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Cleavage of Tetrahydrofuran by Benzyne

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It was reported recently[1] that tetrachlorobenzyne reacts with various ethers to give tetrachlorophenyl ethers, but that no similar reaction is observed with tetrahydrofuran (THF). This report prompts us to relate our recent experiences which indicate that THF is indeed cleaved when it is used as a solvent in the diazotization of anthranilic acid with amyl nitrite, or even when it is heated with benzene diazonium-2-carboxylate alone.

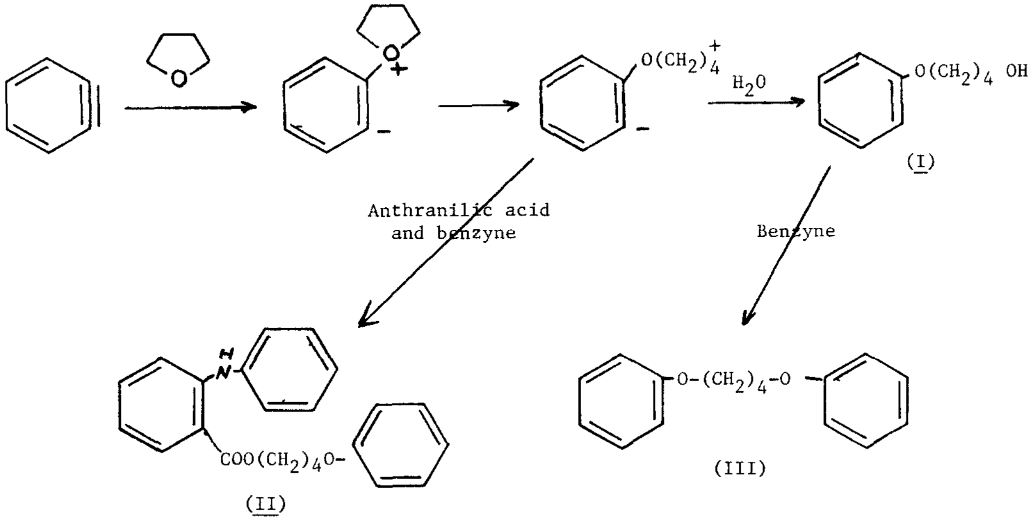
For some time we have studied the possible Diels-Alder reactions of benzyne with styrene and substituted styrenes.[2] The procedure involves the generation of benzyne from anthranilic acid and amyl nitrite in THF as solvent, and in the presence of the styrene. In these experiments two unexpected products were obtained repeatedly, regardless of the styrene used. One of these compounds is a new one, δ-phenoxybutyl-N-phenylanthranilic acid (II), m.p. 83.0-83.3°. Its structure was established by spectra, saponification and synthesis. The second compound is 1,4-diphenoxybutane (III).[3]

After these compounds were identified as being formed apparently independently of the diene used, they were produced simply by reacting anthranilic acid with amyl nitrite in THF. Yields so obtained were 17% of II and 4% of III, based on anthranilic acid used.

Obviously both of these compounds result from cleavage of THF, a solvent widely used in the diazotization of anthranilic acid. Neither is formed when other solvents are used. It is surprising that the THF ring is ruptured under the mild conditions of these experiments.

Several subsequent experiments showed that very likely benzyne is responsible for the ring cleavage. Refluxing anthranilic acid, or amyl nitrite, with THF did not produce a change. However, when THF was heated with benzene diazonium-2-carboxylate (previously formed and isolated) and an equivalent amount of water, III (8%) was formed together with a liquid, 4-phenoxybutanol (I)(23%), the yields based on anthranilic acid used. Compound I was identified by spectral and gas chromatographic comparison with an authentic sample.[4]

A likely mechanism for the formation of these products follows:



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