crystalline. The clear end was cut off and dissolved in demineralized water and the metal then recovered by electrodeposition. More than 80 per cent of the metal could be recovered in this way. Spectrographic analysis of this material showed no trace of impurities, the approximate limit of detection, as determined by control experiments, being 1 in 10^6 . That the electrodeposition by itself was not effective in the purification had been shown by earlier experiments.

The spectrographic work was carried out by N. Rain, of this Laboratory. Acknowledgment is made to the Admiralty for permission to publish this communication.

J. L. RICHARDS Services Electronics Research Laboratory, Baldock, Herts. Nov. 17

¹ Pfann, W. G., J. Metals, 747 (July 1952).

The Lupulone and isoHumulone Complex

At about the same time that we announced the existence of prehumulone¹, the presence of a fourth lupulone in hops was suggested by Howard, Pollock and Tatchell². The present communication gives chromatographic proof of the existence of such a substance, which we propose to call 'prelupulone'. This chromatographic separation of the lupulone fraction of hops into its four components has been achieved by the technique described by us for the chromatography of the 'humulone complex'¹. This is shown in the elution pattern of Fig. 1, which was obtained on a silica gel column, $1 \cdot 3$ cm. $\times 123$ cm., buffered at pH 10.55 and containing 25 per cent methanol. The four bands were named in accordance with present knowledge of humulone chemistry^{1,3}.

When the 'lupulone complex' is recrystallized, the percentage of colupulone in the crystals thus obtained (still a mixture of several lupulones) is higher than in the starting material. This is probably due to the lower solubility of colupulone. It is therefore possible by repeated crystallizations (about five times from light petroleum and five times from methanol-water) to obtain pure colupulone with a melting point of $94^{\circ}-96^{\circ 2}$. Chromatography of this product on the column mentioned above yields a single band, corresponding exactly with the colupulone band of Fig. 1.



Fig. 1. Chromatography of the 'lupulone complex'. Volume of each fraction 4.5 ml. E(1%, 1 cm.) lupulone in iso-octane = 159 $(\lambda = 275 \text{ m}\mu)$



Fig. 2. Chromatography of the 'isohumulone complex'. Volume of each fraction 6 ml. E(1%, 1 cm.) isohumulone in iso-octane = 275 (λ = 275 m μ)

The presence of an *iso*prehumulone in a beer extract can also be shown by chromatography. This separation is not as successful as for the humulone and lupulone complex, owing to extensive overlapping of the bands. An example of such a separation on a silica gel column $1.3 \text{ cm.} \times 85 \text{ cm.}$, buffered at pH 5.22 and containing 25 per cent methanol, is shown in Fig. 2.

The beer isohumulone mixture for chromatographic analysis is obtained by extracting acidified (N sulphuric acid) beer with 2.5 times its volume of *iso*-octane. When this volume ratio is used, practically no emulsion is formed and centrifuging can be avoided. The *iso*-octane is evaporated under reduced pressure before chromatography.

M. VERZELE

(Associate of the F.N.R.S.)

Laboratory for Organic Chemistry,

University of Ghent.

Sept. 26.

¹ Verzele, M., Bull. Soc. Chim. Belg., No. 64, 70 (1955).

² Howard, G. A., Pollock, J. R. A., and Tatchell, A. R., J. Chem. Soc., 174 (1955).

^{*} Rigby, F. L., and Bethune, J. L., J. Amer. Chem. Soc., 74, 6118 (1952).

Adsorption of Trace Amounts of Cations on Anion Exchange Resins by the Formation of Insoluble Salts

It has been shown¹ that cations may be precipitated around the beads of an anion exchange resin in a column, when passed in aqueous solution through the resin, which is in a form providing a suitable anion. For example, when a cobalt solution is used with a resin in the sulphide form, cobalt sulphide is formed around the beads of resin. The nature of these precipitates suggested that fairly high concentrations of precipitating anion were present in the region of the surface of the resin particles. It seemed likely that the anion concentration

It seemed likely that the anion concentration within a bead of resin might be extremely high and that a very small amount of a cation in aqueous solution, diffusing into the resin, might be precipitated in the resin itself. This hypothesis was tested by passing carrier-free radioactive isotopes down columns of anion resin in suitable forms. The behaviour of these tracers was related to the solubility of the compounds concerned and to the formation of soluble complex ions.

A column, $4\overline{0}$ cm. long and 0.3 cm. in diameter, was packed with 'Amberlite *IRA* 400' anion resin (60-85 B.S. mesh-size). The amount of resin used was calculated to have a five-fold excess of capacity