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Conserved RHR Motif Enables Widespread Use Of Non-Canonical Redox Cofactors In Aldehyde Dehydrogenases

Tech ID: 34628 / UC Case 2025-860-0

CONTACT

Ben Chu
ben.chu@uci.edu
tel: .



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BRIEF DESCRIPTION

This technology improves enzymatic activity and biomanufacturing cost by engineering a conserved motif into enzymes and utilizing low-cost non-canonical redox cofactors.

FULL DESCRIPTION

Biomanufacturing relies on enzymes and cells to produce fuels, materials, medicines, and foods, however, the enzymes use costly natural redox cofactors (NAD(P)+) with inherent electron delivery issues. This technological invention identifies a conserved sequence motif that enables a class of enzymes to bind and utilize non-canonical redox cofactors (NRC), which are more cost-effective than NAD(P)+. One-third of these enzymes naturally contain this motif, whereas for the remaining two-thirds, introducing the motif enhanced their NRC activity by up to 60-fold, surpassing the performance of nearly all known natural and previously engineered NRC-active enzymes. The motif can be transferred into diverse enzymes to significantly boost their NRC activity, enabling precise enzyme design and modification for superior low-cost biomanufacturing performance.

SUGGESTED USES

- » Cost-effective biomanufacturing of fuels, chemicals, and specialty materials
- » Industrial biocatalysis requiring efficient electron transfer
- » Pharmaceutical production involving enzyme-mediated synthesis
- » Food and beverage industries leveraging enzyme transformations

ADVANTAGES

- » Enables use of low-cost, biomimetic non-canonical redox cofactors (NRCs)
- » Significantly enhances enzyme activity towards NRCs by up to 60-fold
- » Transferable motif allows broad enzyme engineering and customization
- » Improves electron delivery precision in biocatalytic processes
- » Reduces reliance on expensive natural cofactors like NAD(P)+

PATENT STATUS

Patent Pending

RELATED MATERIALS

- » [Saleh S et al. A Sequence Motif Enables Widespread Use of Non-Canonical Redox Cofactors in Natural Enzymes. bioRxiv \[Preprint\]. Doi: 10.1101/2025.08.01.668186.](#)

