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Tuning carbon nanomaterials as supports for hydrogenases and other biocatalysts

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PURPOSE OF THE ABSTRACT

The use of hydrogenase enzymes in biotechnology offers possibilities for cleaning up biocatalysis, replacing glucose or formate as reductants with the atom-efficient H2 gas. Biocatalytic hydrogenations represent the equivalent of hydrogenations catalysed by metals such as Pd/C, but without the need for precious metals. Hydrogenases have been employed on carbon supports, together with NAD+ reductase, for heterogeneous catalysis of NADH recycling,1,2 or in solution for recycling of reduced flavins3. This project aims to explore design principles for carbon nanomaterials which are suited to supporting biocatalysts either in batch or continuous flow – more broadly, providing opportunities for making biocatalysis more sustainable and environmentally friendly. Carbon materials are synthesized by aerosol-assisted or floating catalyst chemical vapour deposition and characterized by electron microscopy, x-ray photoelectron spectroscopy, and Raman spectroscopy. Various material qualities are achieved both by targeting diverse intrinsic structural properties and through heteroatom doping. Furthermore, electro-analytical and electro-synthetic methods are employed and the synthesized materials are utilised as heterogeneous supports for redox enzymes. This poster describes new work at the interface between Biocatalysis and Materials Science which will expand the biocatalytic toolbox towards new reactivities, enabling greener chemical synthesis.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

BIBLIOGRAPHY

1. Reeve, H.A.; Lauterbach, L.; Lenz, O.; Vincent, K.A. Enzyme-Modified Particles for Selective Biocatalytic Hydrogenation by Hydrogen-Driven NADH Recycling. ChemCatChem, 2015, 7, 3480-3487.

2. Zor, C.; Quinson, J.; Thompson, L.A.; Lonsdale, T.H.; Dillon, F.; Grobert, N.; Vincent, K.A. H2-driven Biocatalytic Hydrogenation in Continuous Flow using Enzyme-Modified Carbon Nanotube Columns. Chem. Commun., 2017, 53,9839-9841.

3. Joseph Srinivasan, S.; Cleary, S.E.; Ramirez, M.; Reeve, H.A.; Paul, C.; Vincent, K.A. E. coli Nickel-Iron Hydrogenase 1 Catalyses Non-native Reduction of Flavins: Demonstration for Alkene Hydrogenation by Old Yellow Enzyme Ene-reductases. Ange. Chemie, 2021, 60, 13824-13828