

Cofactor-free Light-driven Whole-cell Cytochrome P450 Catalysis

박종현, 이상하, 차건수¹, 최다솜, 남동현, 이재형, 이정결²,

윤철호¹, 박찬범, 정기준[†]

KAIST; ¹전남대학교; ²건국대학교

Cytochrome P450s can catalyze various regioselective and stereospecific oxidation reactions of non-functionalized hydrocarbons. Here, we have designed a novel light-driven platform for cofactor-free, whole-cell P450 photo-biocatalysis using eosin Y (EY) as a photosensitizer. EY can easily enter into the cytoplasm of *Escherichia coli* and bind specifically to the heme domain of P450. The catalytic turnover of P450 was mediated through the direct transfer of photo-induced electrons from the photosensitized EY to the P450 heme domain under visible light illumination. A proof-of-concept for the photoactivation of the P450 catalytic cycle in the absence of cofactors and redox partners is successfully conducted using bacterial P450s (variants of P450 BM3) and human P450s (CYPs 1A1, 1A2, 1B1, 2A6, 2E1, and 3A4) for the bioconversion of various substrates, including marketed drugs (simvastatin, lovastatin, and omeprazole) and a steroid (17 β -estradiol), to demonstrate the general applicability of the light-driven, cofactor-free system.