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A NOVEL FRAGMENTATION REACTION LEADING TO MULTIPLE BOND FORMATION+

Hans Hettler and Hubertus Neygenfind
Max-Planck-Institut für Experimentelle Medizin, Göttingen

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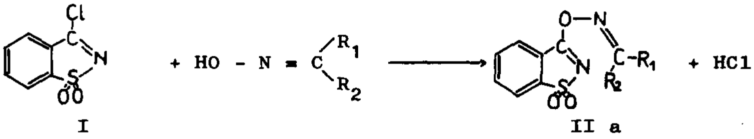
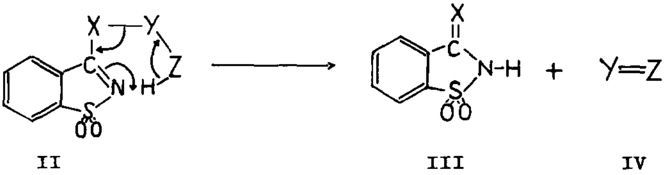
Pseudosaccharinchloride (I)$^{1)}$ forms crystalline derivates with a variety of substances (e.g. alcohols$^{2)3)}$ amines$^{4)}$ amides$^{5)}$ and ureas$^{5)}$) in a facile and straightforward reaction. Since (I) is easily accessible and rather stable by comparison we became interested in it's use as a protecting group.
Recently we found, that (I) also reacts with oximes to yield the crystalline oxime ethers (II a) c.f. Table I.



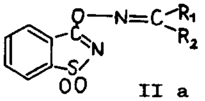
Ethers derived from ketoximes undergo the normal BECKMANN rearrangement under appropriate conditions$^{6)}$.

The feasibility of saccharine formation together with the steric array of pseudosaccharine derivatives lead us to envisage the general fragmentation scheme giving rise to multiple bond formation

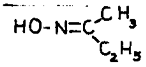
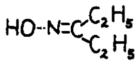
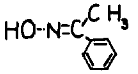
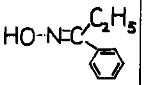
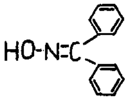
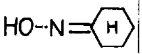
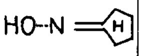


+ "Reactions with Pseudosaccharinchloride" Part III

TABLE I

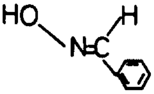
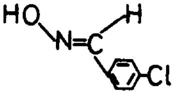
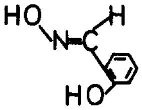
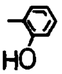
Product 

II a

Oxime component	R_1	R_2	Product II a Mp. °C	Analysis calcul.	 found	R_f - Values+
	$-CH_3$	$-C_2H_5$	142	C=52,36 H= 4,79 N=11,11	52,29 5,10 11,08	0,615
	$-C_2H_5$	$-C_2H_5$	145	C=54,12 H= 5,30 N=10,52	54,19 5,30 10,34	0,675
	$-CH_3$		165	C=59,98 H= 4,03 N= 9,33	59,96 4,34 9,34	0,685
	$-C_2H_5$		150	C=61,13 H= 4,49 N= 8,91	60,99 4,56 8,90	0,72
			165	C=66,27 H= 3,90 N= 7,74	66,23 4,16 7,65	0,83
			156	C=54,53 H= 4,57 N=10,60	54,49 4,65 10,60	0,595
			138	C=56,10 H= 5,07 N=10,07	55,64 5,01 10,21	0,67

+R_f-Values run on Silicagel F_{254} thin layer plates (MERCK). Solvent: Benzene/Methanol (9:1)

TABLE I (continued)

Oxime component	Product II a					
	R_1	R_2	Mp. °C	Analysis calcul.	found	R_f - Values$^+$
		-H	152	C=58,73 H= 3,52 N= 9,79	58,86 3,65 9,77	0,69
		-H	166	C=52,42 H= 2,83 N= 8,74	52,12 3,21 8,59	0,71
		-H	138	C=55,62 H= 3,33 N= 9,27	55,66 3,34 9,30	0,05

In table I information is given on some of the oxime derivates. For their preparation we gradually added the oxime to an ice cold solution of pseudosaccharinchloride in dioxane. At the same time a stream of nitrogen was passed through the solution.

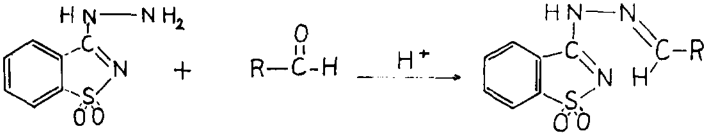
In the case of ketoximes (with the exception of isocyclic oximes) tertiary amines proved to be useful for removing the hydrochloric acid formed during the reaction. The preparation of anti-aldoxime ethers turned out to be quite difficult obviously because of the possibility of trans-elimination.

In contrast the syn-aldoxime ethers can be prepared conveniently from acetonitrile solution (containing just enough water to avoid precipitation of the oxime) in the presence of an excess of tertiary amine.

For example the syn-benzaldoxime (II a, $R_1=C_6H_5$, $R_2=H$) on heating above the melting point (152°) undergoes a clean fragmentation reaction to yield saccharin (IIIa x=O) and benzonitrile (IVa= $C_6H_5-C{\equiv}N$). When carried out in a simple device for thermolysis in vacuo benzonitrile was obtained in 95% yield.

Pseudosaccharin derivatives of substituted ureas[5)] (IIb x=NH, y= -C=O, z= N-R) on heating in vacuo form isocyanates. In this way phenylisocyanate was formed when the derivative of N-phenylurea (m.p. 260°) was heated above 200°.
The derivative of dicyclohexylthiourea (IIb x= NC_6H_{11}, y= C=S, z= NC_6H_{11}) when heated to 172° decomposes to yield cyclohexylisothiocyanate in 90% yield.

Another group of substances susceptible to fragmentation is formed conveniently when reacting aldehydes with "pseudosaccharin hydrazine", a reaction described by SCHRADER[7)8)] many years ago.



II d

The hydrazones (IId) on heating in vacuo decompose to yield the corresponding nitriles.
In this reaction however some byproducts are formed.

Examination of the mass spectra of pseudosaccharinethers2)3) e.g. in the case of the ß-phenylethylether (IIe x=O y=CH$_2$-z=CHC$_6$H$_5$, C$_{15}$H$_{13}$SO$_3$N m.p. 156-158° calc. 11,16% S found 11,08% S) indicates that olefin (IVe = styrene) formation is in fact vastly predominant. This result was born out in the experiment. Thus the pseudosaccharin-ß-phenylethylether when heated to 245° at reduced pressure (20 mm) decomposed to yield rather pure styrene as proved by gas chromatography and IR-spectroscopy.

Experiments with the corresponding derivative of ß-phenylethylamine (II f x=-NH y=CH$_2$ z=CHC$_6$H$_5$, C$_{15}$H$_{14}$SO$_2$N$_2$ m.p. 253° calc. 62,92% C, 4,93% H, found 62,90% C, 5,01% H) up to 350° showed only minute styrene formation on thermolysis.

Pseudosaccharin derivatives of amines4) can be reverted to the corresponding amines in very good yield by alcali fusion provided the amine is stable under the conditions employed.

The melting points quoted are uncorrected.

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