

**Electronic Supplementary Information:**

**Robust Triplet-Triplet Annihilation Photon  
Upconversion by Efficient Oxygen Scavenging**

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# Contents

1	Sample degradation	S3
2	Nitrogen deoxygenated samples	S14
3	Freeze-pump-thaw samples	S15
4	Lifetime measurements	S17

## List of Figures

Fig. S1 –Abs: 10 mM DMS, high conc. TTA-UC . . . . .	S3
Fig. S2 –Abs: 500 mM BME, high conc. TTA-UC . . . . .	S4
Fig. S3 –Abs: 100 mM BME, high conc. TTA-UC . . . . .	S5
Fig. S4 –Abs: 500 mM DMS, low conc. TTA-UC . . . . .	S6
Fig. S5 –Abs: 500 mM DPropS, low conc. TTA-UC . . . . .	S7
Fig. S6 –Abs: 500 mM DMTM, low conc. TTA-UC . . . . .	S8
Fig. S7 –Abs: 500 mM PDFP, low conc. TTA-UC . . . . .	S9
Fig. S8 –Abs: 500 mM DMDS, low conc. TTA-UC . . . . .	S10
Fig. S9 –Abs: 500 mM ChDS, low conc. TTA-UC . . . . .	S11
Fig. S10 –Abs: 500 mM DPS, low conc. TTA-UC . . . . .	S12
Fig. S11 –Abs: 500 mM DBS, low conc. TTA-UC . . . . .	S13
Fig. S12 –Abs: 500 mM DMTM, 240 min irradiation, low conc. TTA-UC . . . . .	S14
Fig. S13 –Abs: no scavenger, 90 min irradiation, low conc. TTA-UC . . . . .	S15
Fig. S14 –Abs: 500 mM DMTM, 90 min irradiation, low conc. TTA-UC . . . . .	S16
Fig. S15 –PdOEP lifetime with scavenger and without scavenger but FPT-purged . . . . .	S17

# 1 Sample degradation

Below are the absorption spectra of the atmosphere-equilibrated samples before and after 30 min of irradiation at 532 nm in completely filled vials closed with screw cap.

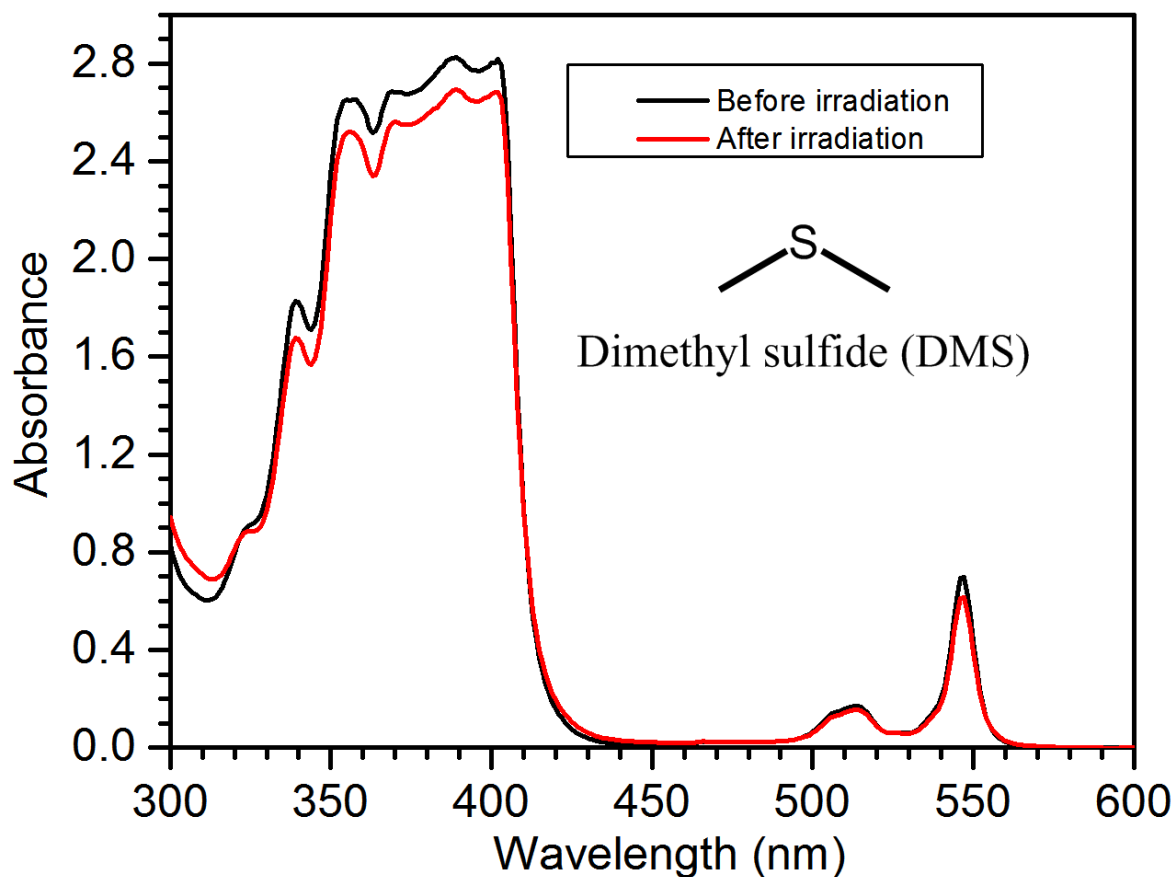


Fig. S1: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 10 mM of DMS as scavenger with high concentration TTA-UC system.

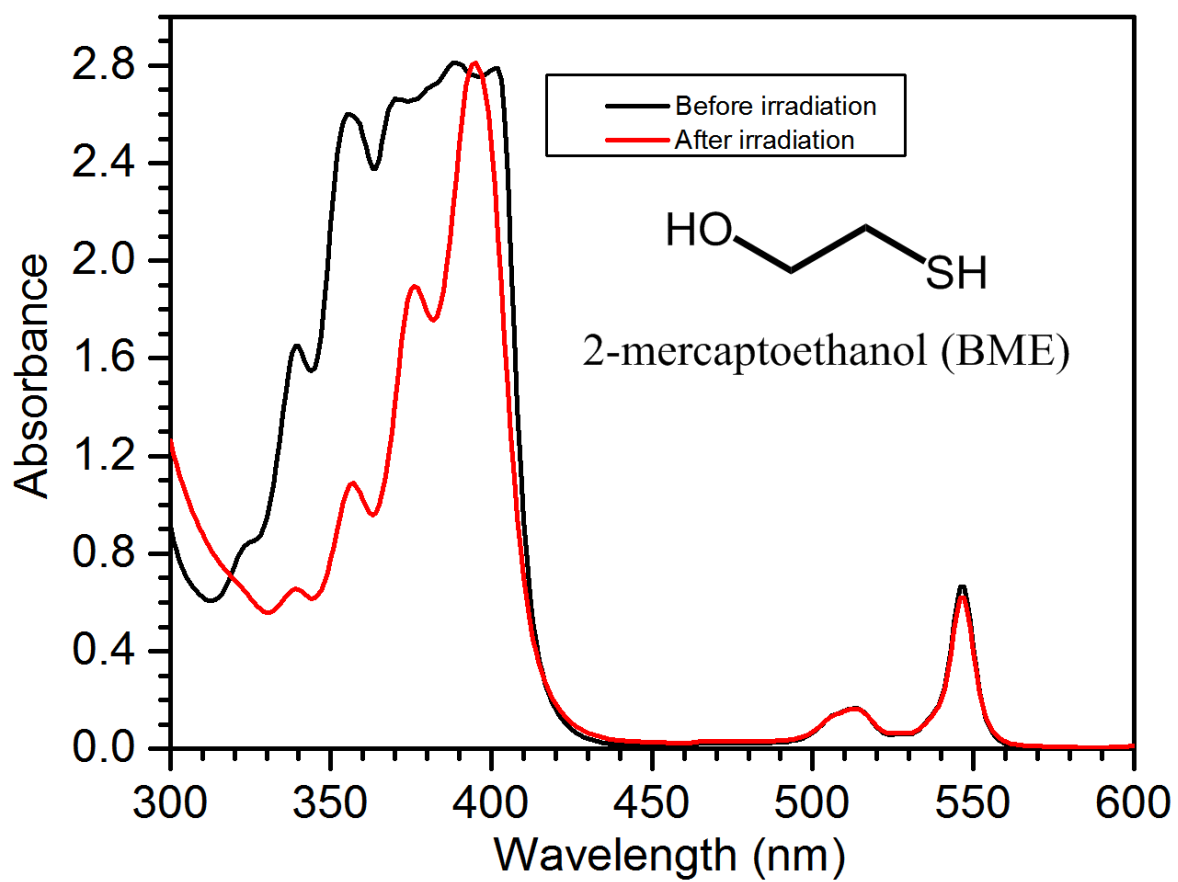


Fig. S2: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of BME as scavenger with high concentration TTA-UC system.

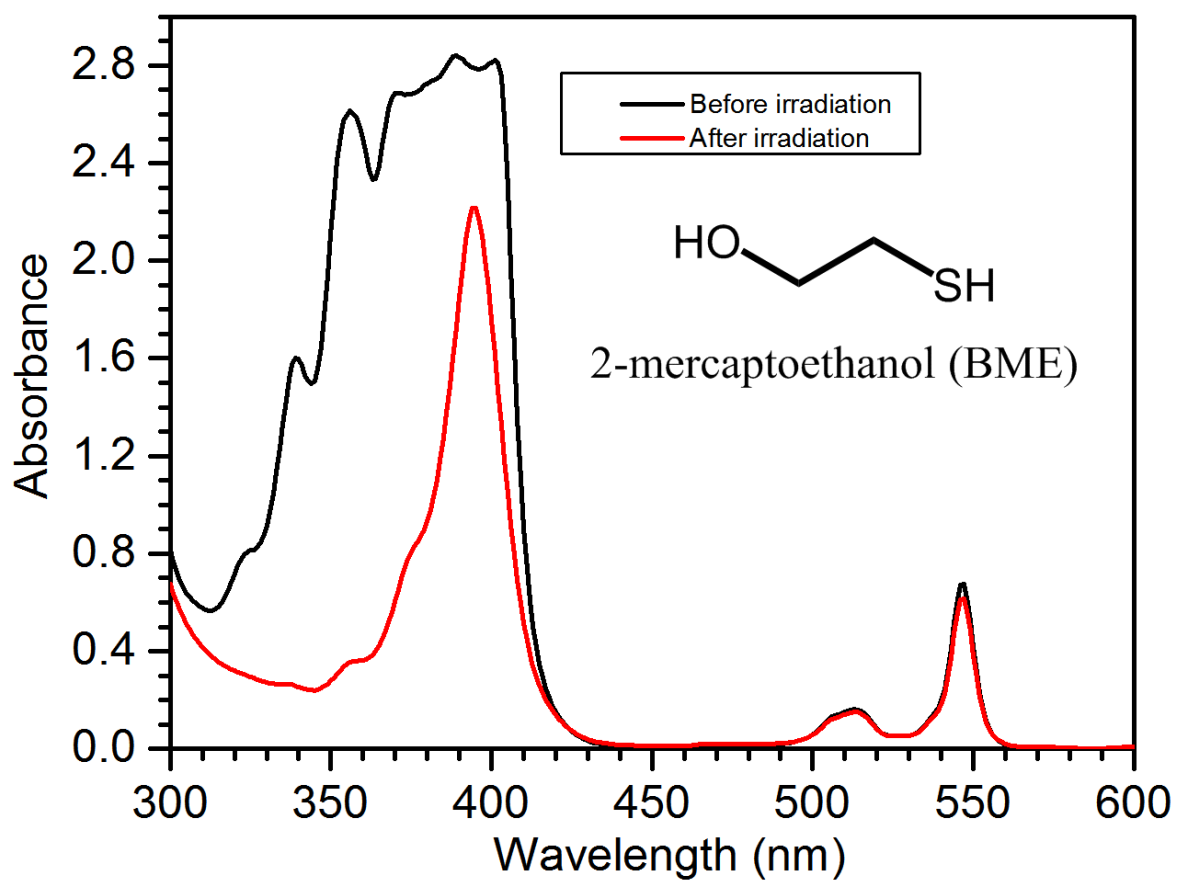


Fig. S3: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 100 mM of BME as scavenger with high concentration TTA-UC system.

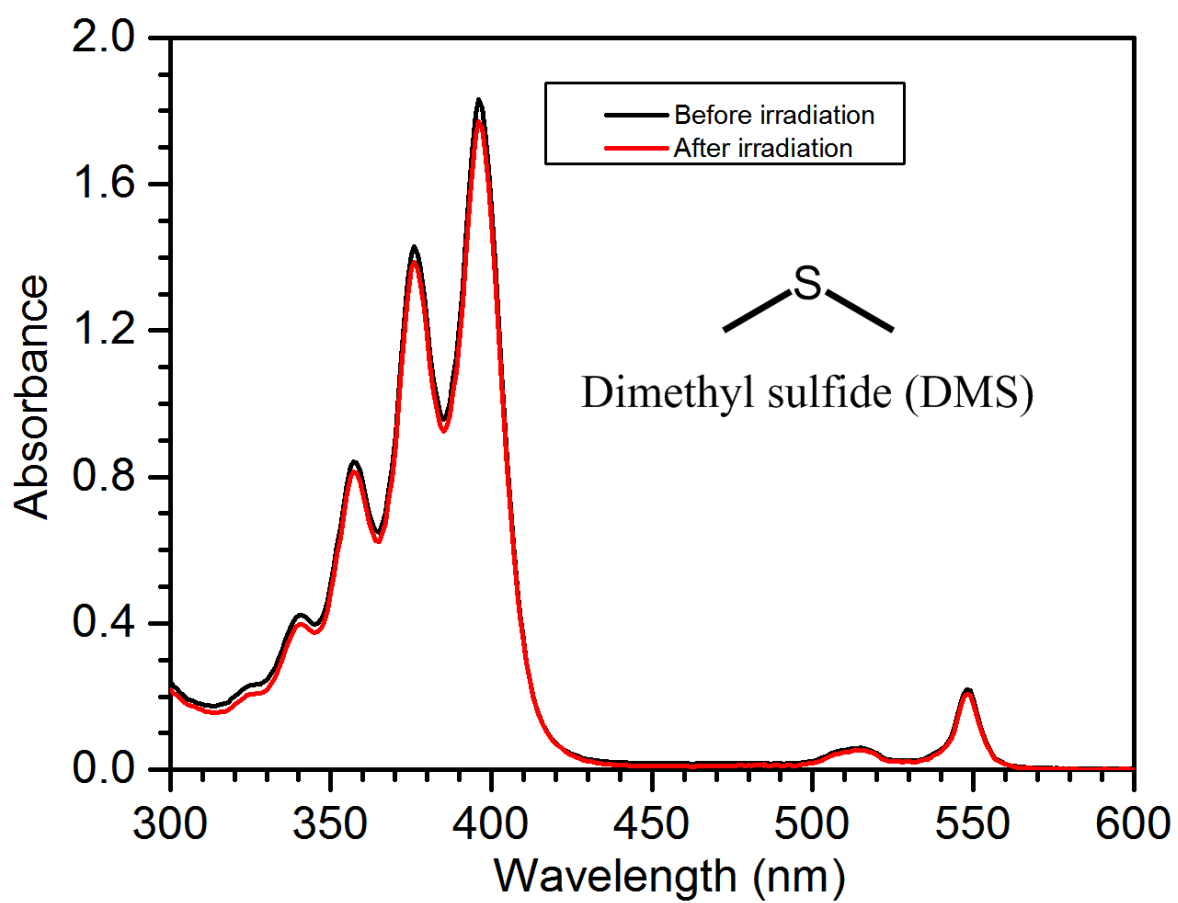


Fig. S4: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DMS as scavenger with low concentration TTA-UC system.

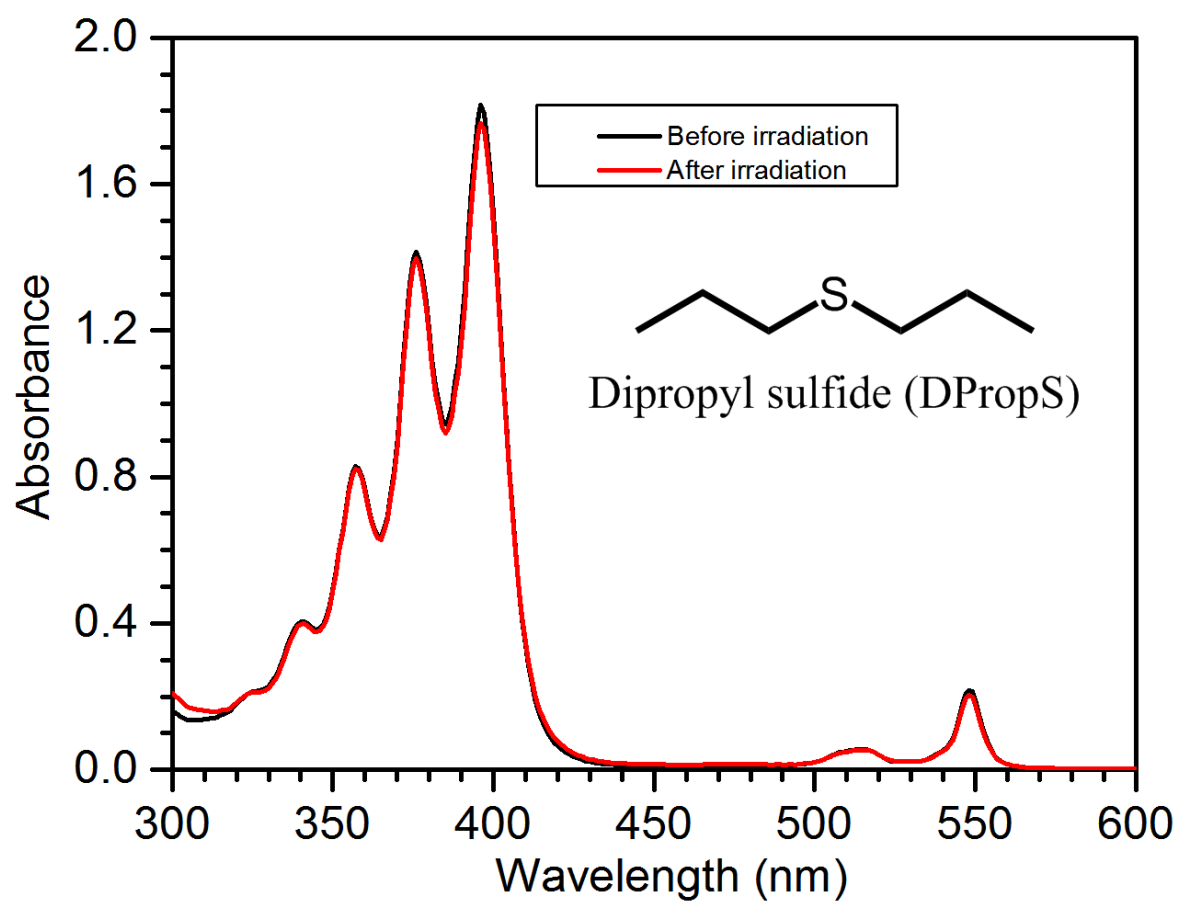


Fig. S5: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DPropS as scavenger with low concentration TTA-UC system.



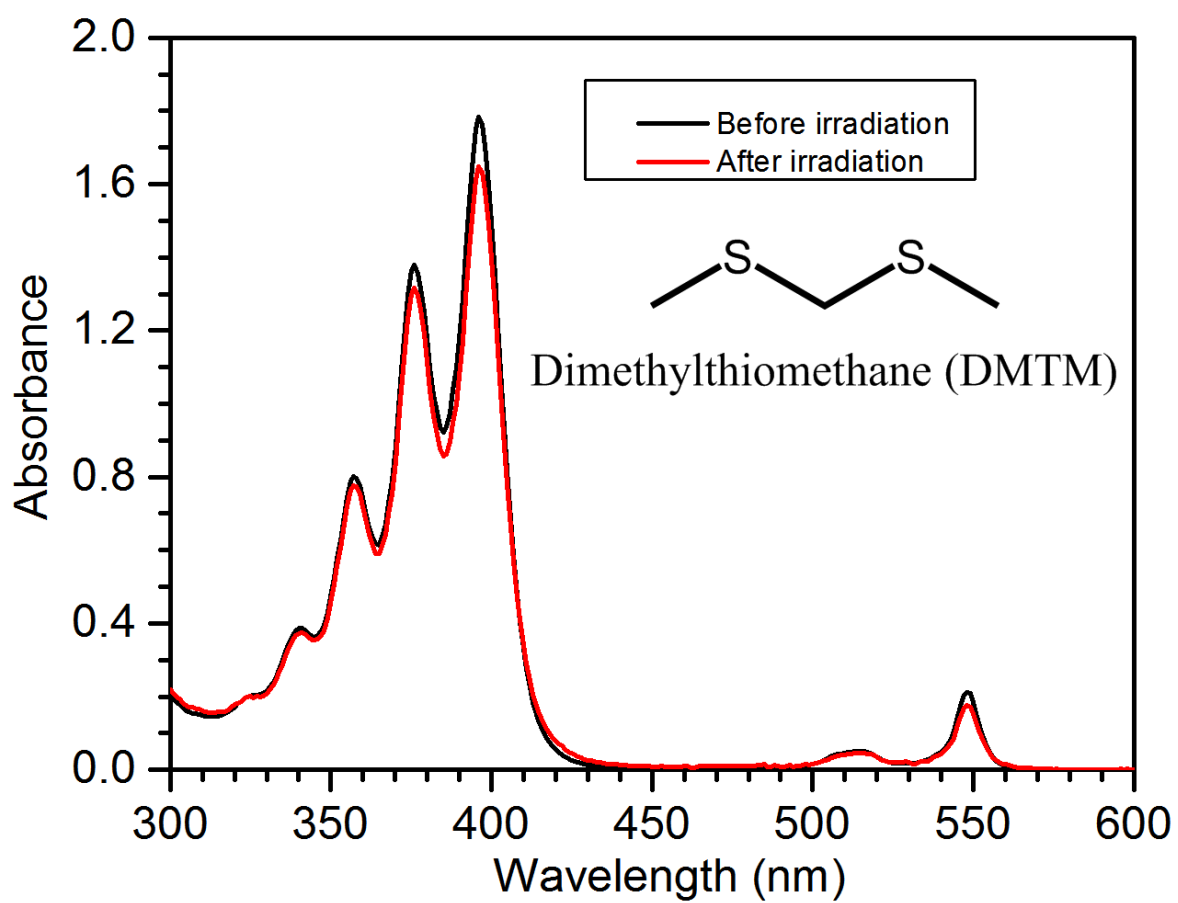


Fig. S6: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DMTM as scavenger with low concentration TTA-UC system.

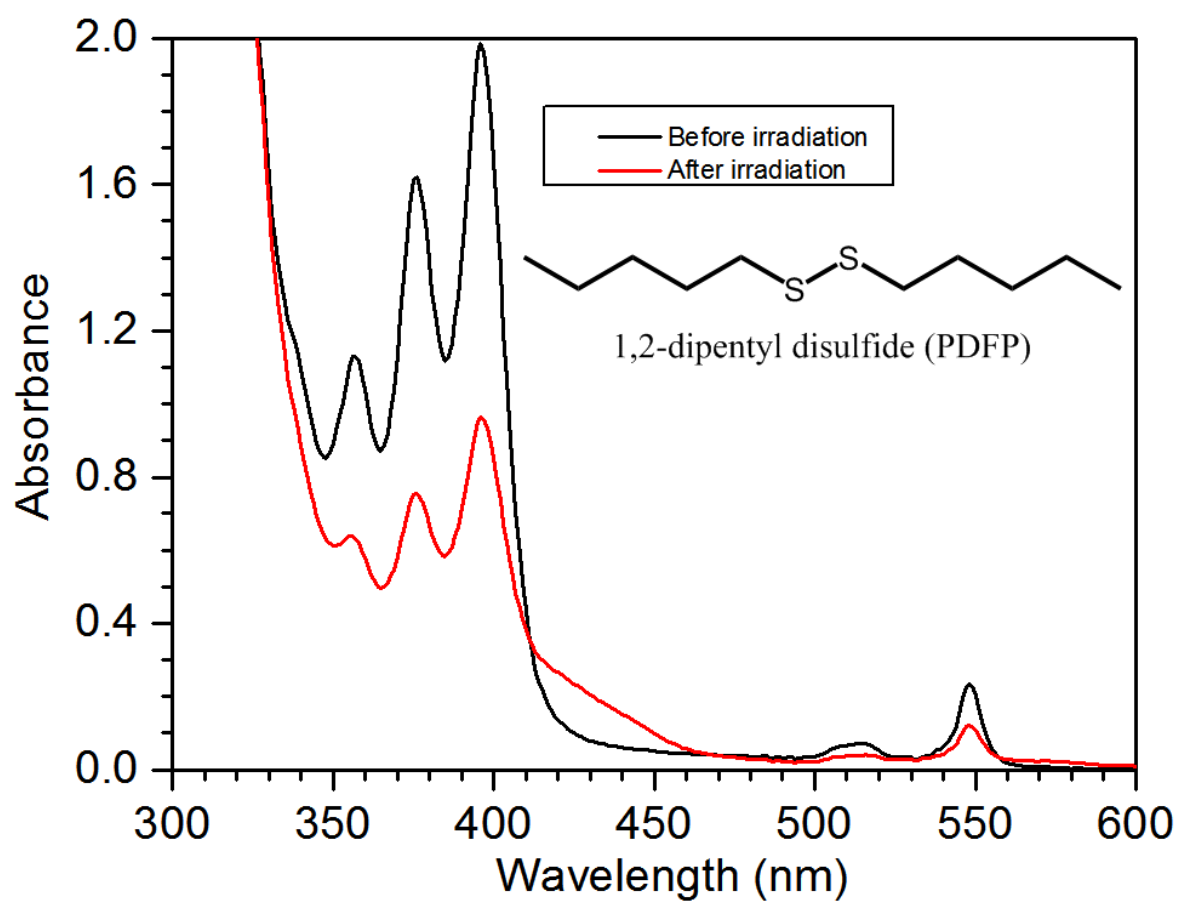


Fig. S7: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of PDFP as scavenger with low concentration TTA-UC system.

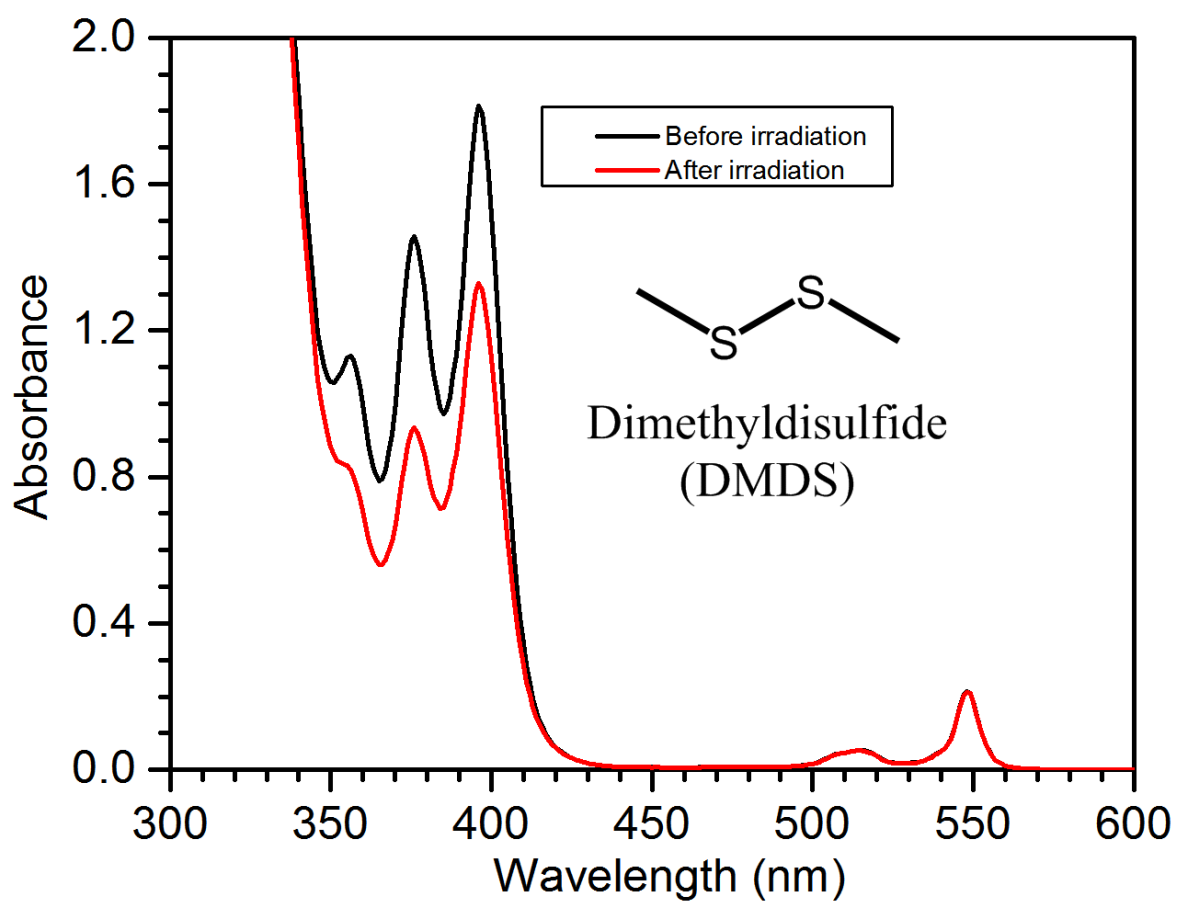


Fig. S8: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DMDS as scavenger with low concentration TTA-UC system.

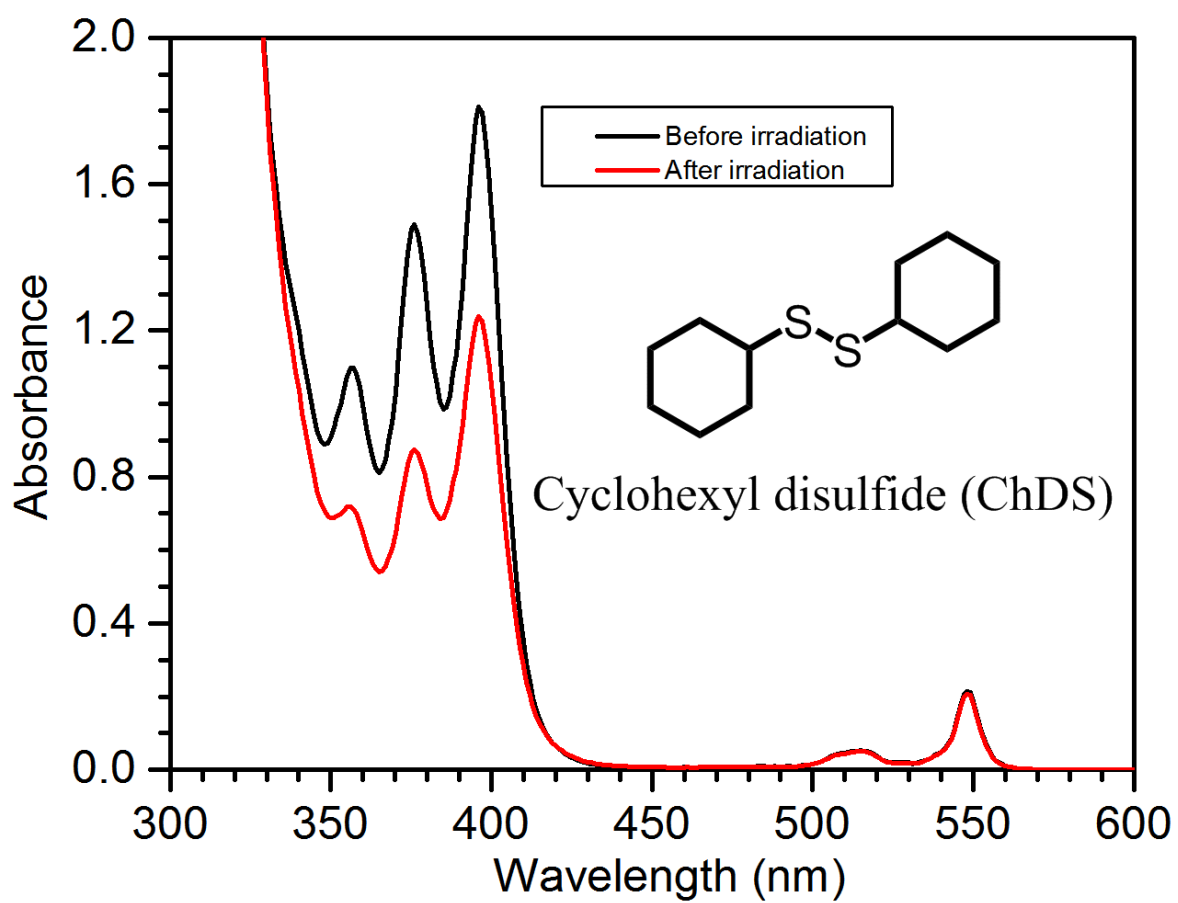


Fig. S9: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of ChDS as scavenger with low concentration TTA-UC system.

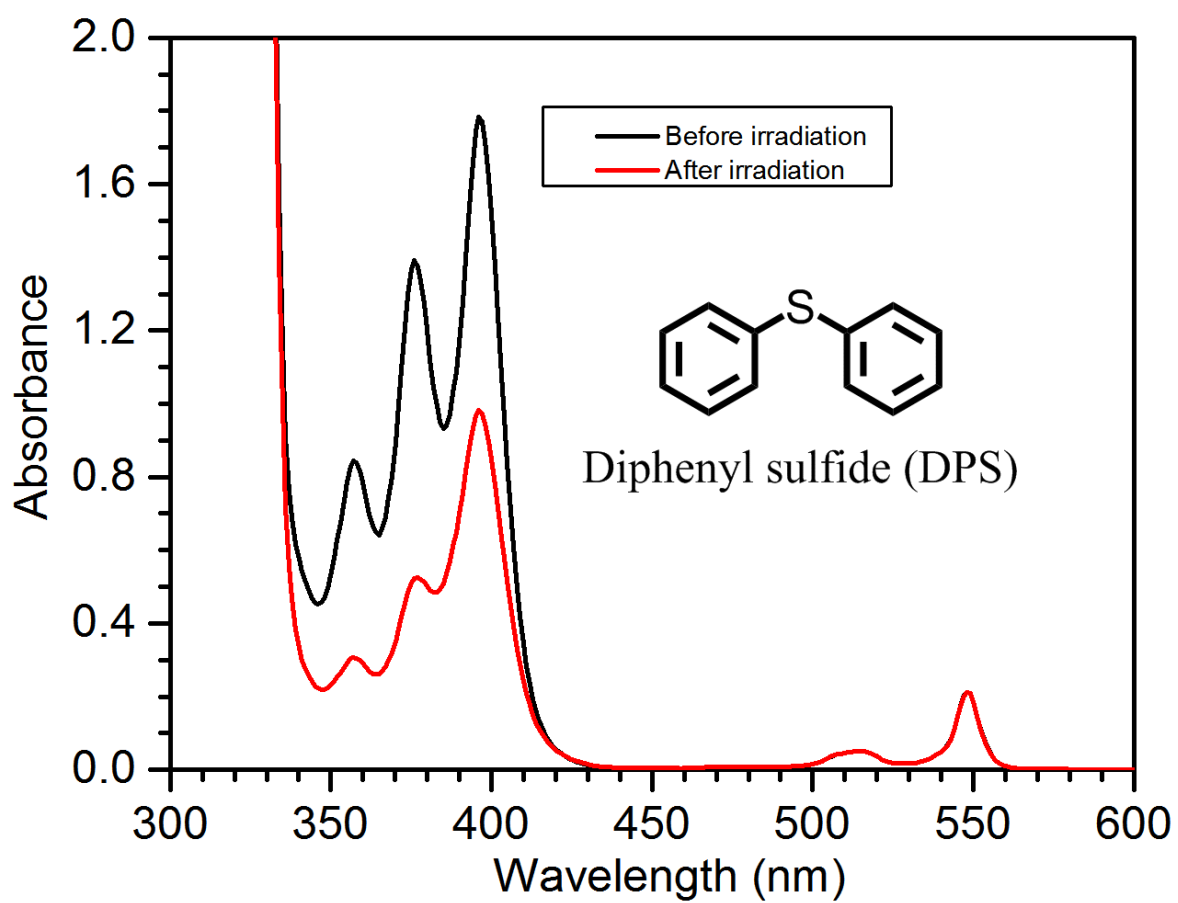


Fig. S10: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DPS as scavenger with low concentration TTA-UC system.

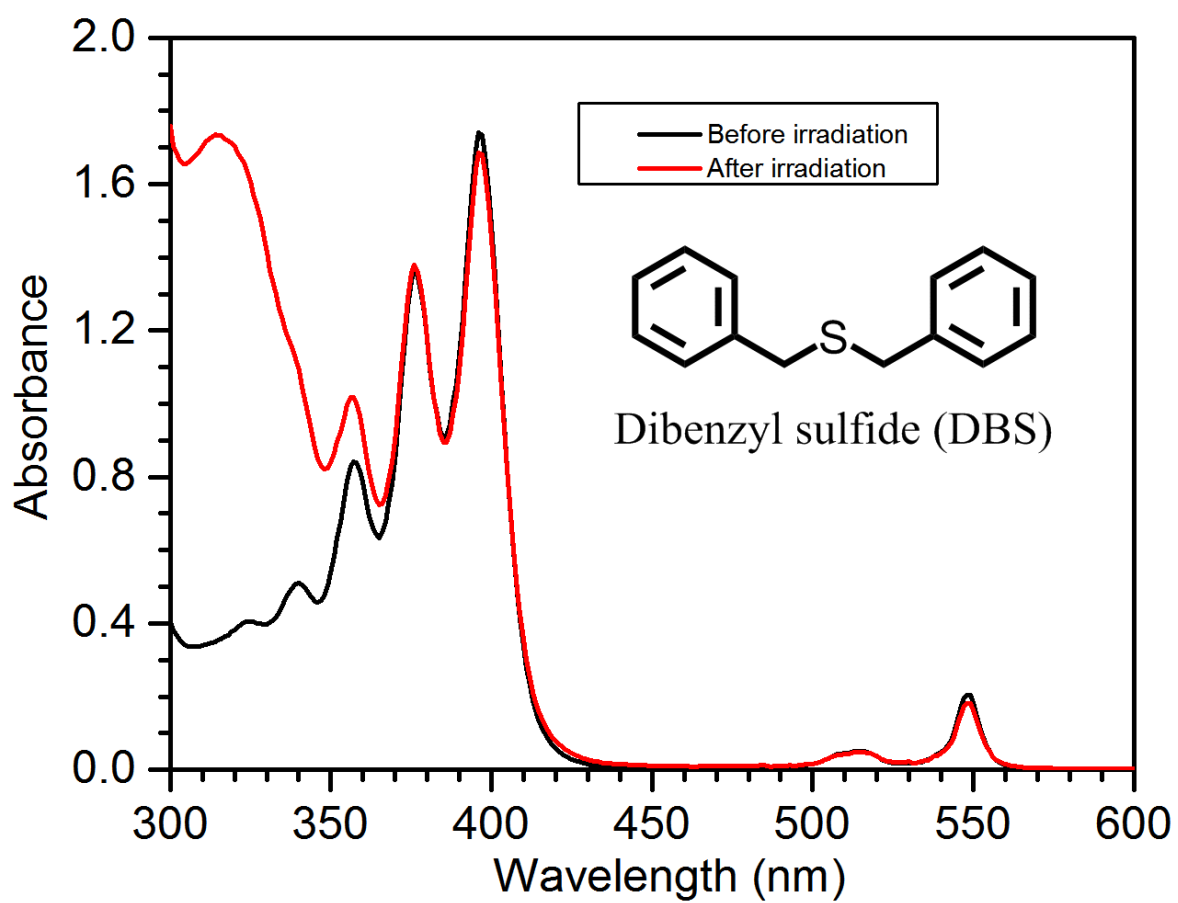


Fig. S11: Absorption spectra before and after the irradiation at 532 nm (30 min) in presence of 500 mM of DBS as scavenger with low concentration TTA-UC system.

## 2 Nitrogen deoxygenated samples

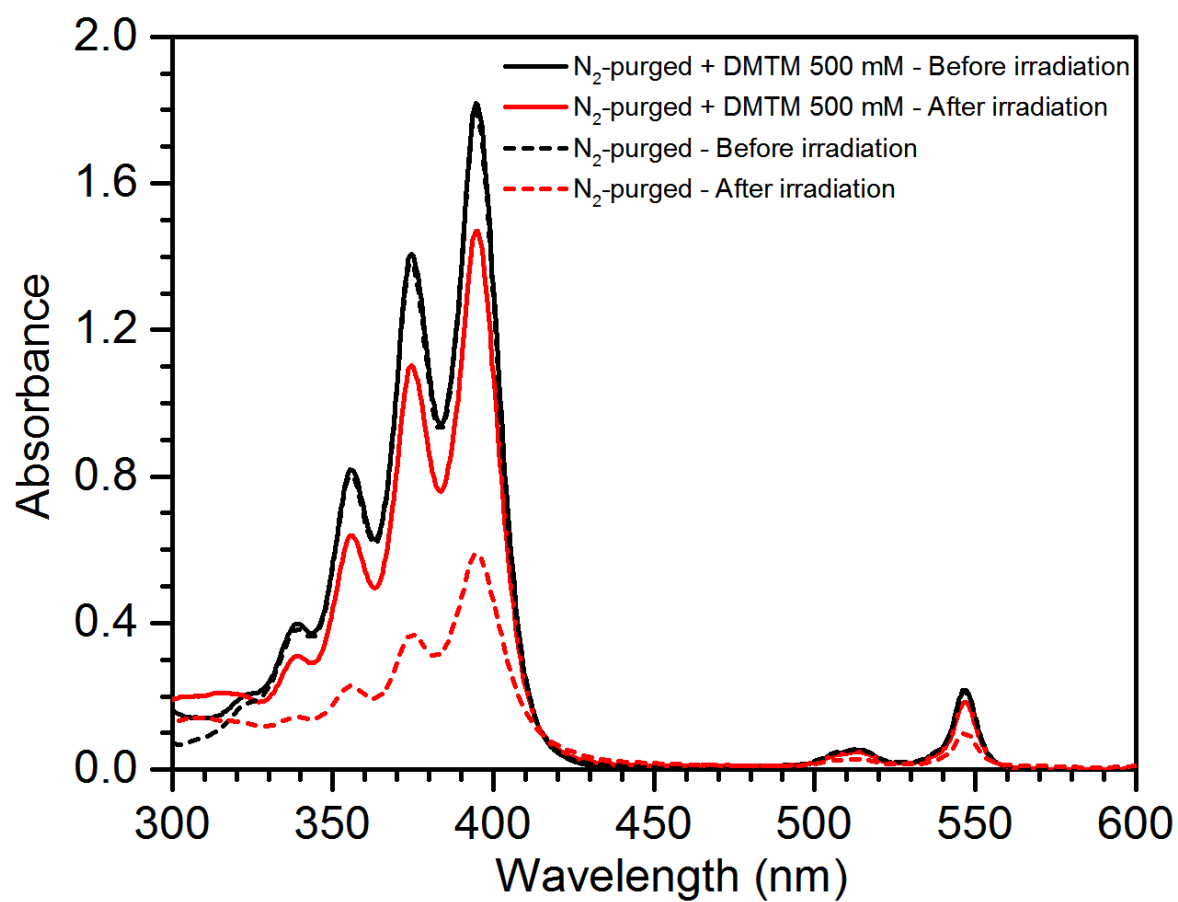


Fig. S12: Absorption spectra before and after the irradiation at 532 nm (240 min) of N<sub>2</sub>-gas purged samples in presence and absence of 500 mM of DMTM as scavenger with the low concentration TTA-UC system.

### 3 Freeze-pump-thaw samples

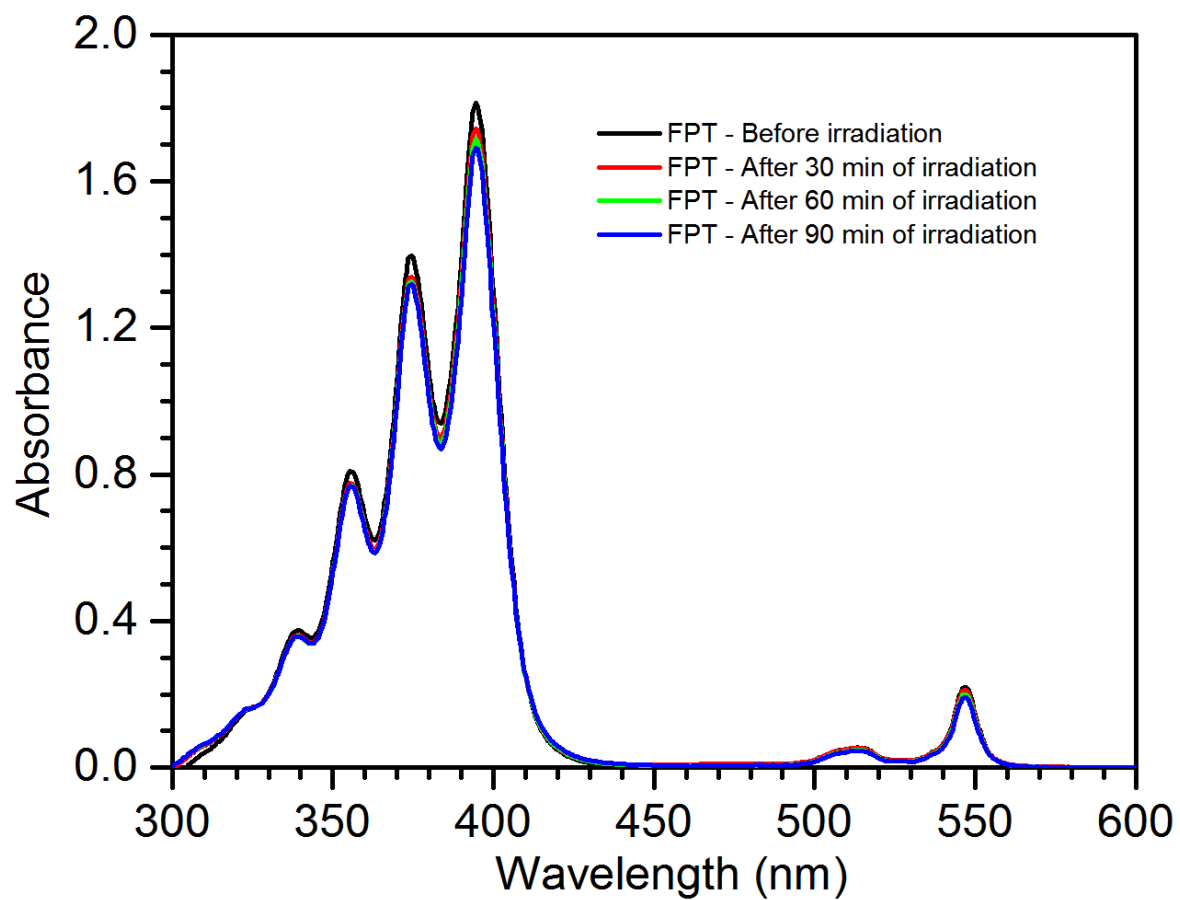


Fig. S13: Absorption spectra before, during and after the irradiation at 532 nm (90 min) of sample with the low concentration TTA-UC system.



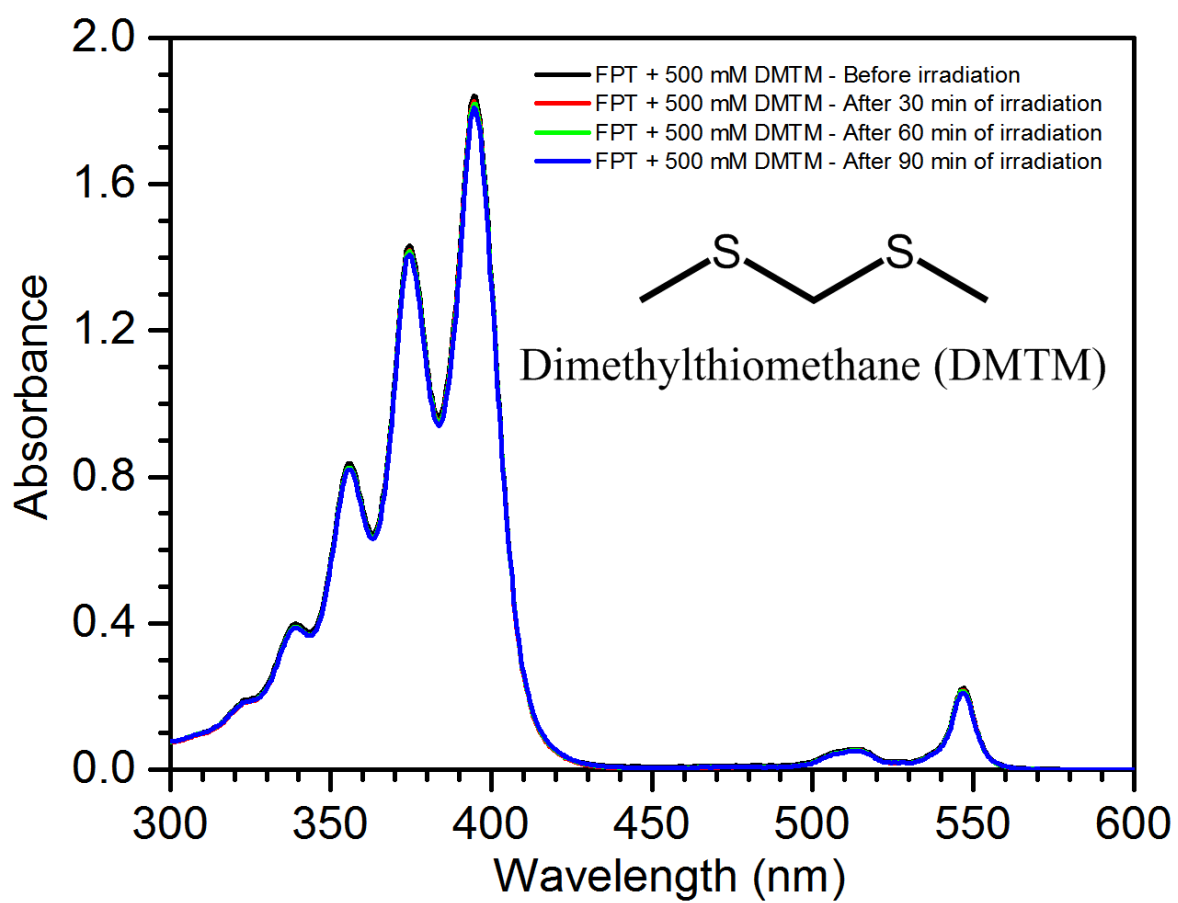


Fig. S14: Absorption spectra before and during the irradiation at 532 nm (90 min) of samples in presence of 500 mM of DMTM as scavenger with the low concentration TTA-UC system.

## 4 Lifetime measurements

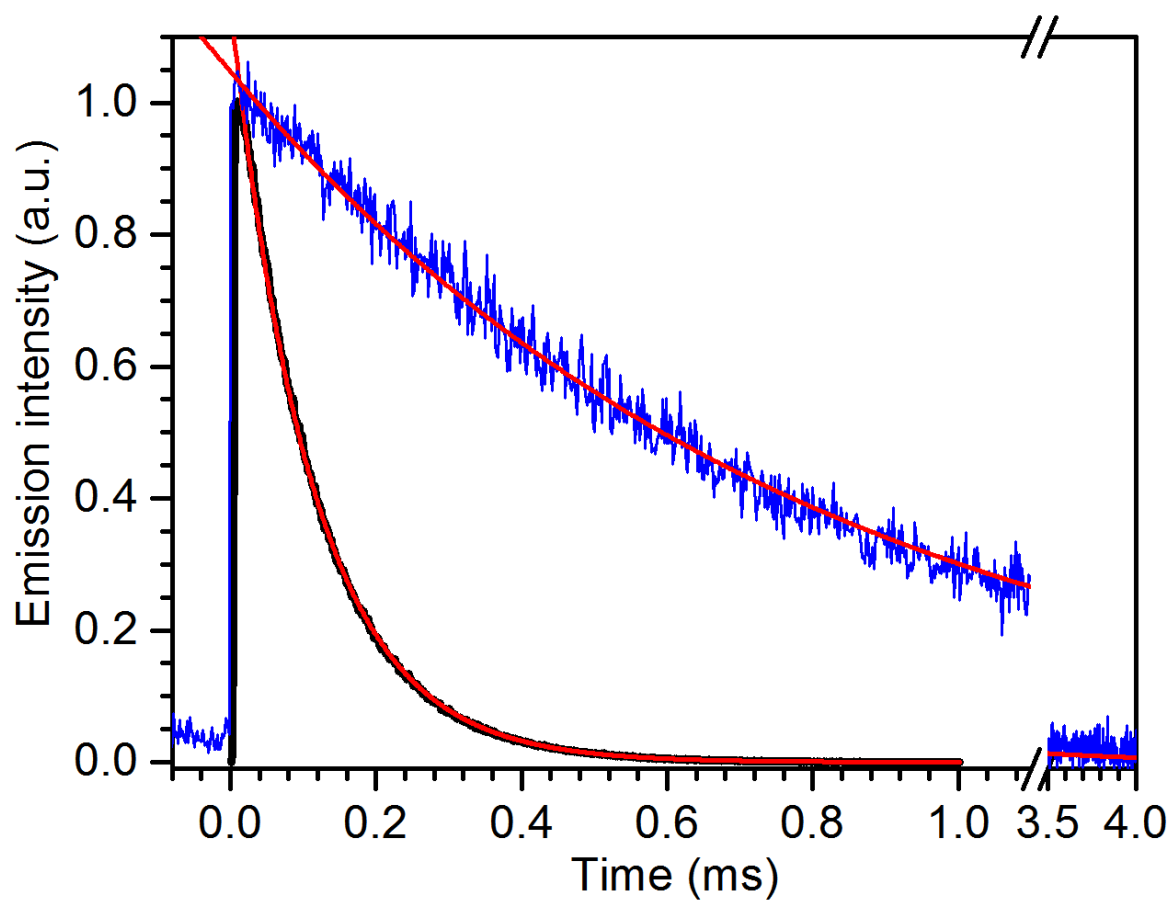


Fig. S15: Phosphorescence lifetime measurements of PdOEP in toluene with 500 mM DMS scavenger (black) and without scavenger degassed using freeze-pump-thaw method (blue). The data was fit well with mono exponential decay (red) revealing a lifetime of 112  $\mu\text{s}$  for the scavenged sample and 770  $\mu\text{s}$  for the freeze-pump-thaw degassed sample. Excitation wavelength was at 547 nm and emission was captured at 660 nm.