無機固体の親水性表面への吸着によるクロロフィルの安定性向上

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Stabilization of chlorophyll by the adsorption on the hydrophilic surface of inorganic solids

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Naturally occurring chlorophyll (Chl) dye is highly safe but not so stable. In this study, Chl was attempted to be stabilized by the adsorption on several inorganic solids. Silica (S) and synthetic non-swelling Mica (M) were used as inorganic solids. M was made hydrophobic by filtration and drying after stirring in water with a cationic surfactant $(CH_3)_3(C_{12}H_{25})N^+$. Hereafter, the hydrophobic M is denoted as C12M. The composite was obtained by mixing a methanolic solution of Chl with each inorganic host in a screw tube bottle, followed by drying up in the air. Photostability of the composites was evaluated from the change in the absorption of Chl in the composite samples during visible light irradiation.

Fig. 1 shows the change in the absorption of each composites during visible irradiation. The decrease in the absorption of Chl on M was smaller than that on C12M, so that the degradation of Chl by visible light was suppressed on M. This is due to the electrostatic interaction between the hydrophilic Chl chromophore and the hydrophilic surface of M. Further stabilization of Chl was obtained by the adsorption on S. We concluded that the effective stability enhancement came from the shielding effect on the Chl in the pore of S from an atmospheric oxygen, as well as from the electrostatic interaction.

Keywords : Chlorophyll; Stabilization; Inorganic Solids; Hydrophilic; Adsorption

天然色素クロロフィル(Chl)は安全性が高い一方で安定性が低いことが問題である。本研究では無機固体への吸着により Chl の安定化を試みた。無機固体としてシリカ(S)と合成粘土である非膨潤性マイカ(M)を用いた。カチオン性界面活性剤である$(CH_3)_3(C_{12}H_{25})N^+$と M を水中で撹拌後，ろ過，乾燥により M の外表面を有機修飾し疎水化した(C12M)。Chl を溶解したメタノール溶液と無機固体(S, M, C12M)をスクリュー管瓶に加え，撹拌後，乾燥させて複合体を得た。複合体に可視光を照射し，Chl の吸光度保持率(A/A_0)から耐光性を評価した。

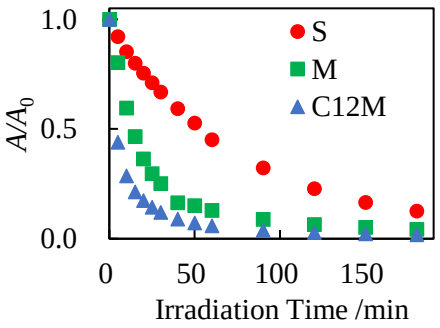

Fig. 1 Changes in the absorption of Chl adsorbed on various inorganic hosts during visible light irradiation.

複合体の吸光度保持率を Fig. 1 に示す。C12M よりも M の方が吸光度の減少が小さく，Chl の可視光による分解が抑制された。これは親水性の Chl 発色団と M の親水性表面との間で静電相互作用が働いたためと考えられる。S に吸着した Chl はさらに高い安定性を示した。静電相互作用に加え，Chl が S の細孔内へ吸着することで，空気中の酸素からの遮蔽効果により高い安定化効果が得られると考えた。

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