

61. Polycyclic Aromatic Hydrocarbons. Part XXIII.

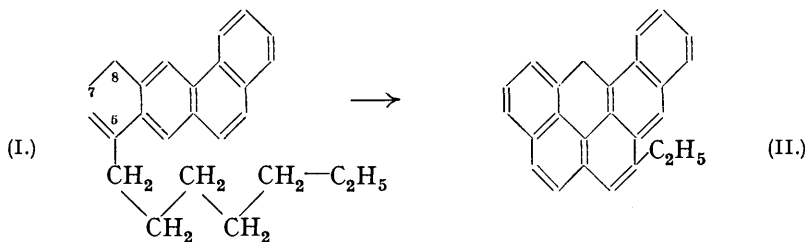
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The 5-methyl, 5-ethyl, 5-*n*-propyl, and 5-*isopropyl* derivatives of 1:2-benzanthracene have carcinogenic properties and it seemed of interest to determine to what extent the length of the carbon chain could be increased without loss of activity.

THE 5-*n*-butyl, 5-*n*-amyl, 5-*n*-hexyl, and 5-*n*-heptyl derivatives of 1:2-benzanthracene have been prepared by the action of alkylmagnesium bromides on 5-keto-5:6:7:8-tetrahydro-1:2-benzanthracene, followed by dehydration of the tertiary carbinols to 5-alkyl-7:8-dihydrobenzanthracenes, which were subsequently dehydrogenated to the completely aromatic state. These new homologues of 1:2-benzanthracene are undergoing biological test. Preliminary results of tests by Professor E. L. Kennaway suggest that there is a steady decline in carcinogenic activity with increasing length of chain. In experiments in which the hydrocarbons in dilute benzene solution were applied to the skin of mice the 5-*n*-butyl compound has given three malignant tumours after 347 days, the 5-*n*-amyl compound has given two malignant tumours after 294 days, whereas the 5-*n*-hexyl and the 5-*n*-heptyl compound have not yet given malignant tumours after 262 and 294 days, respectively.

In the case of the hexyl and the heptyl compound dehydrogenation of the dihydroderivatives gave by-products in addition to the alkylbenzanthracenes. The pure *by-product* was isolated from the heptyl compound (I). Its high carbon content showed that the intact side chain was no longer present and a possible formulation is (II). This structure accords with the analytical values for carbon and hydrogen and, as it is a benzanthrene type of structure, it would account for the relative instability of the compound, which became discoloured on heating to 80° or on keeping for some weeks. The ultra-

violet absorption spectrum, examined by Dr. E. Roe, showed that the compound was not a simple derivative of 1 : 2-benzanthracene or of chrysene.



EXPERIMENTAL.

Grignard Condensations.—Finely powdered 5-keto-5 : 6 : 7 : 8-tetrahydro-1 : 2-benzanthracene (Haworth and Mavin, J., 1933, 1012) (0.1 g.-mol.) was added to an ice-cold Grignard solution prepared from the appropriate alkyl bromide (0.11 g.-mol.) in ether (100 c.c.) and benzene (165 c.c.). The suspension was kept at room temperature for 18 hours and then decomposed with ice and ammonium chloride.

5-Alkyl-7 : 8-dihydro-1 : 2-benzanthracenes.—The crude tertiary carbinol was obtained by evaporation of the benzene-ether solution and was dehydrated by an hour's boiling with picric acid (25 g.) in alcohol (165 c.c.). The picrate of the hydrocarbon separated on cooling; it was freed from picric acid, and the hydrocarbon purified by distillation at 0.2—0.4 mm., followed by crystallisations from methyl or ethyl alcohol.

5-Alkyl-1 : 2-benzanthracenes.—Dehydrogenation of the dihydro-compound was effected by heating with platinum-black at 300—310° for 24 hours, the product being purified through its picrate, distilled in a vacuum, and then recrystallised from alcohol.

The following table gives the m. p.'s and analytical figures of the individual compounds :

Derivative of 1 : 2-benzanthracene.	M. p.	Hydrocarbon.				Picrate.				
		Found.		Theo.		Found.		Theo.		
		C, %.	H, %.	C, %.	H, %.	M. p.	C, %.	H, %.	C, %.	H, %.
5-Ethyl-7 : 8-dihydro-, C ₂₀ H ₁₈	109—110°	92.7	7.2	93.0	7.0	159—160°	64.0	4.6	64.0	4.3
5-n-Butyl-7 : 8-dihydro-, C ₂₂ H ₂₂	69—70	92.2	7.65	92.3	7.7	124—125	65.3	4.9	65.2	5.0
5-n-Butyl-, C ₂₂ H ₂₀	81	92.6	7.3	92.9	7.1	116—117	65.6	4.5	65.5	4.5
5-n-Amyl-7 : 8-dihydro-, C ₂₃ H ₂₄	59—60	92.0	8.0	92.0	8.0	90—91	65.3	4.9	65.7	5.1
5-n-Amyl-, C ₂₃ H ₂₂	93	92.6	7.6	92.55	7.45	85—86	66.4	5.4	66.0	4.8 *
5-n-Hexyl-7 : 8-dihydro-, C ₂₄ H ₂₆	47—48	91.4	8.5	91.7	8.3	86—87	66.3	5.6	66.3	5.3
5-n-Hexyl-, C ₂₄ H ₂₄	72—73	92.3	7.6	92.25	7.75	90—91	66.9	5.15	66.5	5.0 *
5-n-Heptyl-7 : 8-dihydro-, C ₂₅ H ₂₈	53—54	91.2	8.4	91.4	8.6	80	75.8	6.6	75.9	6.7
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5-n-Heptyl-, C ₂₅ H ₂₆	68	91.9	8.0	92.0	8.0	82—83	67.0	5.4	66.9	5.3

* Characterisation in these two cases was better made by the *s*-trinitrobenzene complexes, which gave more satisfactory analyses than the picrate. The trinitrobenzene complex of 5-n-amyl-1 : 2-benzanthracene crystallised in orange-yellow needles (from alcohol), m. p. 112—113° (Found : C, 68.2; H, 4.9. C₂₃H₂₂C₆H₃O₆N₃ requires C, 68.1; H, 4.9%). The trinitrobenzene complex of 5-n-hexyl-1 : 2-benzanthracene formed vermilion prisms (from alcohol), m. p. 116—117° (Found : C, 68.7; H, 5.2. C₂₄H₂₄C₆H₃O₆N₃ requires C, 68.5; H, 5.2%).

Hydrocarbon obtained as a By-product in the Dehydrogenation of 5-n-Heptyl-7 : 8-dihydro-1 : 2-benzanthracene (I).—The crude dehydrogenation product gave a small amount of material which was considerably less soluble in alcohol than the main fraction. This material, m. p. 115—116°, was treated in alcoholic solution with *s*-trinitrobenzene, and gave a complex which, after recrystallisation from benzene, formed orange needles, m. p. 159—160°. The trinitrobenzene was removed from this by reduction with stannous chloride in aqueous alcoholic solution, and the regenerated hydrocarbon was sublimed in a high vacuum and recrystallised from alcohol. This hydrocarbon (possibly II) formed colourless leaflets, m. p. 116.5—117.5° (Found : C, 94.0; H, 5.8. C₂₅H₁₈ requires C, 94.3; H, 5.7%). It dissolved in concentrated sulphuric acid with a reddish-brown coloration.

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