Aggregation of Metallochiorophylls: Examination by Spectroscopy

Is coordination aggregation a unique property of magnesium-containing chlorophylls, or do other metallochiorophylls behave similarly? The aggregation properties of metallochiorophylls had not been studied in detail before recent presentation (1) of new information, derived from infrared and nuclear magnetic resonance (NMR) measurements, on the aggregation behavior of divalent nickel, copper, and zinc chlorophylls.

Metal ions play a decisive, but still little understood, role in the photosynthetic unit. Chlorophyll, the most important compound of photosynthesis, is a magnesium (II) complex of dihdropporphyrrin (chlorin) liquid. Examination of chlorophyll derivatives in which magnesium is replaced by other metal ions (metallochiorophylls) is valuable in providing information about the contribution by the metal to the various properties and functions of chlorophyll. The state of aggregation of chlorophyll is a property requiring special attention.

The tendency to self-aggregation of divalent nickel, copper, and zinc methyl pheophorbides a and b was examined by infrared spectroscopy (1). Of these, only the zinc compounds showed significant coordination aggregation. Measurements by NMR on zinc pheophytin a and zinc methyl pheophorbide a and b show that both coordination aggregation and aggregation occur in nonpolar solvents. However, NMR and infrared measurements indicate that under comparable conditions in nonpolar solvents the zinc chlorophylls are aggregated to a considerably lesser extent than are magnesium chlorophylls.

Visible and infrared spectra of nickel, copper, and zinc methyl pheophorbides a and b are reported (1) and tentative band assignments are made. Considerations of absorption position and relative intensities suggest that the extent of metal-ligand interaction follows the order Ni>Cu>Zn>Mg. The materials used (1) were chromatographically pure, and their visible, ultraviolet, infrared, and NMR spectra are entirely compatible with their presumed molecular structures.

Reference:

Notes:
1. This information may be useful to horticulturists and canners of green vegetables.
2. Inquiries may be directed to:
   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
Reference: B69-10163

Source: L. J. Boucher and J. J. Katz
Chemistry Division
Argonne National Laboratory
(ARG-10273)

Patent status:
Inquiries concerning rights for commercial use of this innovation may be made to:
Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439

Category 04