good yields as colorless crystals, possessing sharp melting points after recrystallization from light petroleum.

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COMMUNICATIONS TO THE EDITOR

CARROT LEAF CAROTENE

Sir:

We have isolated carotene from carrot leaves to determine whether it contains the components of carrot root carotene, or whether, like the majority of leaf carotenes reported, it is optically inactive. Only two optically active leaf carotenes, tea[1] and horse chestnut,[2] have been reported. The method of extraction described by Smith[3] was followed with minor modifications. We obtained 0.370 g. of recrystallized carotene from 6 kg. of leaf powder.

Specific optical rotations and melting points were determined on two samples, one recrystallized from petroleum ether–ethanol, the other from *n*-heptane.

Sample	M. p., °C. (Berl block, corr.)	$[\alpha]^{22}_{6678}$
Pet. ether–ethanol	175.7	+33.6° (36.6 mg. in 15 cc. benzene)
n-Heptane	176.8	+37.3° (33.0 mg. in 15 cc. benzene)

The specific rotation indicates approximately 10% of α-carotene.

The absorption spectrum in 95% ethanol was observed visually. Absorption maxima were found at 4533 Å. and approximately 4780 Å., nearly the positions of the maxima of β-carotene.

Adsorption on a column of Norit A (Pfanstiehl) from dichloromethane solution (method developed and shortly to be described by H. H. Strain) gave excellent resolution of the components. The first few drops of colored percolate, transferred to 95% ethanol, gave very sharp bands, with maxima at 4470 and 4738 Å., confirming the presence of α-carotene.

Adsorption on fibrous alumina from benzene and low boiling petroleum ether (50% by volume) showed the presence of a colored ring in the position to be expected for γ-carotene.[4] This ring was extracted and re-adsorbed from fresh solvent on a new column. When re-extracted, the solution was too dilute for satisfactory spectroscopic identification. How-

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(1) I. P. C. R. (Tokyo), **19**, 127 (1932).
(2) *Ber.*, **64**, 1349 (1931).
(3) J. H. C. Smith, *J. Biol. Chem.*, **96**, 35 (1932).
(4) *Ber.*, **66**, 407 (1933).

ever, the behavior of the ring is an indication of the presence of the γ-component.

It is concluded that carrot leaf carotene resembles carrot root carotene in its composition rather than the optically inactive carotenes hitherto found in most leaves.

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THE EFFECT OF THE SOLVENT ON THE POTENTIAL OF THE CHLORANIL ELECTRODE

Sir:

Since the original study of the chloranil electrode by Conant and Fieser,[1] it has been generally assumed both at Harvard and elsewhere[2] that "the potential of the saturated chloranil electrode against the hydrogen electrode is independent of the solvent (and has the value +0.664 volt at 25°")."[3]

This assumption is, of course, well founded provided the solution studied is really in equilibrium with the unsolvated solid chloranil and its hydroquinone. Since this electrode has been chiefly used in glacial acetic acid, the following observations seem important.

In the course of certain measurements in this solvent (to be published later) it appeared that if the value +0.664 volt was accepted for the chloranil electrode, all the potentials measured differed from those obtained in the same system when a hydrogen electrode was used. The discrepancy disappeared if the value +0.680 volt was assigned to the chloranil electrode. We therefore measured directly the effect of the solvent on the potential of cells without liquid junction and containing a hydrogen and a chloranil electrode, with the result that Conant and Fieser's value of +0.664 volt was confirmed in 50% aqueous alcohol, while in glacial acetic acid and in 50% aqueous dioxane the values +0.680 volt and +0.715 volt were obtained.

These differences are due to the fact—previously overlooked—that tetrachlorohydroquinone is solvated in certain solvents, as has indeed long been known.[4] The solid phase in equilibrium with the saturated solution in glacial acetic acid is principally $C_6Cl_4(OH)_2{\cdot}2AcOH$, while in contact with dioxane solutions the solid phase is $C_6Cl_4(OH)_2{\cdot}C_4H_8O_2$. From the observed differences of potential the free energies of solvation

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[1] Conant, Small and Taylor, THIS JOURNAL, **47**, 1959 (1925); Hall and Conant, *ibid.*, **49**, 3047 (1927); Conant and Chow, *ibid.*, **55**, 3745 (1933).

[2] Hall, *ibid.*, **52**, 5115 (1930).

[3] Conant and Chow, *loc. cit.*, p. 3748.

[4] See. *e. g.*, König, *J. prakt. Chem.*, [2] **70**, 33 (1904).