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A photobiocatalytic one-pot sequential approach to transform aryl diazonium salts into enantioenriched 1-arylpropan-2-ols

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PURPOSE OF THE ABSTRACT

Photocatalysis has recently emerged as a powerful tool towards the synthesis of highly valuable (chiral) organic compounds in a straightforward manner and under mild reaction conditions. Interestingly, light-driven chemical transformations can be easily combined with enzymes, giving rise to photobiocatalytic processes that have already been applied for multiple cascades as well as for nicotinamide cofactor recycling purposes.[1] Thus, combining photocatalytic with enzymatic methods allows the creation of molecular complexity from easily accessible starting materials, especially when assembling C–C bond formation and stereoselective processes.

Particularly, the Meerwein arylation consists of the coupling of a diazonium salt with an electronically poor alkene using a reducing promoter, typically a copper(I) salt as catalyst, affording the corresponding alkylated arene product.[2] In this context, different groups have exploited the light-driven Meerwein-type α-arylation between aryl diazonium salts and enol acetates using ruthenium complexes[3] or porphyrins[4] as photocatalysts in organic media to produce 1-arylpropan-2-ones.

Based on our previous experience in the photobiocatalytic synthesis of optically active 1-arylpropan-2-ols,[5] valuable intermediates of different organic compounds with remarkable biological activities,[6] herein we have envisaged to integrate a Meerwein arylation reaction under light conditions catalyzed by the photosensitizer 9-mesityl-10-methylacridinium perchlorate ([Acr-Mes]ClO4), followed by the action of stereocomplementary alcohol dehydrogenases (Scheme 1). Hence, different enantiopure 1-arylpropan-2-ols have been obtained from simple and easily accessible aryl diazonium salts and isopropenyl acetate. Some of the experiments were easily scaled-up and a one-pot three-step conversion of aniline into enantiopure (R)- or (S)-1-phenylpropan-2-ol has also been demonstrated.

FIGURES

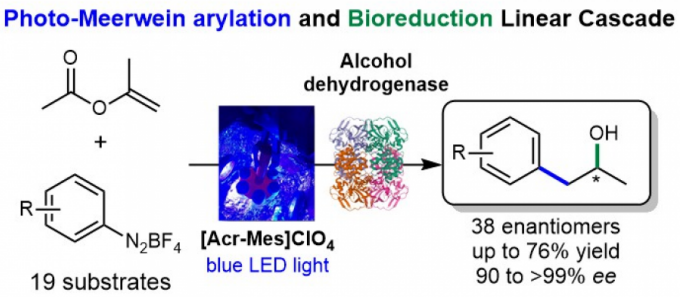

FIGURE 1

Scheme 1

Photobiocatalytic cascade to obtain enantioenriched 1-arylpropan-2-ols from diazonium salts

FIGURE 2

KEYWORDS

photocatalysis | alcohol dehydrogenases | diazonium salts | Meerwein arylation

BIBLIOGRAPHY

[1] L. Schmermund, V. Jurkaš, F. F. Özgen, G. D. Barone, H. C. Büchsenschütz, C. K. Winkler, S. Schmidt, R. Kourist, W. Kroutil, ACS Catal. 2019, 9, 4115-4144.

[2] S. Kindt, M. R. Heinrich, Synthesis 2016, 48, 1597-1606.

[3] T. Hering, D. P. Hari, B. König, J. Org. Chem. 2012, 77, 10347-10352.

[4] A. A. N. de Souza, N. S. Silva, A. V. Mu□ller, A. S. Polo, T. J. Brocksom, K. T. de Oliveira, J. Org. Chem. 2018, 83, 15077-15086.

[5] J. Albarrán-Velo, V. Gotor-Fernández, I. Lavandera, Adv. Synth. Catal. 2021, 363, 4096-4108.

[6] M. Morelli, E. Tognotti, Exp. Neurol. 2021, 342, 113754.