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Short Communications

The Ozonization of *p*-Benzoquinone

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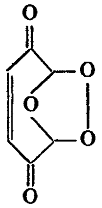
In the course of our investigations on the reactions between quinones and β-diketones it became desirable to subject some of the substances prepared to ozonolysis. Searching of the literature disclosed the surprising fact that very little was known about the action of ozone on quinones and it was therefore decided to look more fully into this question.

For the sake of simplicity *p*-benzoquinone was chosen as a model substance. The ozonolysis of this quinone was reported by Fichter, Metzer and Leepin [1]. These authors worked in chloroform solution but gave no information about working temperatures or concentrations of ozone. They did, however, claim to have isolated an ozonide (or "perozonide") with the composition $C_6H_4O_9$ contrary to the expected normal diozonide of *p*-benzoquinone $C_6H_4O_8$. When this ozonide was decomposed by water it yielded formic acid and another acid the identity of which they did not establish.

In the present investigation *p*-benzoquinone was ozonized in chloroform at 0° with 3 to 3.5 % ozone. An ozonide was formed and being almost insoluble in chloroform it separated as a gel-like mass varying in colour from almost white to yellow. Purification of the ozonide for analysis was very difficult because of its sensitivity to moisture, the risk of thermal decomposition and because it retained chloroform very tenaciously. No analytical data will therefore be presented on this occasion. The ozonide was (as Fichter *et al.* also observed) not explosive but burned vigorously when heated on a spatula in a Bunsen flame.

Water decomposed the ozonide very rapidly without noticeable evolution of heat. Hydrogen peroxide could not be detected among the decomposition products. The aqueous solution containing these was treated in a column with an ion exchange resin in order to remove some acidic compounds. The neutral eluate reduced Fehling's solution at room temperature and reacted with the common carbonyl reagents. There must consequently have been an aldehydic compound present. If the solution was boiled for some minutes with dilute hydrogen peroxide and then evaporated to dryness maleic acid could be isolated in good yield. These results point towards the following structure for the aldehydic compound:

CHOCOCH=CHCOCHO (I).



II.

As will be seen this is a compound to be expected if benzoquinone reacted with ozone to give the monozonide (II) and this again was decomposed by water to a dialdehyde. A further indication that (I) is the correct structure of the carbonyl compound is found in the fact that it reacts with 2,4-dinitrophenylhydrazine to give a derivative of the approximate composition $C_{30}H_{20}N_{16}O_{16}$ corresponding to a tetrakis-(dinitrophenylhydrazone) of (I). (Found: C 40.76, H 2.51, N 26.04. Calc. for $C_{30}H_{20}N_{16}O_{16}$: C 41.86, H 2.34, N 26.05.) The highly interesting compound (I) will be the subject of further investigations. Experiments on the ozonization of other quinones and quinonoid substances are in hand.

1. Fichter, Fr., Jetzer, M. and Leepin, R. *Ann.* **395** (1913) 1.

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