

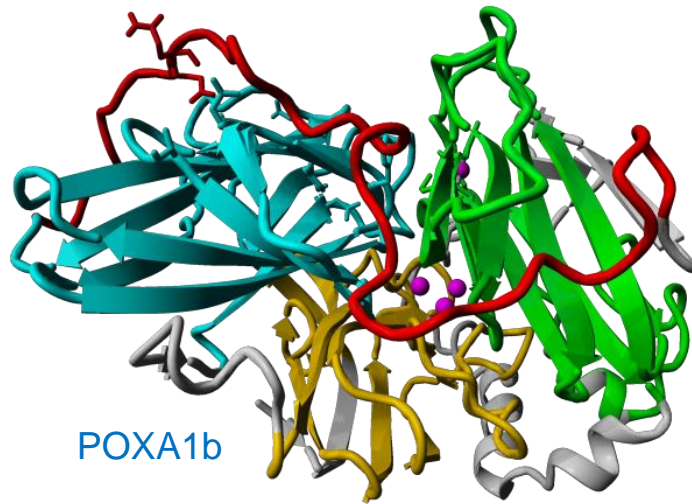
# Enhancement of laccases thermostability in Betaine - based Natural Deep Eutectic Solvents

Simona Varriale<sup>1</sup>, Astrid E. Delorme<sup>2</sup>, Jean-Michel Andanson<sup>2</sup>, Vincent Verney<sup>2</sup>, Cinzia Pezzella<sup>1</sup>

<sup>1</sup>Biopox srl, Viale Maria Bakunin 12, Naples, 80125, Italy

<sup>2</sup>Université Clermont Auvergne, CNRS, SIGMA Clermont, ICCF, F-63000 Clermont-Ferrand, France

## LACCASES



Multi-copper-containing oxidoreductases used in a wide range of sectors, from the **textile** to the **pulp** and **paper** industry, through the applications in **food** industry and **bioremediation** processes

## NADES

Natural Deep Eutectic Solvents

**HBA**  
Betaine



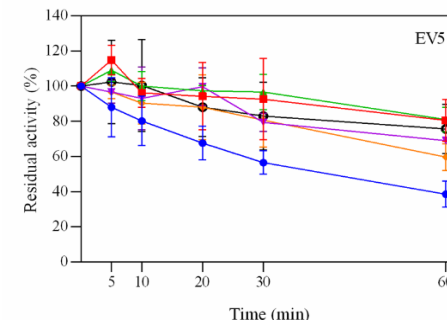
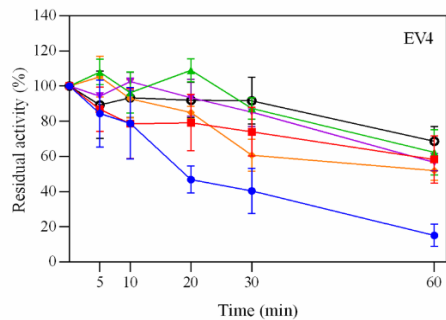
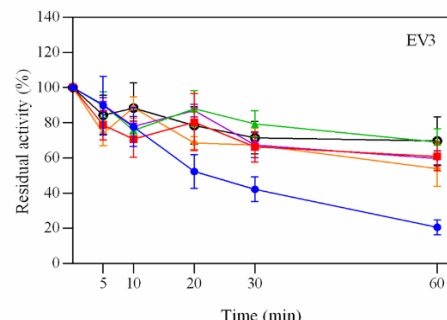
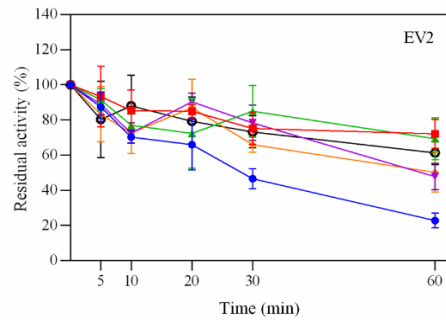
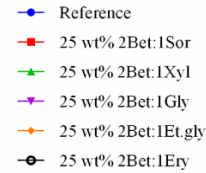
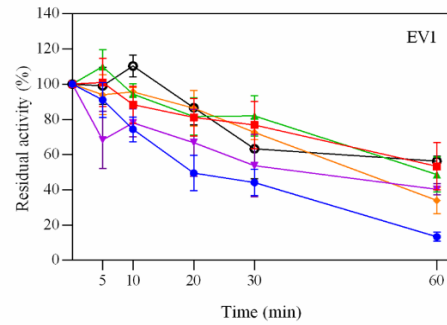
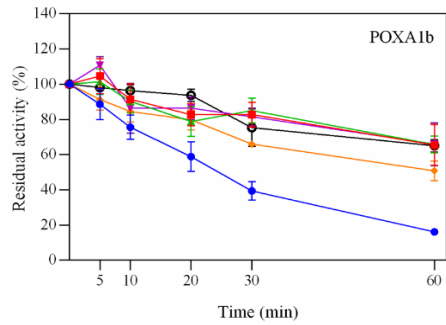
**HBD**  
Sorbitol  
Xylitol  
Glycerol  
Ethylene glycol  
Erythritol

Solvents with **melting temperature** lower than that of its individual HBD and HAD components; characterized by low flammability, low volatility, thermal and chemical stability, wide polarity, facile synthesis, low vapor pressure and high solvability.

AcES 2021 – September 1- 3, 2021 | Virtual



# Enhancement of laccases thermostability in Betaine - based Natural Deep Eutectic Solvents

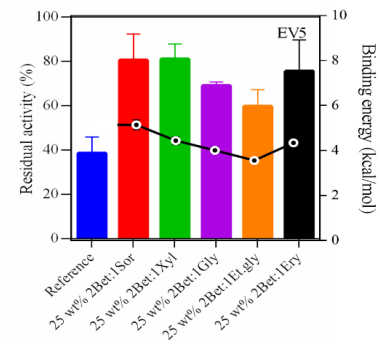
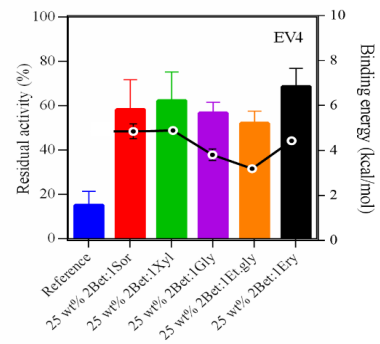
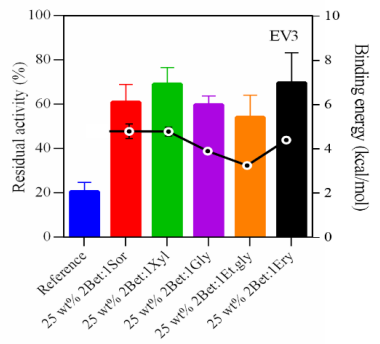
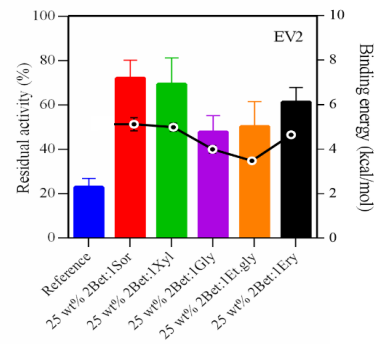
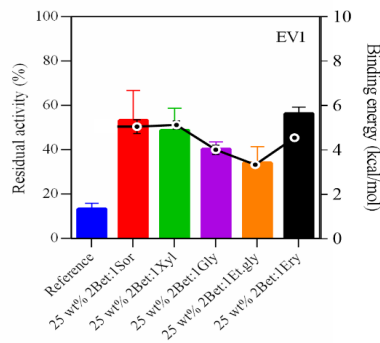
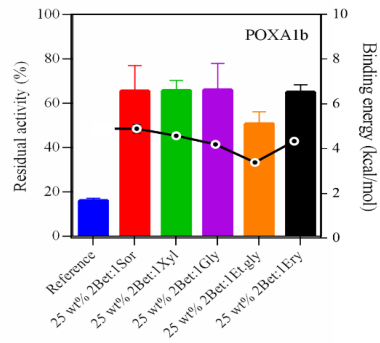


## Thermal stability of laccases in NADES at 70°C

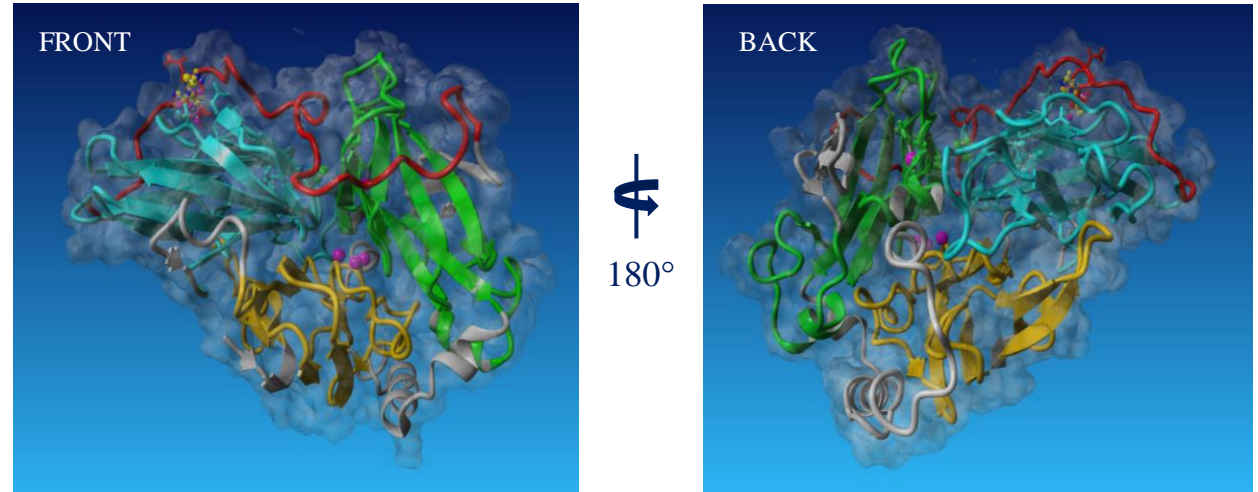
- Improvement of **thermal stability** of all tested laccases compared to the reference solution
- The positive effect is due to the **combined action** of the HBD and the HBA of NADES
- Thermostabilizing effect of NADES is **specific** for each enzyme
- Better results using **25 wt% 2Bet:1Sor** and **2Bet:1Xyl** NADES solutions
- At least **two-fold increase** in laccases half-life (up to  $t_{1/2}$  105 minutes)



# Enhancement of laccases thermostability in Betaine - based Natural Deep Eutectic Solvents



POXA1B



## Small molecule docking between laccases and NADES components

- Most interactions between HBD and L1 loop of laccases
- Correlation between residual activity and binding energy

The enhancement of thermostability of laccases when incubated in NADES media provides a cost-friendly solution to inhibit thermal inactivation of enzymes and could unlock a range of innovative industrial applications for laccases.



# Enhancement of laccases thermostability in Betaine - based Natural Deep Eutectic Solvents

Thank You!



TERMINUS has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement number 814400.

Viale Maria Bakunin, 12  
80125 Naples (Italy)  
[www.biopox.com](http://www.biopox.com)

simona.varriale@unina.it  
pezzella@biopox.com

