

Preparation and Characterization of PLAL-Derived Cobalt Nanoparticles for Methylene Blue Photodegradation

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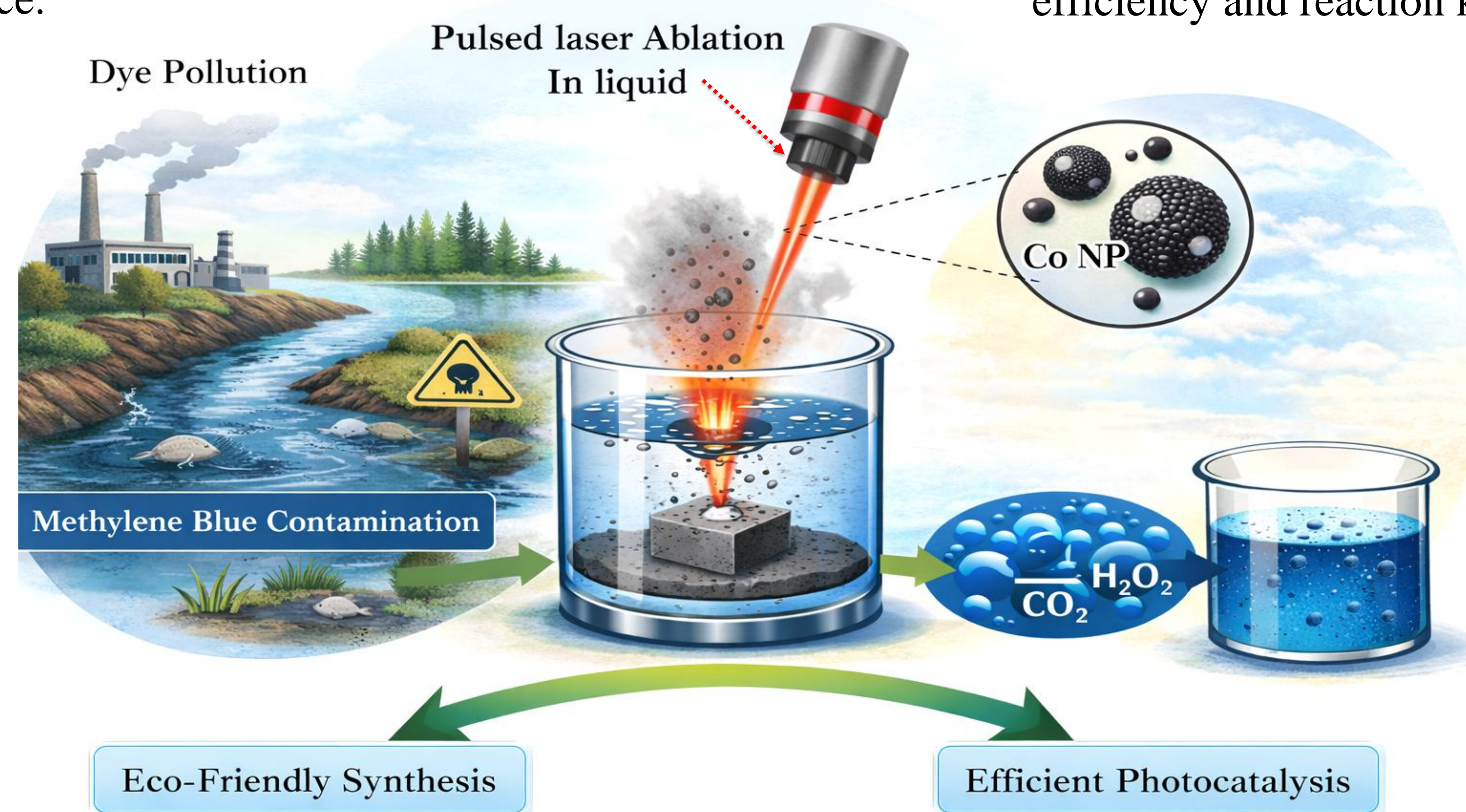
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INTRODUCTION

- Organic dye pollutants such as **methylene blue** pose serious environmental risks to aquatic systems.
- PLAL** enables surfactant-free synthesis of cobalt nanoparticles.
- This work synthesizes **Co nanoparticles** in **ethylene glycol** and tests their UV-driven photocatalytic performance.

Objective:

- Synthesize PLAL-derived Co nanoparticles
- Characterize size, surface chemistry, and carrier lifetime
- Measure MB degradation efficiency and kinetics under UV light



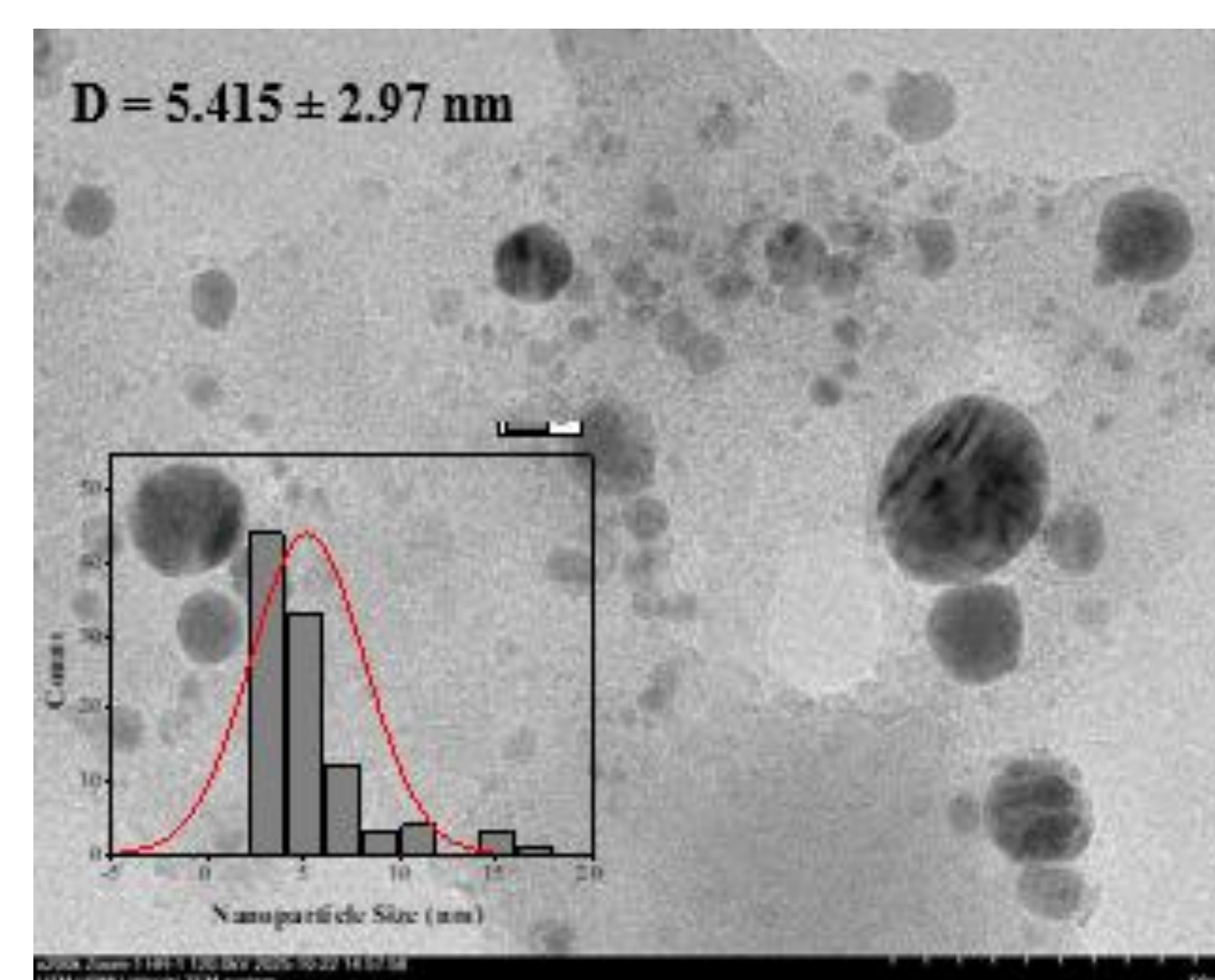
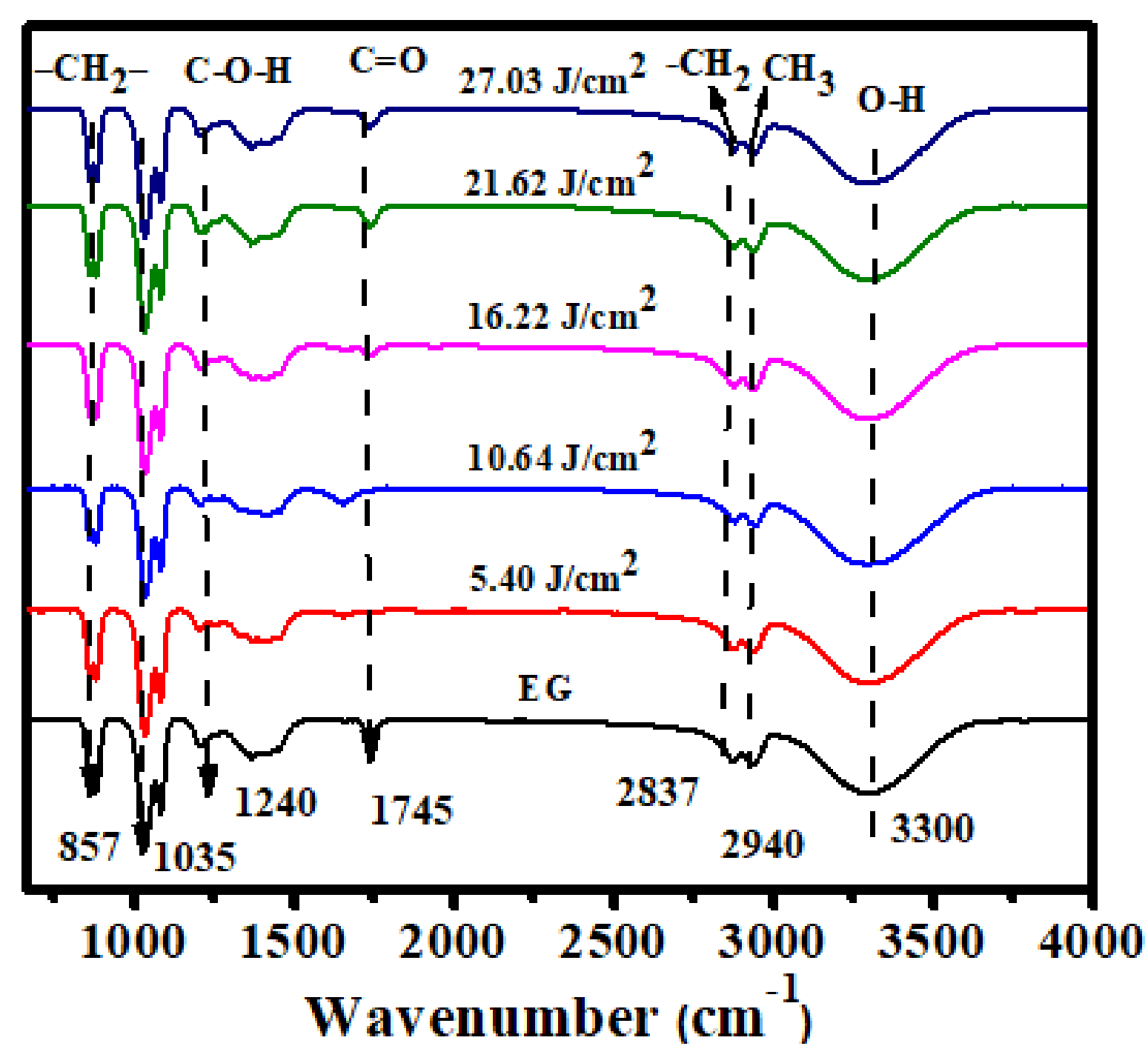
METHOD

- Co NPs** were synthesized via **PLAL** in ethylene glycol.
- Photocatalytic degradation of **MB dye** was performed under **UV irradiation**.
- UV-Vis analysis** was used to track degradation efficiency and reaction kinetics.

RESULTS & DISCUSSION

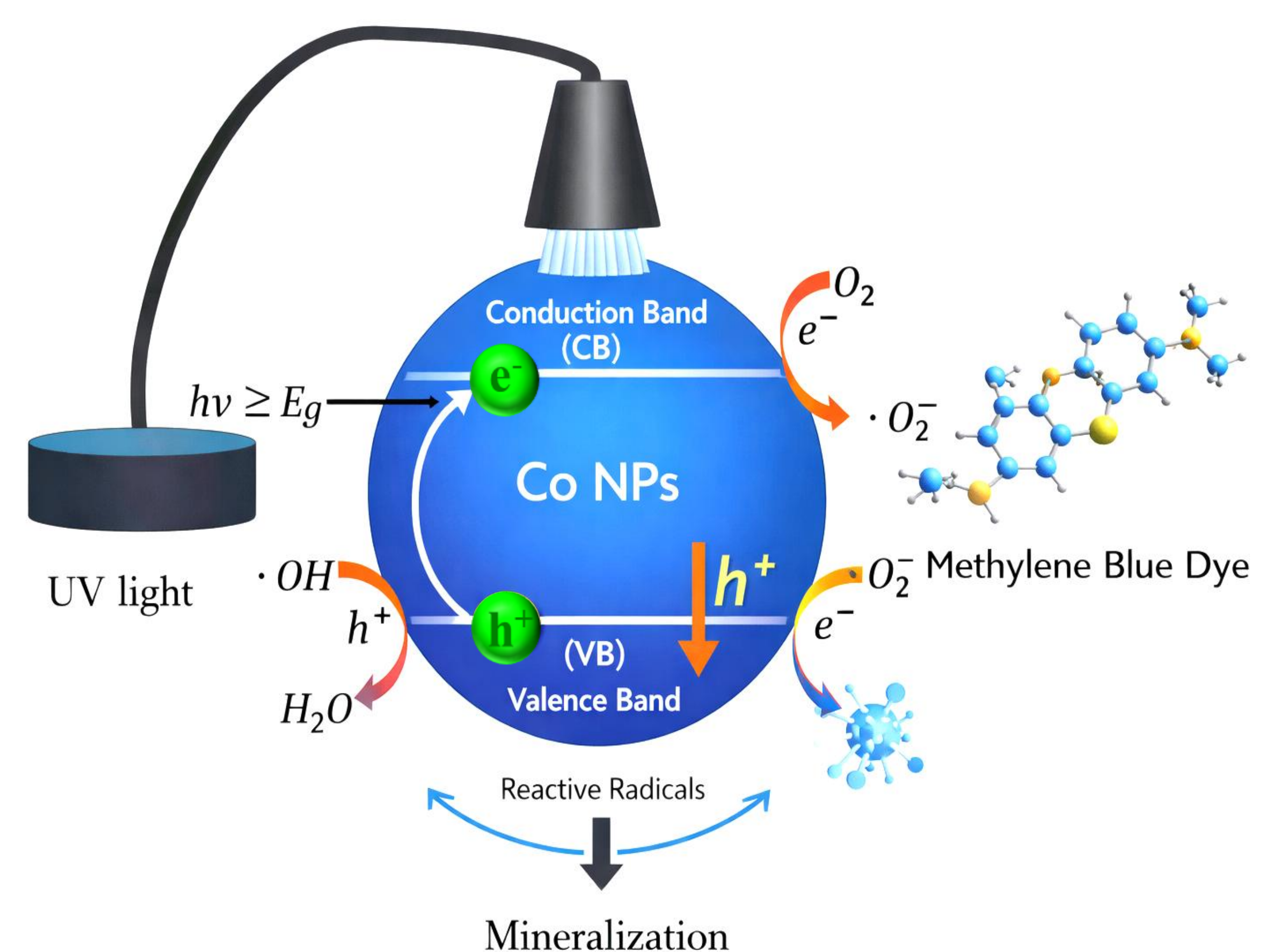
Chemical & Surface Structure Analysis

- FTIR confirms EG capping of Co NPs (O-H $\sim 3300\text{ cm}^{-1}$, C=O $\sim 1745\text{ cm}^{-1}$).
- TEM confirms $\sim 5.4\text{ nm}$ spherical Co NPs.



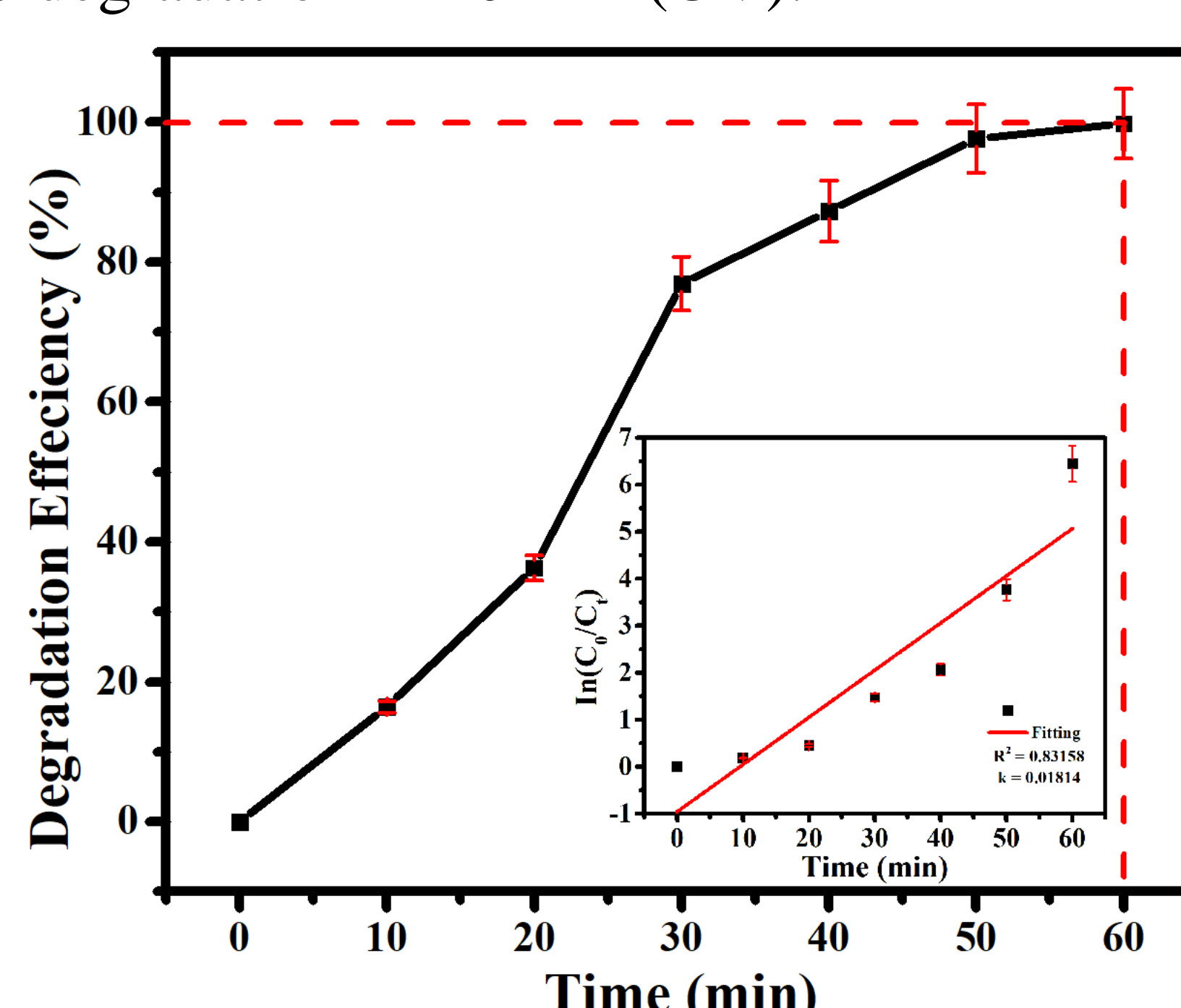
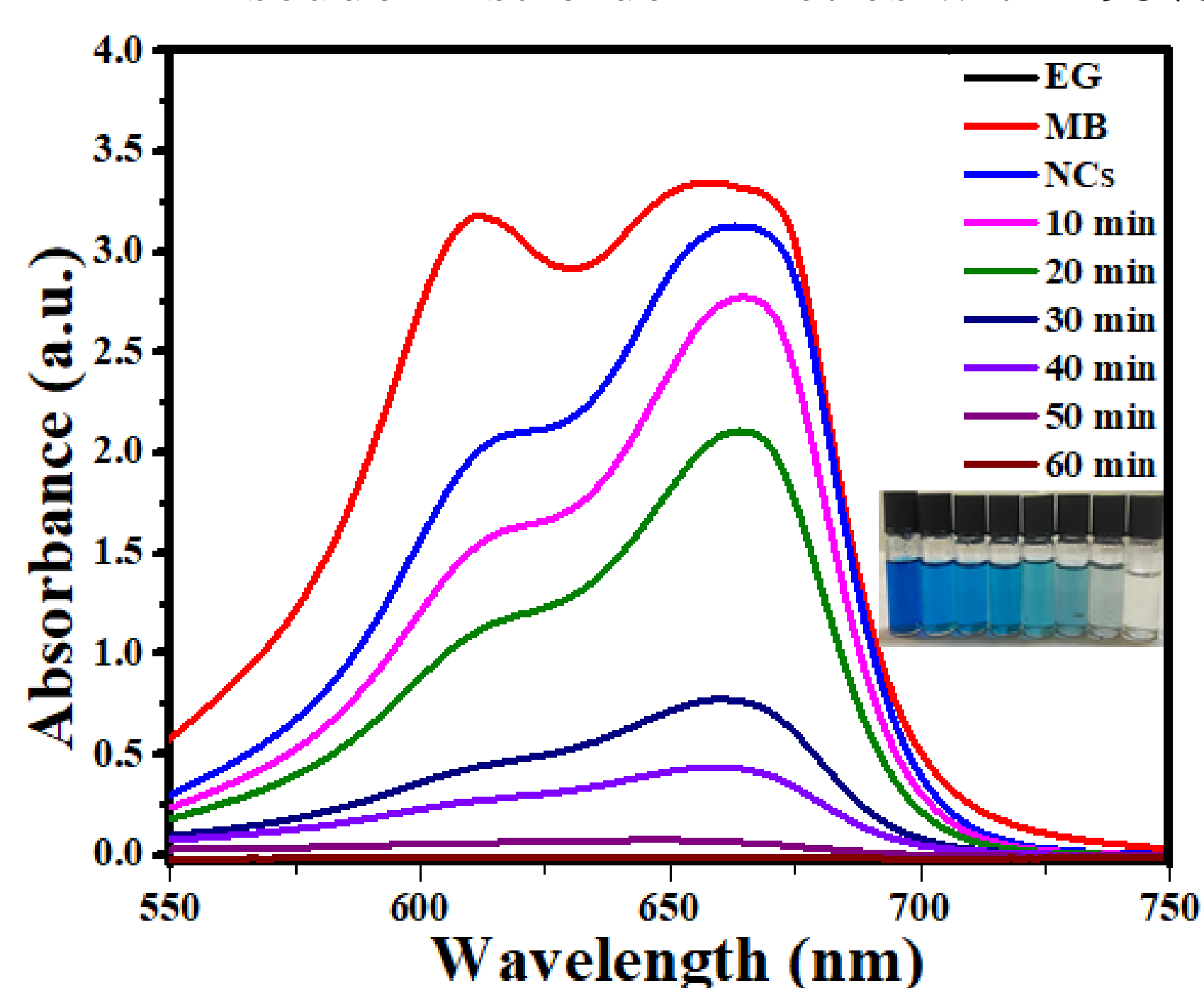
Photocatalytic Performance

- Photoexcitation:** UV light generates e^-/h^+ pairs on the Co-NPs.
- Radical Formation:** Electrons produce $\cdot O_2^-$ and holes generate $\cdot OH$.
- Degradation:** These highly reactive radicals attack and mineralize the MB dye.



Degradation Efficiency & Linear Fitting

- MB peak ($\sim 664\text{ nm}$) decreases with UV, confirming dye degradation.
- Maximum degradation efficiency of $\sim 95\%$ achieved within 40 min of UV irradiation.
- Pseudo-first-order kinetics with $\sim 95\%$ degradation in 40 min (UV).



CONCLUSIONS

- Co NPs ($\sim 5.4\text{ nm}$) successfully synthesized via PLAL in ethylene glycol.
- FTIR confirms ethylene glycol capping (O-H, C-H, C=O).
- Prolonged lifetime ($\sim 6.03\text{ ns}$) indicates reduced recombination and separation.
- High photocatalytic activity: $\sim 95\%$ MB degradation in 40 min under UV.
- Results show potential for wastewater treatment applications.