**Table 1 | Optimization of the reaction condition**a



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Entry | Photocatalyst | Copper | Ligand | Yieldsb |
| 1 | **Ir-1** | - | - | < 5% |
| 2 | **Ir-1** | Cu(OAc)2 | - | 26% |
| 3 | **Ir-1** | Cu(OAc)2 | L1 | 48% |
| 4 | **Ir-1** | Cu(OAc)2 | L2 | 45% |
| 5 | **Ir-1** | Cu(OAc)2 | L3 | 14% |
| 6 | **Ir-1** | Cu(OAc)2 | L4 | 49% |
| 7 | **Ir-1** | Cu(OAc)2 | L5 | 29% |
| 8 | **Ir-1** | Cu(OAc)2 | L6 | 18% |
| 9 | **Ir-1** | CuO | L4 | 30% |
| 10 | **Ir-1** | CuBr2 | L4 | 19% |
| 11 | **Ir-1** | CuCN | L4 | 6% |
| 12c | **Ir-1** | Cu(OAc)2 | L4 | 81% |
| 13c | **Ir-2** | Cu(OAc)2 | L4 | 48% |
| 14c | **Ir-3** | Cu(OAc)2 | L4 | 60% |
| 15c | **Ir-4** | Cu(OAc)2 | L4 | 50% |

aReaction conditions: **1** (0.5 mmol), photocatalyst (0.015 mmol), copper (0.1 mmol), ligand (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 15oC. bIsolated yield. cthe reaction was carried out at 30oC.

**Table 2 | Substrate scope of piperidine-4-carboxylic acids**

Reaction conditions: substrate (0.5 mmol), **Ir-1** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 40 h.

**Table 3 | Substrate scope of piperidine-4-carboxylic acids**



Reaction conditions: substrate (0.5 mmol), **Ir-2** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 72 h.

**Table 4 | Substrate scope of all carbon cyclic acids**



Reaction conditions: substrate (0.5 mmol), **Ir-1** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 40 h.

**Table 5**| **Substrate scope of acyclic acids**



Reaction conditions: substrate (0.5 mmol), **Ir-2** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 72 h.

**Table 6**| **Substrate scope of β-hydroxy acids**



Reaction conditions: substrate (0.5 mmol), **Ir-2** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 72 h.

**Table 7**| **Substrate scope for the ketone-alcohol products**



Reaction conditions: substrate (0.5 mmol), **Ir-1** (0.015 mmol), Cu(OAc)2 (0.1 mmol), **L4** (0.125 mmol), Cs2CO3 (0.75 mmol), Selectfluor (0.75 mmol), DCM (10 mL), 45W blue LEDs, 30oC, 72 h. a Yields were determined by 1H NMR.