Short Communications and Preliminary Notes

PRELIMINARY NOTE ON EXPERIMENTS CONCERNING THE STATE OF CHLOROPHYLL IN THE PLANT

by

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Three characteristics of chlorophyll as occurring *in vivo, viz.* the location of the absorption maxima, the fluorescence and the photochemical activity, are known to differ from those of this pigment *in vitro*. A study was made to investigate the factors which are responsible for the state of chlorophyll in the plant. This problem has been approached in three ways:

a. by studying the fluorescence capacity of chlorophyll in a monolayer,

b. by examining the factors influencing the location of the red absorption band,

c. by determining the properties of "synthetic" chlorophyll-complexes.

The following results have been obtained:

a. The experiments concerning the spreading of chlorophyll on water showed that this pigment does not, or at least not perceptibly, fluoresce when arranged in a monolayer. Consequently the fluorescence of green cells cannot be ascribed to the possible occurrence of chlorophyll in monolayers.

b. Comparison of the absorption spectra of chlorophyll in three groups of "solvents" (alcohols, other organic solvents and water) showed that the location of the red absorption band *in vivo* may not be ascribed to a high refraction index of some constituent of the chloroplast. In each group of these "solvents" KUNDTS' rule[1] appeared to hold.

Mixing "solvents" of two groups in different ratios caused no gradual shift of the red absorption band. Instead of this, in a small range of mixing ratios, a new absorption peak arose while the original one weakened. This phenomenon may be explained by assuming that chlorophyll occurs in different states in the three groups of "solvents". In this respect association of the chlorophyll molecules, combination of the pigment with solvent molecules, or mesomery phenomena may play a part.

With the aid of DEBYE's "molecular weight" determination method by scattering[2] it was shown that in dilute solutions association of chlorophyll molecules did not occur in acetone, nor in ethanol. Combination with solvent molecules may occur. However, in concentrated solutions in acetone association takes place; probably three pigment molecules combine with each other. This phenomenon, however, does not influence the location of the absorption peaks.

With ethanol the results are influenced by the probable formation of ethyl chlorophyllid at high pigment concentrations. The experiments suggest that in this case also association occurs.

The conclusion seems warranted that association of a few chlorophyll molecules does not affect the absorption spectrum. So it seems rather improbable that the location of the red absorption peak of chlorophyll *in vivo* can be explained in terms of association phenomena.

c. Various chlorophyll complexes have been prepared. One of these, a complex of chlorophyll with proteins of white leaves of *Pelargonium zonale* hybrid "Madame Salaray" showed the following properties in common with chloroplast suspensions: fluorescence, location of the red absorption band at 6800 A, and a photochemical activity, which might be identical with the HILL-reaction[3] in which quinone[4] was used as a reagent.

The above results make it highly probable that the location of the red absorption band of chlorophyll adsorbent complexes depends on the nature of the adsorbent. *In vivo* chlorophyll may be adsorbed in a three molecular associated state. However, the position of the red absorption band can not be explained in terms of this phenomenon.

A full account of this study will be published elsewhere.

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Received December 24th, 1952

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* This investigation has been made possible by a grant of the Netherlands Organisation for Pure Research (Z.W.O.).