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Continuous Flow Photoelectrochemical Alkylation Enabled by Benzophenone

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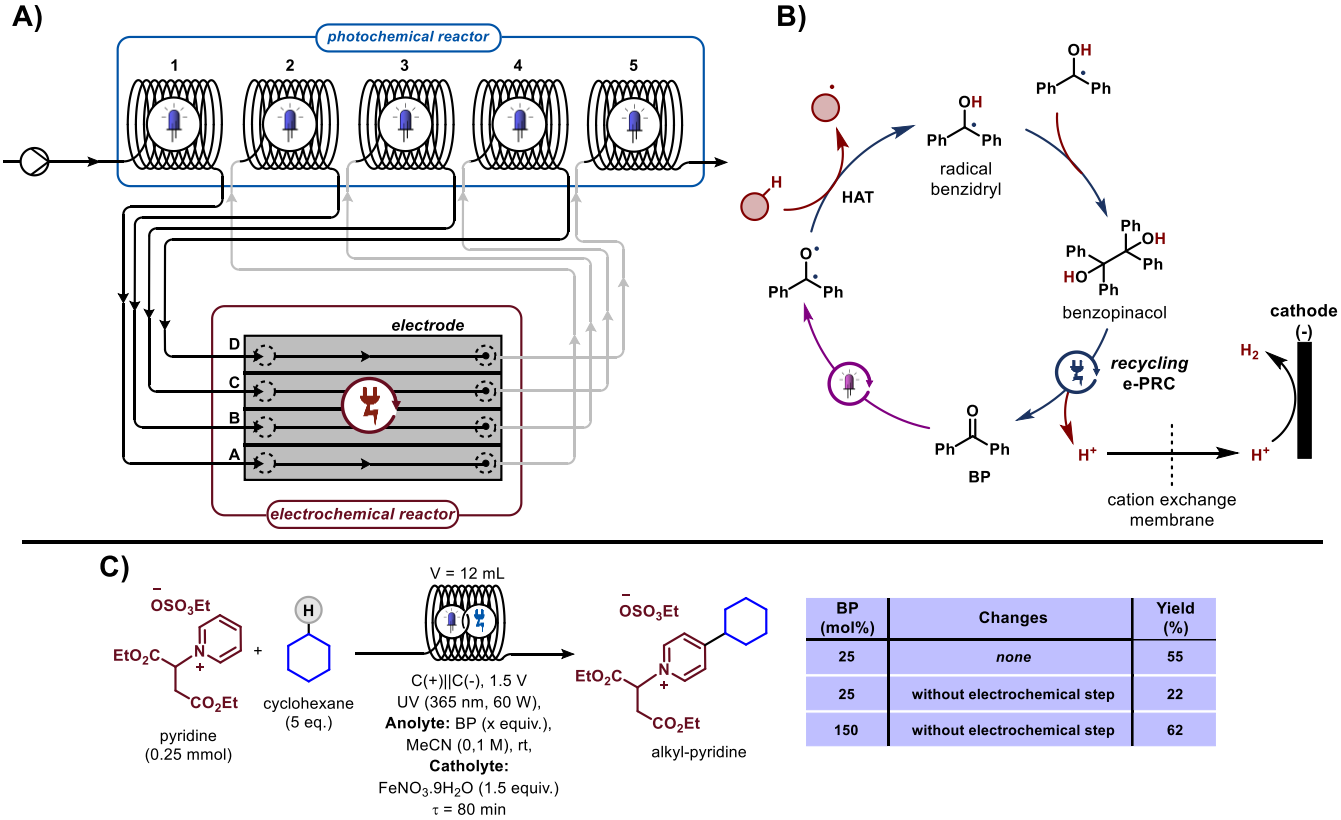
Highlights

Herein, we describe a novel continuous flow photoelectrochemical reactor for recycling electrochemically mediated photoredox catalysis (e-PRC), which enables the catalytic use of benzophenone without significant loss of efficiency.

Abstract

Benzophenone (BP), an effective hydrogen atom transfer (HAT) photocatalyst, has limited synthetic utility due to its tendency to dimerize into benzopinacol.[1] The electrochemical oxidative cleavage of benzopinacol regenerates benzophenone,[2] suggesting that a recycling approach based on electrochemically mediated photoredox catalysis (recycling e-PRC) could enable its catalytic use. In this work, we present a novel continuous flow photoelectrochemical reactor (Fig. 1A) that performs HAT photocatalysis using catalytic quantities of benzophenone (Fig. 1B). In a C–4 pyridine alkylation reaction, a 55% yield was achieved using 25 mol% benzophenone, a result comparable to the 62% yield observed under stoichiometric conditions (150 mol%) (Fig. 1C).



BP (mol%)	Changes	Yield (%)
25	*none*	55
25	without electrochemical step	22
150	without electrochemical step	62

Fig. 1: A) Schematic representation of the novel photoelectrochemical reactor; B) Catalytic cycle of BP based on recycling e-PRC; and C) Pyridine alkylation reactions *via* photoelectrochemistry in flow.

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