The composition of cashew nut-shell liquid (CNSL) and the detection of a novel phenolic ingredient

No comprehensive chromatographic examination of cashew nut-shell liquid (*Anacardium occidentale* L.) has been reported although this material has considerable industrial importance at the present time mainly as a source of cardanol by decarboxylation. Quantitative investigation by thin-layer chromatography of CNSL extracted at low temperature to avoid decarboxylation has now shown that it is a more complex mixture than previously supposed and that formerly the percentage of anacardic acid has been overestimated.

Preliminary examination on Silica Gel G with light petroleum–diethyl ether–formic acid (70:30:1, by vol.) indicated cardol (R_F 0.20), a novel phenol (R_F 0.36), cardanol (R_F 0.58), not previously reported as a natural constituent, anacardic acid (R_F 0.76) and two less polar substances (R_F 0.82 and 0.92).

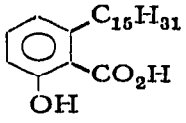
Column chromatography and preparative TLC were together useful for obtaining relatively large amounts of the individual components, but quantitative analysis of CNSL was best accomplished by preparative TLC alone. After extensive investigation, the phenolic components were separated through a multiple development procedure with light petroleum–diethyl ether–ammonia followed by ether–ammonia and isolated after visualisation with Rhodamine 6 G. The eluted ingredients were examined spectrophotometrically in the region 280–310 mμ and their intensities of absorption compared with those of the pure phenolic reference compounds. The composition of CNSL thus found was anacardic acid (71.7%), cardol (18.7%), cardanol (4.7%), novel phenol (2.7%) and two unknown minor ingredients (2.2% difference). Additionally, each of the phenolic constituents was demonstrated by argentation–TLC[1] (Fig. 1) to contain the saturated (trace only), monoene, diene and triene components in agreement with previous findings[2,3], the average composition being that of the diene. In the absence of silver nitrate the components of each phenol behave chromatographically on Silica Gel G as a homogeneous material.

Identification of the major phenolic compounds followed from correlation of their chromatographic behaviour with previous structural assignments by BACKER AND HAACK[4]. In the present work hydrogenation (Pd/C) of anacardic acid gave 2-carboxy-3-pentadecylphenol (I), cardol gave 5-pentadecylresorcinol (II) and cardanol gave 3-pentadecylphenol (III) having in each case the correct m.p. and elementary analysis.

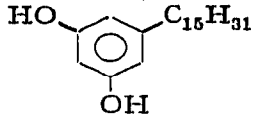
The novel phenol was hydrogenated to a product crystallising from light petroleum as prisms m.p. 94–96°. Found: C 77.54 %, H 11.26 %; required for $C_{12}H_{35}O_2$: C 78.75 %, H 11.25 %; and for $C_{19}H_{32}O_2$: C 78.00 %, H 11.0 %.

The likely presence of an *o*-dihydric system in the novel phenol has been indicated by chemical, chromatographic, U.V. and I.R. spectroscopic evidence.

Its properties are distinct from those of phenols already described such as urushiol[5], glutarhengol[4,6] the long chain quinols[7] and the wheat bran phenols[8]. The



(I)



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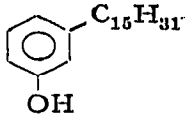

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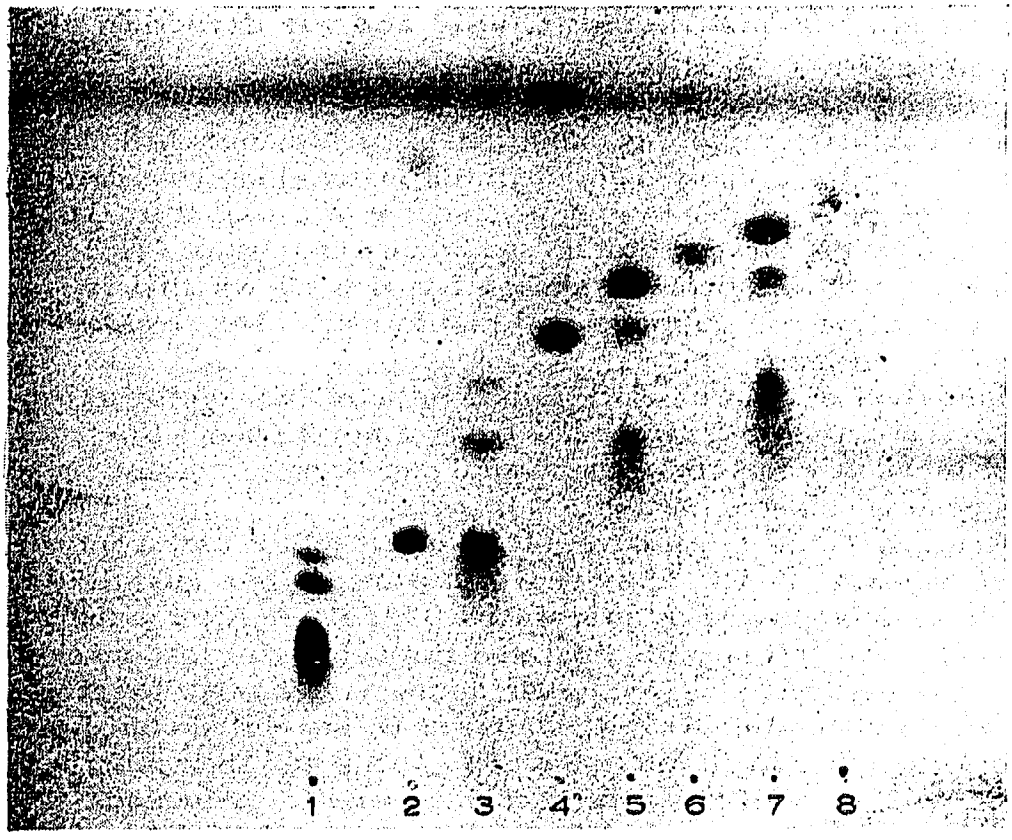

Fig. 1. Thin-layer chromatogram of CNSL phenols, before and after hydrogenation, on Silica Gel G impregnated (10% w/w) with silver nitrate. The developing solvent was diethyl ether—light petroleum—formic acid (30:70:1) and the spots were located by spraying with 50% H_2SO_4 and charring. Samples 1, 3, 5 and 7 were respectively cardol, novel phenol, cardanol and anacardic acid, each showing (from the bottom) triene, diene and monoene constituents and 5 and 7 showing trace amounts of the saturated compound. Samples 2, 4, 6 and 8 were, respectively, portions of the same samples after hydrogenation.

existence of the novel phenol is of some significance biochemically and with regard to its possible role in the physiological action of CNSL.

A full structural determination will be described subsequently when this work, which has had to be curtailed, is completed.

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Received August 18th, 1966

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