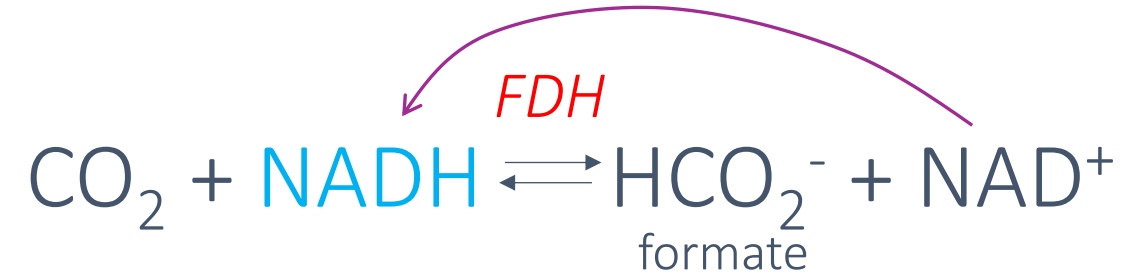
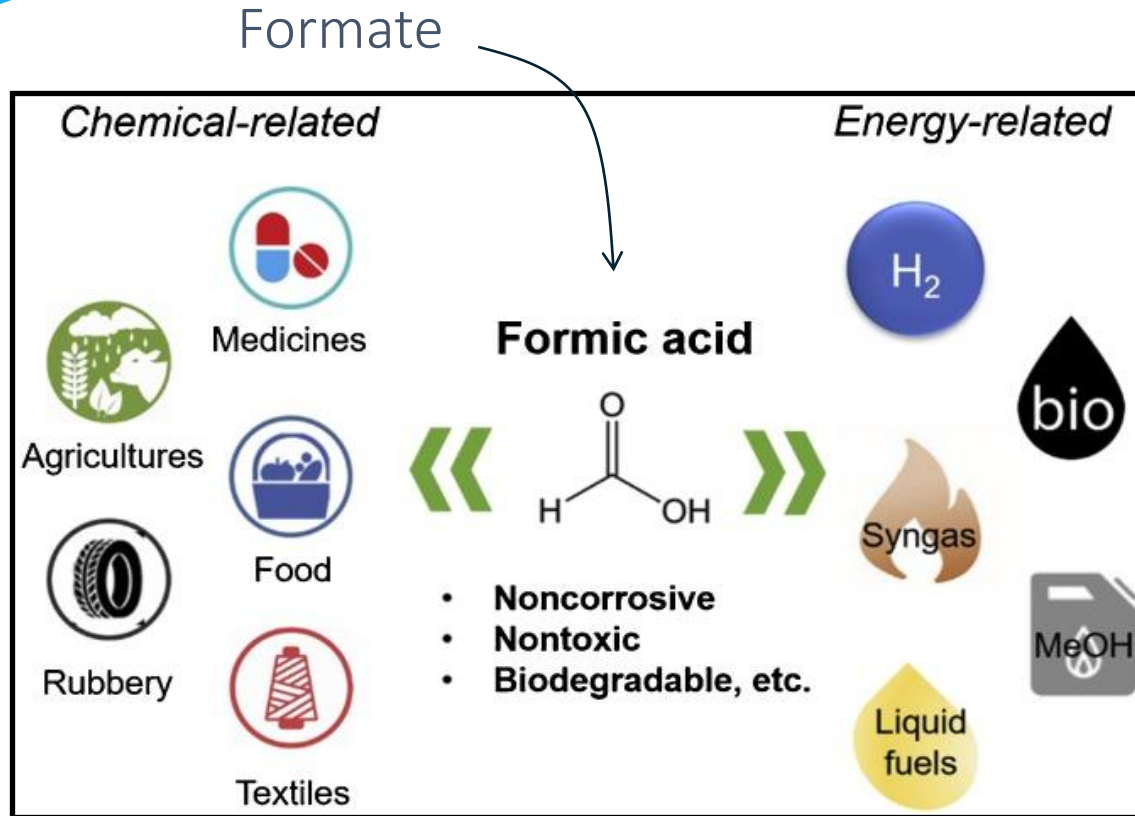


CO₂ conversion into formate catalysed by
immobilized formate
dehydrogenases and regeneration
of the NADH cofactor used during
conversion

Context and objective



FDH : formate dehydrogenase, enzyme

NADH : expensive cofactor \$\$\$

⇒ Regeneration of *NADH*

- Conversion of CO₂ into formate
- Regeneration of *NADH*

⇒
One process

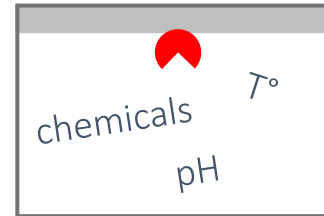
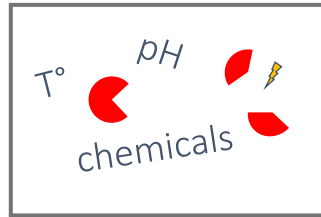
- Low environmental impact using LCA
- Low economical cost

FDH immobilisation

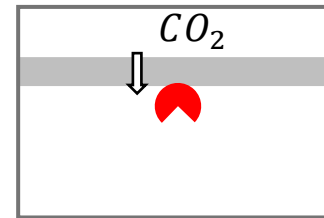
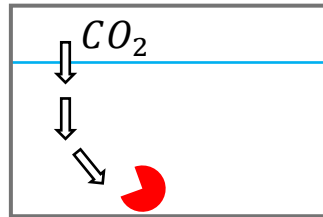


Why immobilize enzymes ?

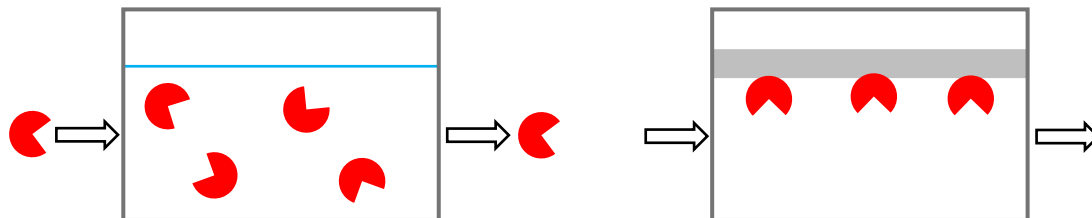
- Improve their stability



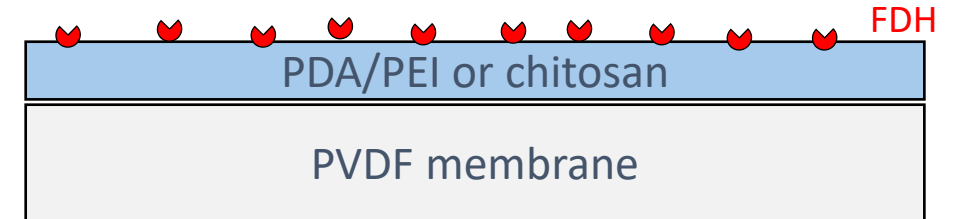
- Reduce the mass transfert resistance



- Reuse of the enzymes



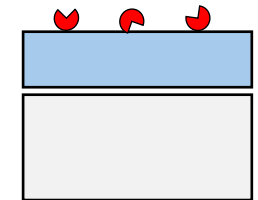
How to immobilise FDH ?



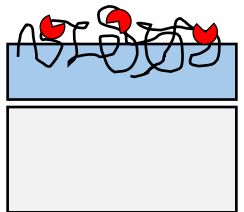
PDA/PEI and chitosan for amine groups

3 methods :

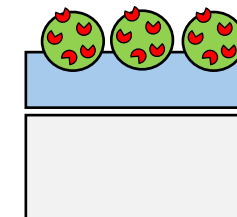
- Physical adsorption



- Covalent immobilisation



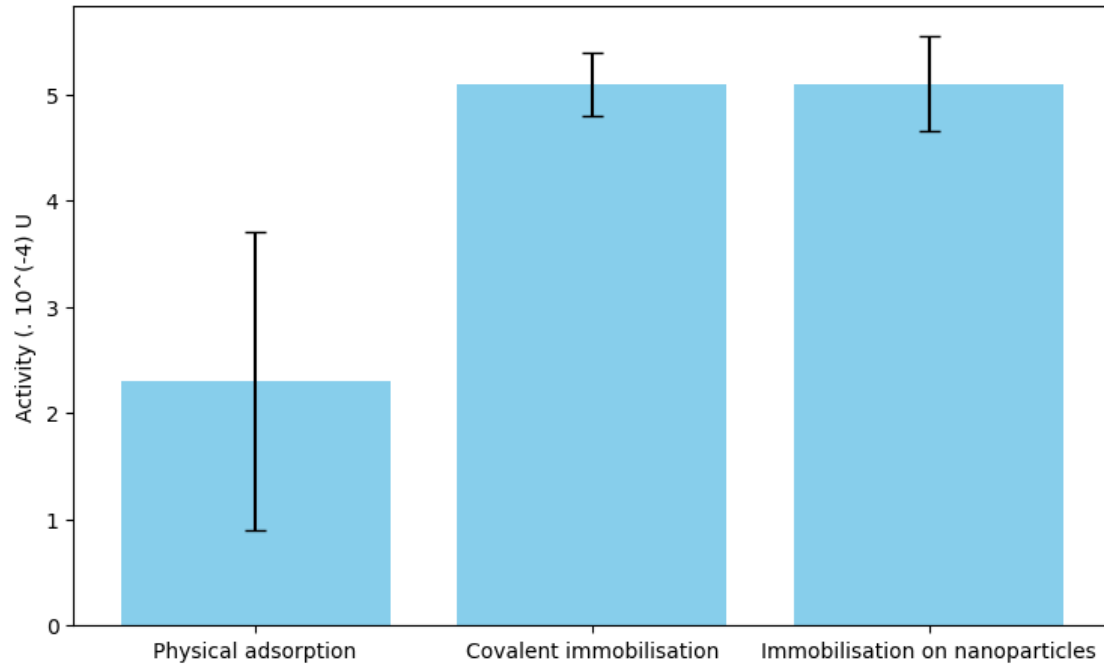
- Immobilisation on nanoparticles



Results of FDH immobilisation

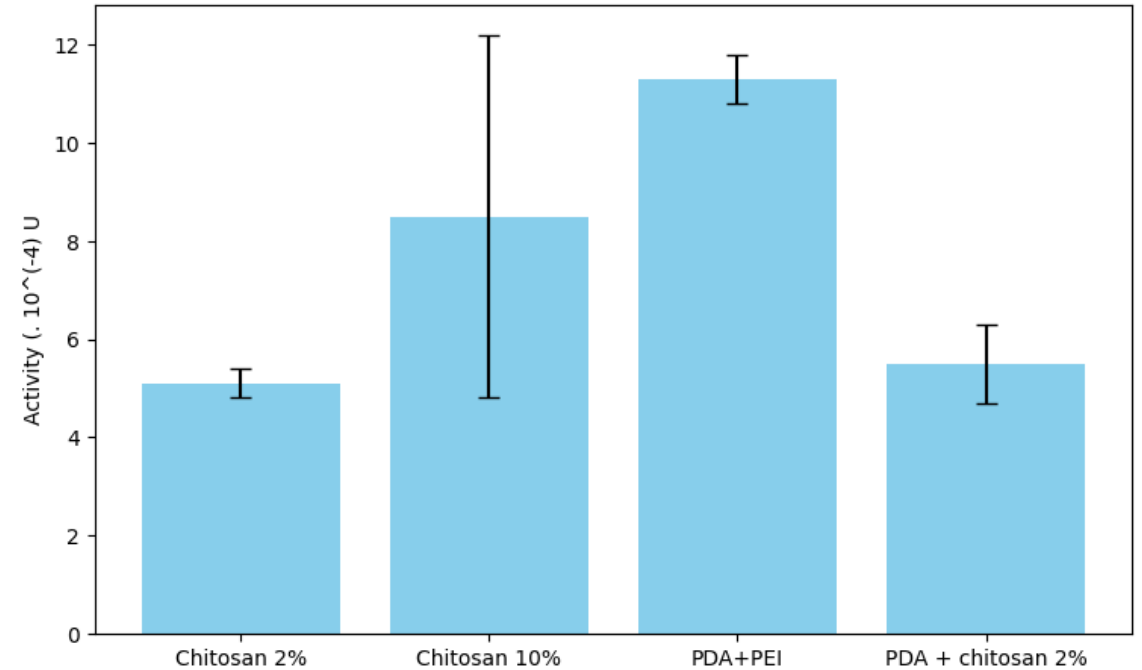
Comparison of catalytic activity of 1cm² of membrane with FDH immobilised

Comparison of the three immobilisation methods



With chitosan 2% as coating

Comparison of coatings

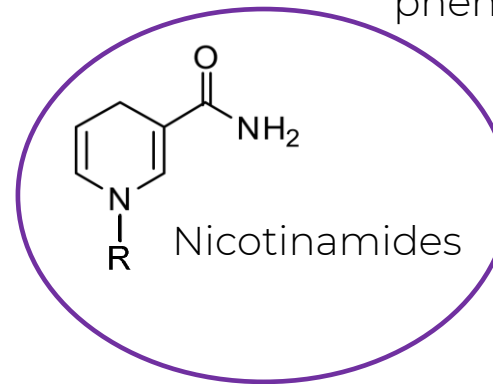
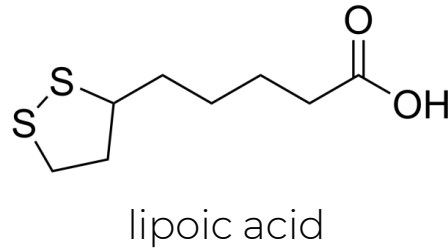
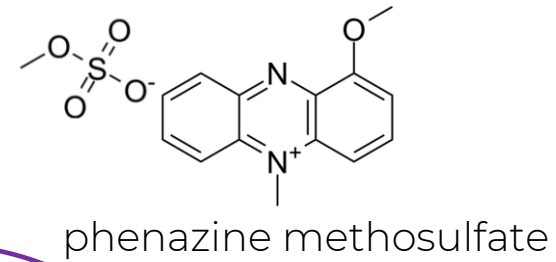
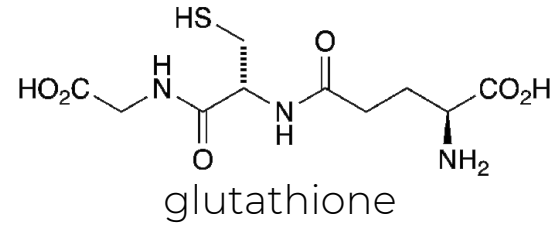
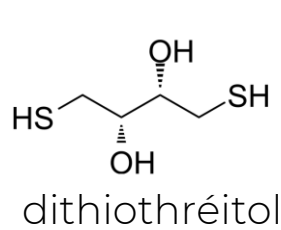
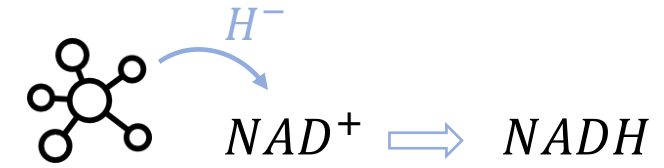


With covalent immobilisation as method

NADH regeneration



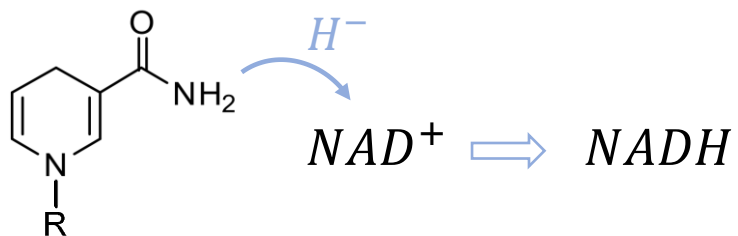
- NADH regeneration can occur through **hydride transfer** from a reducing agent.



Study of the reaction :

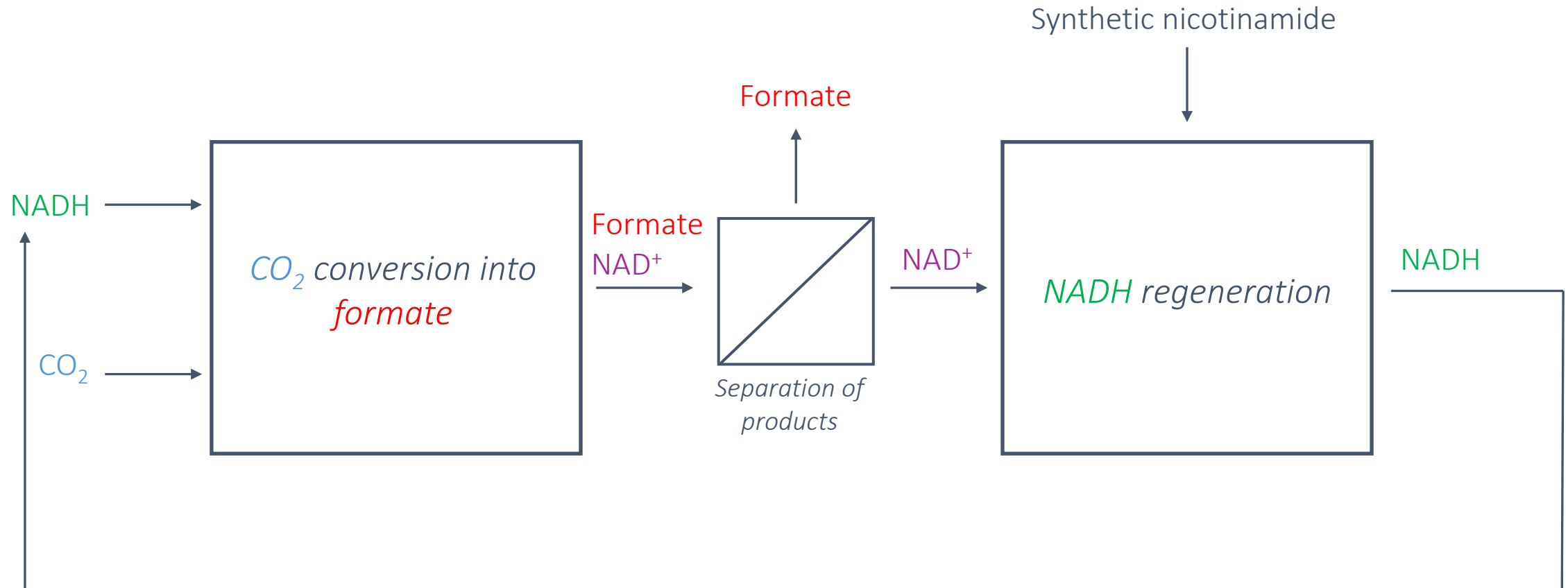
- Oxygen level
- pH
- Buffer
- Temperature

- Hydride exchange between low-cost synthetic **nicotinamide** and NAD^+ for NADH regeneration



- No catalyst
- No electricity

Complete process



Thank you !

E-mail : ysaline.toussaint@uclouvain.be