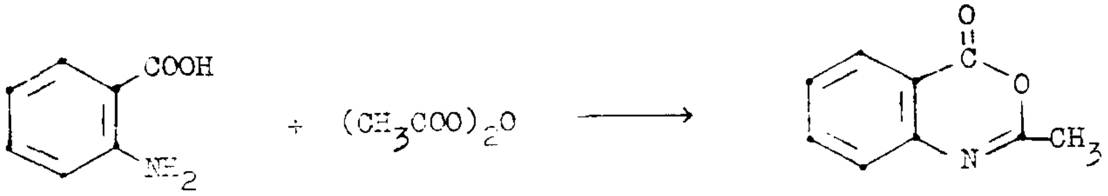
It is not attempted to cover the whole literature in this review, however, the important methods of preparation and reactions will be compiled.

Methods of Preparation of 3,1,4-Benzoxazin-4-ones

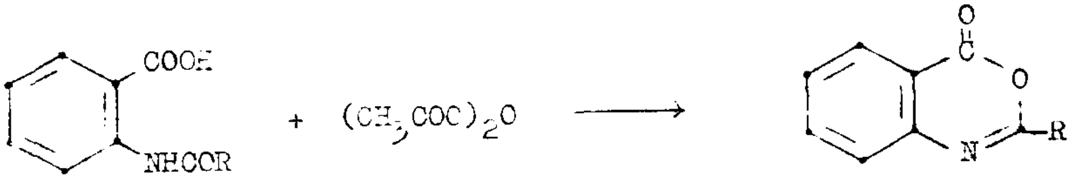
(1) 2-Alkyl and 2-aryl 3,1,4-benzoxazin-4-ones:

The first compound of this series (previously named as acylanthranil) was obtained by the action of benzoyl chloride on anthranil[1], but this method was not of general applicability because of the instability of anthranil and lack of a satisfactory method for its preparation.

Bogert and Seil[2,3] prepared acetanthranil (1) by heating anthranilic acid or ring substituted anthranilic acids with acetic anhydride, and by heating preformed N-acetyl or N-benzoyl anthranilic acids (2) with acetic anhydride. They obtained the corresponding acetanthranils and benzanthranils (3).



(1)



(2)

(3)

R = Me or Ph

Zentmyer and Wagner[4] adapted these procedures to the preparation of a series of benzoxazones by heating with excess acetic anhydride and slow distillation of acetic acid formed in the reaction and obtained benzoxazones (3) (R = H, CH_3, C_2H_5, n-propyl, phenyl, o- and p-tolyl, o-and p-chlorophenyl, o- and p-nitrophenyl or 3-pyridyl). In general no interchange of acyl groups was noted, although the method failed when R in 3 was isobutyl, n-amyl, undecyl or 3,5-dinitrobenzoyl.

Heller and Fiesselmann[5] showed that anthranilic acid reacts with benzoyl chloride in pyridine to give 3,1,4-benzoxazinone (3; R = phenyl). o-Nitrobenzoyl chloride reacted similarly with anthranilic acid to give the corresponding benzoxazone[6] (3; R = o-nitrophenyl).

Recently, Bain and Smally[7] reported that 2 moles of benzoyl chloride reacted with one mole anthranilic acid in pyridine to give (3; R = phenyl), whereas with one mole benzoyl chloride a mixture of (3; R = phenyl) and N-benzoylanthranilic acid (2) was produced. Hence, it became obvious that the excess of benzoyl chloride was involved in the formation of the benzoxazinone. This was proved when equimolecular amounts of N-benzoylanthranilic acid (2) and benzoyl chloride were reacted in pyridine to give benzoxazinone in almost quantitative yield.