# Supplemental Information for

# A Mini Review on Photocatalytic Lignin Conversion into Monomeric Aromatic Compounds

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Table S1 List of Abbreviations

| Abbreviation | Definition |
|---|---|
| 2D | Two-Dimensional |
| 3D | Three-Dimensional |
| BDE | Bond Dissociation Energy |
| CB | Conduction Band |
| CBM | Conduction Band Minimum |
| COF | Covalent Organic Framework |
| CZCP | Carbazolic Copolymers |
| DFT | Density Functional Theory |
| DOS | Density of States |
| Ea | Activation energy |
| Eg | Band gap |
| EHCO | Electron-Hole Coupled |
| EPR/ESR | Electron Paramagnetic Resonance/Electron Spin Resonance |
| FID | Flame Ionization Detector |
| fs | Femtosecond |
| FTIR | Fourier Transform Infrared |
| HAA | Hydrogen Atom Abstraction |
| HAT | Hydrogen Atom Transfer |
| HOMO | Highest-Occupied Molecular Orbital |

| | |
|---|---|
| LMCT | Ligand-to-Metal Charge Transfer |
| LUMO | Lowest-Unoccupied Molecular Orbital |
| LSPR | Localized Surface Plasmon Resonance |
| MCF | Mesoporous Cellular Silica Foam |
| MOF | Metal-Organic Framework |
| NMR | Nuclear Magnetic Resonance |
| ns | nanosecond |
| μs | microseconds |
| PCET | Proton-Coupled Electron Transfer |
| PCN | Polymeric Carbon Nitride |
| POF | Porous Organic Frameworks |
| ps | Picosecond |
| QDs | Quantum Dots |
| ROS | Reactive Oxidative Species |
| SET | Single Electron Transfer |
| UV | Ultraviolet |
| VB | Valence Band |
| VBM | Valence Band Maximum |

Table S2 Typical Lignin Model Compounds Used in Literature and Their Structures

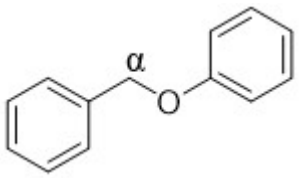
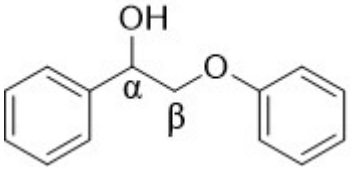
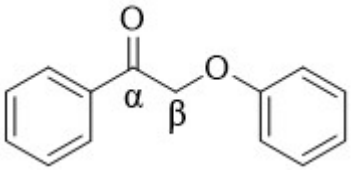
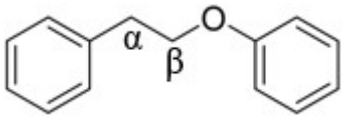
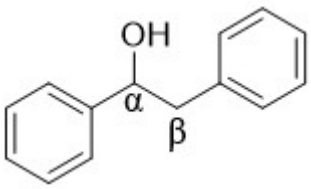
| Lignin Model Compound | Type | Molecular Structure |
|---|---|---|
| benzyl phenyl ether (BPE) | α-O-4 |  |
| 2-phenoxy-1-phenylethanol (PP-ol) | β-O-4 |  |
| 2-phenoxy-1-phenylethanone (PP-one) | β-O-4 |  |
| 2-phenylethyl phenyl ether (PPE) | β-O-4 |  |
| 1,2-diphenylethanol (DPol) | $C_\alpha$–$C_\beta$ |  |

Table S3 The performance of C-O bond cleavage by representative photocatalysts from previous literature

| Ref | Catalyst | Reaction Condition | | | | | | Conversion | Selectivity | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Solvent | Substrate Amount | Temp | Atmosphere | Reaction time | Light Source | Lignin Model | Monomeric Aromatics | By-products |
| 1 | $ZnIn_2S_4$ (5 mg) | 1 mL $CH_3CN$ | 0.10 mmol PP-ol | 42 °C | $N_2$ | 4 h | 9.6 W blue LEDs (455 nm), | >99% | 83%~90% | 6% |
| 2 | $Zn_4In_2S_7$ (10 mg) | 5 mL $CH_3CN/H_2O$ (1:1 v/v) | 0.10 mmol PP-ol | - | $N_2$ | 4 h | Xe lamp (400–780 nm), 0.6 W/cm$^2$ | 99% | 82%~86% | 9.6% |
| 3 | Ni/CdS (20 mg) | 10 mL $CH_3CN$/0.1 M KOH (2:8, v/v) | 0.10 mmol PP-ol | - | $N_2$ | 2 h | 8 W Blue LED (440–460 nm) | ~100% | ~90% | - |
| 4 | Ag2S@ CdS (1 mg) | 1 mL $CH_3CN$ | 10 mg PP-ol | 30 °C | Ar | 3 h | 6 W Blue LED | 99% | 91%~95% | 4% |
| 5 | ZIS-3 (10 mg) | 5 mL $CH_3CN/H_2O$ (2:3, v/v) | 10 mg PP-ol | 20-25 °C | Ar | 1.5h | Xe lamp, (420–780 nm, 0.35W/cm$^2$) | ~100% | 91%~93% | 4.7% |
| 6 | SL-$Fe_3O_4$/$TiO_2$ (100mg) | 50 mL methanol, 0.5 mL 30% $H_2O_2$ | 0.5 mmol PP-ol | 40 °C | $O_2$ | 12 h | 500 W Hg lamp | 94.3% | 10.7% | - |
| 7 | ZIF-8-$NH_2$@Bi/ $Bi_2MoO_6$ (10 mg) | 10 mL $CH_3CN/H_2O$ (1:1, v/v) | 10 mL PP-ol (0.05 mmol/L) | 20-25 °C | Air | 6h | 300 W xenon lamp (λ > 400 nm) | 93% | 48%~57% | 34% |
| 8 | CdS−SH/ $TiO_2$ (10 mg) | 5 mL $CH_3CN$ | 1 mg PP-ol | 20 °C | $N_2$ | 1h | 300 W xenon lamp | 99% | 85%~87% | <1% |
| 9 | CdS-150 (10mg) | 5 mL $CH_3CN/H_2O$ (2:3, v/v) | 10 mg PP-ol | 20 °C | He | 1h | Xe lamp, (420–780 nm, 0.35W/cm$^2$) | ~100% | ~85%-87% | - |
| 10 | CZIS-3 | 5 mL $CH_3CN/H_2O$ (2:3, v/v) | 10 mg PP-ol | 20 °C | He | 1.5h | Xe lamp, (420–780 nm, 0.35W/cm$^2$) | ~100% | 91.5%~93.6% | 9.6% |

Table S4 The performance of C-C bond cleavage by representative photocatalysts from previous literature

| Ref | Catalyst | Reaction Condition | | | | | | Conversion | Selectivity | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Solvent | Substrate Amount | Temp | Atmosphere | Reaction time | Light Source | Lignin Model | Monomeric Aromatics | By-products |
| [11] | MCSCN-75 (12 mg) | 30 mL $CH_3CN$ | 0.012 mmol PP-ol | R.T. | Air | 1.5 h | 20 W LED (λ = 420–430 nm) | 95% | ~90% | - |
| [12] | CS@3%rGO (10 mg) | 1 ml $CH_3CN$ | 1 mg PP-ol | - | $O_2$ | 200 min | 300 W xenon lamp | 95% | ~80% | 3% |
| [13] | $CuO_x$/ceria/A-NT(10 mg) | 1 ml $CH_3CN$ | 0.05 mmol DP-ol | R.T. | $O_2$ | 5 h | 9.6 W Blue LED (455 nm) | ~75% | ~98% | - |
| [14] | mpg-$C_3N_4$ (10 mg) | 1 ml $CH_3CN$ | 0.05 mmol PP-ol<br>0.05 mmol DP-ol | - | $O_2$ | 10 h | 6 W LED (455 nm) | 96%<br>~89% | ~91%<br>~80% | 7/%<br>~14% |
| [15] | 40$Ag_3PO_4$–60PCN (10 mg) | 5 mL $CH_3CN/H_2O$ (1:1,) | 0.1 mmol DP-ol | - | $O_2$ | 6 h | Xe lamp, (420–780 nm, 0.6W/cm$^2$) | ~99% | ~86% | ~10% |
| [16] | $W_{10}D_1U_9$-2 (10 mg) | 5 ml $CH_3CN$ | 0.05 mmol PP-ol<br>0.05 mmol DP-ol | R.T. | $O_2$ | 5 h | Xe lamp, (420–780 nm, 0.35W/cm$^2$) | ~90%<br>~82% | ~90%<br>~87% | ~10%<br>~10% |
| [17] | DEG CN (40 mg) | 5 ml $CH_3CN$ | 0.1 mmol DP-ol | R.T. | $O_2$ | 10 h | Xe lamp, (300W, 0.15W/cm$^2$) | ~100% | ~96% | - |
| [18] | NaK-U (10 mg) | 1 ml $CH_3CN$ | 0.05 mmol PP-ol | 35 ℃ | $O_2$ | 10 h | 40 W LED (427 nm) | ~99% | ~91% | - |