most of these latter records. In this investigation, although we have ascribed prominent similarities in the records to travelling disturbances, no conclusions can be drawn regarding the nature or type of travelling disturbances in the *F*-layer. Further investigations are in progress with the purpose of extending the usefulness of this method to get full information on the actual wind velocities and directions by simultaneous study of transmissions from three distant transmitters. A full report of these investigations will shortly be published elsewhere.

B. Ramachandra Rao
E. Bhagiratha Rao

Ionosphere Laboratories,
Physics Department,
Andhra University,
Waltair, India.
July 17.

[1] See preceding communication.
[2] Munro, G. H., *Proc. Roy. Soc.*, A, **202**, 208 (1950).

Quantitative Determination of Ethylene Oxide Products in Aqueous Solutions or Dispersions

In recent years, the use of ethylene oxide condensation products as detergents, wetting agents, finishes, and so on, has steadily increased. This makes an analytical method for the determination of such products more and more desirable. In most cases, it is felt, an accuracy of ± 5 per cent is sufficient. The method must be rapid and simple enough for practical purposes.

For a considerable time it has been known that ferrocyanic acid gives addition products with oxygen-containing organic compounds. Starting from this fact, the possibility of using potassium ferrocyanide for the analytical determination of ethylene oxide condensation products was examined. After several modifications the following method was devised.

To a certain volume of the aqueous solution or dispersion of the ethylene oxide product, hydrochloric acid is added while stirring. Then a known quantity (*A*) of potassium ferrocyanide is added.

The flaky precipitate is filtered and the remaining potassium ferrocyanide in the filtrate (*B*) is estimated by titration with zinc sulphate. $A - B$ is the quantity of potassium ferrocyanide consumed by the formation of the precipitate.

For each ethylene oxide condensation product a fixed relation exists between the quantity of potassium ferrocyanide necessary to precipitate a certain amount of ethylene oxide condensation product. This relation (f) can easily be determined using a known quantity of ethylene oxide product. For a solution or dispersion containing an unknown quantity of the same ethylene oxide condensation product (x) it then follows that:

$$x = f\,(A - B).$$

Determinations have been carried out on nonyl phenol condensed with 6, 9 and 12 moles of ethylene oxide in varying dilutions between 0·15–3 gm. per litre. Results obtained show that the value of f for each adduct in the interval 0·6–3 gm. per litre is a constant generally within ± 5 per cent.

A relationship seems to exist between the number of moles of ethylene oxide present in one mole of condensation product and the number of moles of $K_4Fe(CN)_6$ required for precipitation. Thus, in the above-mentioned interval, approximately 0·7, 1·0 and 1·5 moles respectively of $K_4Fe(CN)_6$ were necessary for the precipitation of one mole of nonyl phenol condensed with 6, 9 and 12 moles respectively of ethylene oxide.

Investigations on this subject, especially with regard to its scope, are being continued, and a detailed description of the method, together with results obtained, will be published at a later date.

The interest of Mr. H. Grunewald and the helpful assistance of Miss Birgitta Andersson and Miss Marianne Dahlström in carrying out the experiments are acknowledged.

N. Schönfeldt

Research Department,
Aktiebolaget Berol-Produkter,
Gothenburg 14.
July 6.

A New Synthesis of Carbazoles

It has been observed that upon attempted distillation of the oxime of 2-phenylcyclohept-2-enone in a high vacuum, thermal cyclization takes place with the formation of cycloheptenoindole[1]. If the generality of this reaction could be demonstrated, a valuable new route would be available towards obtaining certain natural products containing the indole nucleus, employing starting materials more readily available than those containing a preformed indole system. We wish to report the extension of the thermal cyclization reaction of oximes to a number of new cases.

Thermal cyclization of the oxime of 2-phenylcyclohexanone yielded 1,2,3,4-tetrahydrocarbazole, m.p. 124–125° (from aqueous ethanol). Admixture with an authentic sample prepared from cyclohexanone phenylhydrazone showed no melting point depression. The infra-red spectra of both specimens were identical.

Similar treatment of the oxime of 2-phenylcyclohex-2-enone yielded carbazole, m.p. and mixed m.p. upon admixture with an authentic specimen, 242°. The infra-red spectra of both specimens were identical.

Thermal treatment of the oxime of 2-(2′,3′-dimethoxyphenyl)cyclohex-2-enone yielded 1,2-dimethoxycarbazole, m.p. 134° (from ethanol). (Anal. calc. for $C_{14}H_{13}O_2N$: C, 74·0; H, 5·8; OCH_3, 27·3 per cent. Found: C, 73·7; H, 6·0; OCH_3, 27·6 per cent.)

Similar treatment of the oxime of 2-(2′,3′-dimethoxyphenol)cyclohexanone yielded 1,2,3,4-tetrahydro-5,6-dimethoxycarbazole as a viscous oil, b.p. 180° (2 mm.). (Anal. calc. for $C_{14}H_{17}O_2N$: OCH_3, 26·8 per cent. Found: OCH_3, 27·1 per cent.) Treatment of the oil with palladium–charcoal in boiling cymene gave 1,2-dimethoxycarbazole identical with the product obtained above.

This novel cyclization reaction appears to involve the direct attack of the oxime nitrogen atom on an aromatic nucleus. The reaction is being extended to other systems, and its mechanism is being investigated.

Alfred Löffler
David Ginsburg

Daniel Sieff Research Institute,
Weizmann Institute of Science,
Rehovoth, Israel.
July 13.

[1] Ginsburg, D., and Pappo, R., *J. Amer. Chem. Soc.*, **75**, 1094 (1953).

© 1953 Nature Publishing Group