SUPPORTING INFORMATION

Enhanced Photostability of Chlorophyll-α using Gold Nanoparticles as Efficient Photoprotector

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Fig. S-1 XPS survey spectra of Chl\textsubscript{a}, Chl\textsubscript{a}-AuNPs, irradiated Chl\textsubscript{a} and irradiated Chl\textsubscript{a}-AuNPs.
High-resolution C1s and N1s XPS spectra for gold nanoparticles (AuNPs) are shown in Fig. S-2 and S-3, respectively. The C1s region of AuNPs comprises three distinct peaks. The peak appearing at 285 eV, is assigned to C-C and C-H from tetraoctylammonium bromide (TOAB), the stabilizing agent used in the preparation of AuNPs. The second peak at 286.07 eV is ascribed to C-N of quaternary amine from TOAB, while a smaller peak at higher binding energy (287.17 eV) is probably due to an impurity.

Fig. S-2 C 1s narrow scan XPS spectra for Chla and Chla-AuNPs.
Fig. S-3 O 1s narrow scan XPS spectra for Chl$\alpha$ and Chl$\alpha$-AuNPs.
**Fig. S-4** C1s narrow scan XPS spectrum for AuNPs.
**Kinetics of Photochemical reaction**

The photodegradation of Chla in presence of O$_2$ can be described by following equation

\[ \text{Chla} + O_2 \xrightarrow{k_v} \text{Chla}(O_2) \]  \hspace{1cm} (1)

The photodegradation rate of Chla was monitored by recording the absorbance at 665 nm as a function of irradiation time, and is:

\[ -\frac{d[\text{Chla}]}{dt} = k[\text{Chla}][O_2] \]  \hspace{1cm} (2)

Where [Chla] denotes the concentration of Chla, [O$_2$] denotes the concentration of O$_2$, $t$ is the reaction time, and $k$ is the rate constant. As the [O$_2$] remains constant as the reaction proceeds, the reaction can be considered pseudo-first-order because it depends on the concentration of [Chla] only.

Thus, eq. (2) can be written as follows:

\[ -\frac{d[\text{Chla}]}{dt} = k'[\text{Chla}] \]  \hspace{1cm} (3)

where \( k' = k[O_2] \)

Solving eq. (3), one obtains eq. (4)

\[ \ln([\text{Chla}]) = -k't + \ln([\text{Chla}]_0) \]  \hspace{1cm} (4)

Where [Chla]$_0$ is the initial concentration of Chla and [Chla], is the concentration of Chla at any time $t$. A plot of $\ln([\text{Chla}])$ vs $t$ should yield a straight line with a slope of $k'$; a typical plot is shown in the inset of Fig. 4.